FORMATIVE ASSESSMENT IN PROPERTY EDUCATION: A COMPARISON BETWEEN BLENDED AND ONLINE LEARNING

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ABSTRACT

Formative assessment is of vital importance to enhance student learning. Students are able to apply their knowledge by completing formative exercises and given the opportunity to rectify their mistakes prior to attempting the summative assessment. Feedback provided for formative assessment has been recognised as central in enhancing student learning as students can use this to reinforce their understanding of the subject.

The paper is based on an exploratory research project using student survey data as well as records of students' performance and activities over the first semester of 2012. The purpose is to study how two groups of property students exposed to different modes of learning responded to the online and traditional formative assessment. The student perceptions and the statistical relationship between formative and summative assessment will be analysed using quantitative analysis techniques.

The research shows that both groups of students, internal (blended) and external (online) students, have benefited from the range of formative assessments offered in this first-year property course, albeit to a different extent. Property academics should, therefore, make good use of formative assessment to enhance student engagement and virtual classroom might be a solution to further engage external students. Besides highlighting challenges, student perceptions and the usefulness of formative assessment, the paper also provides recommendations for future research.

Keywords: formative assessment, online test, practice quiz, property education, summative assessment

INTRODUCTION

Student engagement has been given emphasis in higher education especially when there are large diverse groups of students. In order to enhance student engagement, there have been various teaching and learning strategies used by property education to improve learning outcomes.These include problem-based learning, project-based learning, work-integrated learning and the use of online learning and blended learning (Anderson, Loviscek and Webb 2000; Born 2003; Boyd 2010; Hefferan and Ross 2010; Koulizos 2006; Mak, Sher and Williams 2010; Susilawati and Peach 2012; Yam and Rossini 2010; Yam and Rossini 2012).

Literature shows that assessment has been acknowledged as a critical factor in stimulating student learning activities (Biggs and Tang 2007; Ramsden 2003). It is deemed to be crucial because, from the student's perspective, assessment is the curriculum (Ramsden 2003). As Biggs (2003, p3) suggests:

> "they will learn what they think they will be assessed on, not what is in the curriculum, or even on what has been 'covered' in the class".

Therefore, assessment methods have been given great emphasis in higher education to promote student learning.

Formative assessment plays a vital role in providing students with opportunities to self-test their knowledge prior to summative assessment, as well as providing opportunities for feedback before formal assessment. This exploratory research uses property student survey data as well as records of students' performance and activities over the first semester of 2012.The purpose of this research is to study how two groups of property students exposed to different modes of learning responded to the online and traditional formative assessment. Quantitative analysis techniques will be used to examine the student perceptions and the statistical relationship between formative and summative assessment.

This paper is structured as follows. First, the literature review will focus on formative assessment. It will be followed by the background of the case study and research methodology. Then, data analysis and discussion will be presented. Finally, the paper provides conclusions, research implications for property education and recommendations for future research. In order to minimise confusion, practice quiz and formative quiz are used interchangeably and weekly test refers to summative test. It is also worth noting that there has been limited literature on assessment from property education, therefore most of the literature in this paper was taken from other disciplines.

LITERATURE REVIEW

Student engagement is one of the most frequently researched topics and is recognised as a method to improve learning quality (Krauseet al 2005). It has been suggested that students need to be engaged as learners if they are expected to succeed academically (Kift 2002, 2004) and both the higher institution and its' staff have been called upon to provide an environment that promotes such engagement (Krause and Coates 2008; Ramsden 2003).

As assessment is crucial in student engagement (Biggs and Tang 2007; Ramsden 2003), formative assessment has been used widely to improve student's learning experience and learning outcomes (Black and William 1998; Hargreaves2005; Yorke 2001). Besides the traditional in-class formative assessment, online formative assessment is also becoming popular because of the large numbers of students which are commonly found in first-year courses (Burrow, Evdorides, Hallam and Freer-Hewish 2005; Higgins and Bligh 2006; Peat and Franklin 2002).

Formative Assessment

The main purpose of formative assessment is to support student learning by providing feedback about their performance to improve student learning (Sadler 1998; Yorke 2003). Black and William (1998, pp7-8) define formative assessment as:

> "encompassing all those activities undertaken by teachers, and/or by their students, which provide information to be used as feedback to modifythe teaching and learning activities in which they are engaged".

Therefore formative assessment can be formal or informal. Yorke (2003, p478) suggests that formal formative assessments are those assessments that "take place with reference to a specific curricular assessment framework". This means students will have to do the work and the assessor has to assess and provide feedback to students. On the other hand, informal formative assessments are those which are not specifically stated in the curriculum including in-class discussion and comment on student drafts (Yorke 2003).

The centrality of formative assessment is feedback and it has been argued that it is the most powerful enhancement to learning (Biggs and Tang 2007; Black and William 1998). Literature suggests that formative assessment increases student mindfulness and also improves long-term retention (Bangert-Drowns, Kulik and Kulik 1991; Nuthall and Alton-Lee 1995).Ramaprasad (1983) defines feedback as information about the 'gap' between the actual level and the reference level of performance, emphasising that information was only 'feedback' if it was used to close the gap. Feedback is important to engage students academically and effective feedback leads to improved learning outcomes (Black and William 1998; Nicol and Macfarlane-Dick 2006; Ramsden 2003).In addition, good feedback gives students an opportunity to rectify their mistakes before any damage is done (Goldfinch and Hughes 2007).

However, there is evidence suggesting that feedback messages are always complex thus students require opportunities to understand them (Ivanic, Clark and Rimmershaw 2000; Higgins, Hartley and Skelton 2001). Black and William (1998) say that the teacher has two options in assisting students to close the gap between the existing achievement and desirable level being, firstly, to develop the student's ability to self-assess and recognise any gaps and leave it to them to carry out any action to improve their learning and, secondly, to take responsibility to guide and direct students how to close the gap.

Shepard (2005) proposes teachers use scaffolding and formative assessment to move student learning forward. The author describes scaffolding as support provided to students in the course of problem solving including reminders, encouragement and hints to successful completion of a task. For an assessment to be 'formative', in line with Black and William's (1998) comments, Sadler (1989) indicates that students first must appreciate what 'high standard' means then evaluate their performance against the standard and be able to take action to improve.

Students are the ones who should be active in learning and responsible to manage their own learning in a student centred learning environment (Lea, Stephenson and Troy 2003). It has been recognised that appropriate and timely feedback improves student learning and formative assessment helps students to become self-regulated learners (Nicol and Macfarlane-Dick 2006). The authors continue to say that corrective advice should be provided so that students understand how to improve their learning. According to Pintrich and Zusho (2002), self-regulation refers to the extent that students regulate their thinking, motivation and behaviour during learning. Results of empirical studies reveal that self-regulated learners are more effective learners, being high achievers, more confident, persistent, and resourceful (Pintrich 1995; Zimmerman and Schunk 2001). Nicol and Macfarlane-Dick (2006, p205) summarize seven principles of good feedback from the literature:

1. helps clarify what good performance is (goals, criteria, expected standard);
2. facilitates the development of self-assessment (reflection) in learning;
3. delivers high quality information to students about their learning;
4. encourages teacher and peer dialogue around learning;
5. encourages positive motivational beliefs and self-esteem;
6. provides opportunities to close the gap between current and desired performance;
7. provides information to teachers that can be used to help shape learning.

Dialogue or discussion with the teacher is essential for feedback to be effective (Laurillard 2002). Teachers should try to encourage discussion as this helps students to understand the expectations and standards better (Freeman and Lewis 1998). Also, it is found that peer discussion can be motivational and stimulate student learning (Boyle and Nicol 2003). It is said that sometimes it is easier for students to accept criticism from their peers than from teachers (Nicol and Macfarlane-Dick 2006).

Online Formative Assessment

Online learning has become a popular mode of delivery as it provides students with flexible access to course content and instructions at any time and from anywhere with unlimited educational discussion opportunities (Centre for Technology in Learning 2009; Garrison and Kanuka 2004). Other benefits of online learning include a variety of media and unlimited web explorations, providing learning opportunities for learners who cannot or choose not to attend traditional face-to-face offerings, disseminating course material more cost-efficiently, enabling academics to handle more students, as a medium to encourage deep learning as the students have more time for reflection and providing students with more resources to promote their learning effectiveness(Arbaugh 2005; Bodzin and Cates 2003; Centre for Technology in Learning 2009; Santally and Raverdy 2006; Spiro and Jehng 1990).

It has been recognised that the use of technology, particularly online learning in property education, is rewarding for both students and academics (Cornish, Reed and Wilkinson 2009; Mak et al 2010; Yam and Rossini 2012; Wolverton and Wolverton 2003). Yam and Rossini's (2012) study on a group of first year property students suggests that external students who were exposed to online learning performed better than internal students in the blending mode. While there are other researchers who reveal online learning is more effective than traditional learning (for example, Asan 2003; Cole and Hilliard 2006; deLeon and Killian 2000), there are studies that indicate no significant difference in effectiveness between online and traditional learning (for example, Jones 2003; Shen, Chung, Challis and Cheung 2007).

Formative assessment is important in both traditional and online learning. Many researchers suggest that student learning outcomes can be improved if online formative assessment is included (Buchanan 2000; Burrow et al 2005; Gardner, Sheridan and White 2002; Henly 2003; Peat and Franklin 2002; Velan, Kumar, Dziegielewski and Wakefield 2002). It has been proposed that online quizzes should be provided so that students can access feedback anytime, anywhere and as many times as they wish (Nicol and Macfarlane-Dick 2006). A study by Martinez and Martinez (1992) reveals that frequent tests can improve learning. Also, previous studies (see Buchanan 2000; Sly

1999; Yam and Rossini 2012) show that students who did the formative quiz performed better than students who did not do the formative quiz. This could be because of familiarity with the type of questions and students doing more study to rectify their mistakes in the practice quiz. The authors comment that formative assessment engages student learning and improves learning effectiveness. Another advantage of the online multiple-choice quiz is that students receive instant feedback on their weaknesses and how to address them (Buchanan, 2000).

It is worth noting that in a review of 40 studies, Bangert-Drowns, Kulik and Kulik (1991) indicate that student's performance improved with frequent testing. However, it only improved up to a certain level and beyond that it could decline again. The paper also reveals that several short quizzes were more effective than the longer ones. This is also evident in Schloss, Smith and Posluzsny's (1990) paper where the students performed significantly better when given a short quiz after each lecture than they did when no quiz was given. Nevertheless, there are also studies that report formative test produced no improvement in learning (Iverson, Iverson and Lukin 1994; Strawitz 1989).

Many researchers argue that timely feedback and the opportunity to repeat the quiz should be included in online formative assessment (Buchanan 2000; Henly 2003; Peat and Franklin 2002; Wang 2008). Buchanan (2000) further comments that students should not be provided with the correct answer, but given reference so that they can learn on their own. In the same study, Buchanan (2000) found that student performance was statistically significantly correlated with both class attendance and use of formative assessment.

Discussion is another form of informal formative assessment (Yorke 2003). Burrow et al (2005) say that students should be encouraged to ask questions and discuss with their teachers or peers when they face difficulties in learning, which can be in the form of email or online discussion forum. Although the study by Yam and Rossini (2012) on first-year property students did not find any significant correlation between online discussion and student performance, the authors found that the online workshops were significant in assisting students in their major assignment. They argue that the online workshop is a useful tool in project-based learning to scaffold the students in completing their individual project.

RESEARCH QUESTION

Formative assessment is essential to improve student performance. Although there have been many studies on the statistical relationship between formative test and summative test (for example, Buchanan 2000; Sly1999; Yam and Rossini 2012), there has not been a study that compares the effectiveness between traditional and online formative assessment to date. To fill the gap, this paper aims to explain the implementation of formative assessments, both online and traditional, across two groups (online versus blended learning) of undergraduate students in a first-year property course.

Apart from examining the relationships between formative and summative assessment, this research was also designed to compare the effectiveness between traditional and online formative assessment. At the same time students' perception of the usefulness of formative assessment was also examined and discussed.

In short, this research sought to address the following hypotheses and questions:

1. students who attended the face-to-face workshop performed better in the summative test than those students who did not attend the face-to-face workshop;
2. students who did the online formative quiz performed better in the summative test than those students who did not do the formative quiz;
3. students who achieved higher marks for their formative quiz performed better in the summative test than those students who had lower marks;
4. students who posted questions in the online discussion forum performed better in the summative test than those students who did not post questions in the online discussion forum;
5. how did the students perceive the usefulness of the formative quiz in assisting them in the summative test?;
6. how did the students perceive the usefulness of the weekly workshop in assisting them in the summative test?; and
7. how did the students perceive the usefulness of the online discussion forum in assisting them in the summative test?

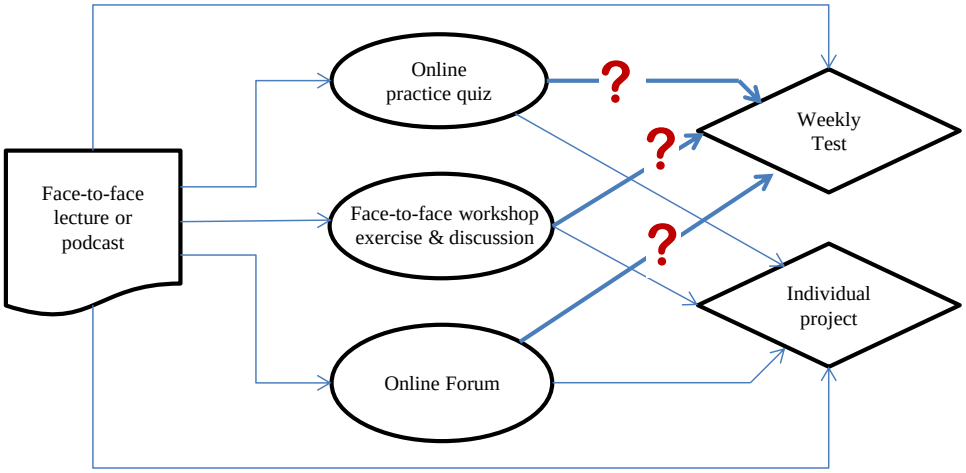
PROJECT BACKGROUND

The case study involved students from a first year, first semester property course, *Discovering Opportunities in Property*. This course was also available as a university-wide elective. Two delivery modes were offered for this course, a blended learning mode for internal students and online learning for external students. Moodle® was adopted for online teaching in the university, being an open source learning management system widely used by higher education institutions in Australia and overseas (University of South Australia 2010).

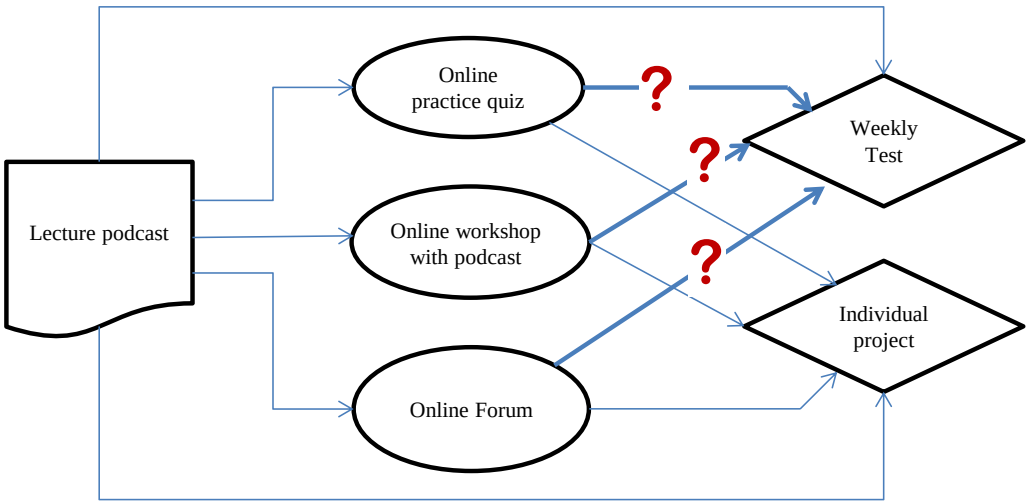
Both internal and external students were provided with the same instructional materials and assessments. A face-to-face lecture and workshop were available to internal students while the external students were provided with podcasts and online workshops. All course materials, such as the study guide, power-point slides, workshop instructions and assignment details, were available online so that all students could access them from anywhere at anytime. Students enrolled in the course were also provided with a booklet which consisted of study guide and workshop templates.

In order to improve student learning experience and performance, both formal and informal formative assessments were planned including weekly online practice quizzes, weekly workshop exercises and an online forum. There were two components of summative assessment for this course, the best 10 of 12 weekly online tests and an individual project which is due at the end of the study period. The weekly test and the individual project each had a 50% weighting for the final summative mark. Students could do the weekly practice quiz as many times as they wished and instant feedback was provided to facilitate their learning. Solutions to the workshop exercise were provided to facilitate student learning. Students were also advised to participate in the online forum to enhance their learning experience.

Blended Learning for Internal Students



Online Learning for External Students



Course Delivery of Blended Learning and Online Learning
Source: Authors
Figure 1

Internal students, who were exposed to the blended learning mode, had the advantage of face-to-face contact during the lecture and workshop. The main purpose of the weekly workshop was to provide students with the opportunity to complete and discuss the workshop exercise as well as to seek assistance with any problems that they faced with their practice quiz and individual project. Students could choose not to attend the lecture and workshop as the podcast and workshop material were also available online. Internal students were advised to ask questions in the face-to-face workshop instead of using the online discussion board. All the formative quizzes were only available online.

For external students, the main channel of communication with the lecturer was the online discussion forum. In other words, the external students did not have the advantage of face-to-face contact as the internal students did. Although email was also used in teacher-student communication, students were discouraged from using email unless it was related to a personal matter. Therefore, this paper did not include email in its analysis.

The course delivery in Figure 1 depicts the elements of formative and summative assessment used for both internal and external students in Semester 1, 2012. The focus of this research was to investigate whether there were any significant correlations between formative assessments and the summative weekly test. These results were then compared to student perceptions of the usefulness of formative assessment in their learning.

RESEARCH METHODOLOGY

This paper is based on an exploratory research project using student survey data as well asrecords of students' performance and activities over the firstsemester of 2012. As suggested by Sander, Stevenson, King and Coates (2000), collecting students' perceptions as feedback is an effective means of giving students a voice in course delivery. The student survey was designed to find out how students perceived the usefulness of formative assessment in their learning. An in-class survey was conducted in Week 11 for internal students while an online survey was open to external students from Week 11 until Week 15. The survey was performed in compliance with the research ethics guidelines of University of South Australia. The variables collected in the survey are summarised in Table 1.

Summative student performance was measured by the marks obtained in each of 12 weekly tests as well as an aggregated best 10 of the 12 which made up 50% of the students final grade. Formative activity was measured on a number of criteria. For internal students, attendance records were kept for workshops and both individual week attendance and aggregate attendance were used as variables. For external students, activity on the online wiki (posting and viewing) was used as an indicator for workshop activity as well as posts to the online forum. Online activity was measured for all students using 'hit counts'. 'Hit counts' have been used in past research when investigating the effectiveness of online learning (see Buchanan 2000; Lowes, Lin and Wang 2007; Yam and Rossini 2012). Although Lowes et al (2007) point out that 'hit data' may be misleading as it says nothing about what the student does, Yam and Rossini (2012) argue that 'hit data' is still useful in indicating frequency of access and usage of online material. In a course such as that used in this paper, where there was no text-book and all materials were online, more hits may not represent

more activity however a failure to hit the material is likely to be a good indicator of lack of activity. Hit counts were collected for each resource and activity on the online course page. For online forums, this was broken down into posting forum items, reading forums and also reading more detailed forum discussions.

Variable	Variable description
Q1: To what extent does your weekly practice quiz assist you in getting a good result in your weekly assessed quiz?	5 Point Likert Scale
Q3: Having done the weekly practice quiz, what do you do to improve your performance in your weekly assessed quiz?You may choose more than one answer	
Q3-Spend1 hour to study the course material again	Dummy Variable 1=yes, 0=no
Q3-Spend2-3 hours to study the course material	Dummy Variable 1=yes, 0=no
Q3-Discuss the questions with other course mates	Dummy Variable 1=yes, 0=no
Q3-Pose my questions to the online forum to seek clarification	Dummy Variable 1=yes, 0=no
Q3-Contact my tutor/lecturerfor clarification	Dummy Variable 1=yes, 0=no
Q3-Do nothing	Dummy Variable 1=yes, 0=no
Q4: What are the three best aspects of the practice quiz?	Open Text question
Q5: What are the three worst aspects of the practice quiz?	Open Text question
Q7: To what extent does your weekly workshop assist you in getting a good result in your weekly assessed quiz?	5 Point Likert Scale
Q8: What are the three best aspects of the weekly workshop?	Open Text question
Q9: What are the three worst aspects of the weekly workshop?	Open Text question
Q10: How useful was the online forum for you?	5 Point Likert Scale
Q11: What are the three best aspects of the online forum?	Open Text question
Q12: What are the three worst aspects of the online forum?	Open Text question
Q13: Do you have any other comments?	Open Text question
External Student	Dummy Variable (1=External "online", 0=Internal "Blended")

Note: Question 2 and Question 6 from the survey are not used in this paper. All students were offered the survey resulting in 121 internal student (61%) and 21 external student (27%) responses.

Student Preference Survey Data
Source: Authors
Table 1

The final important formative indicator was activity on the weekly practice quizzes. Each weekly online test had an accompanying weekly practice quiz with similar style of questions although no questions were replicated in the weekly test. Students could attempt these quizzes on multiple occasions but with reasonable time lags imposed between attempts. Three indicators were collected for each quiz and then as a total aggregate for each student. These were the number of attempts for each weekly quiz, the minimum mark and the average mark. All student performance and activity variables are listed in Table 2.

The data was analysed in a descriptive form and using basic regression modelling. Data from the student perception survey that was collected as Likert scales was tabulated and presented as bar charts with separate responses for internal and external students, each group summing to 100%. Mann-Whitney and Kruskal-Wallis were estimated to test the hypothesis that the responses from

Variable	Variable description
Student Characteristics	
External Student	Dummy Variable (1=External "Online" , 0=Internal "Blended")
Student Age	Continuous Variable Age in years and decimal years at course commencement
Male Student	Dummy Variable (1=Male , 0=Female)
Elective Student	Dummy Variable (1=Taking course as elective, 0 = Taking Property Program)
Business Student	Dummy Variable (1=Enrolled in Business Program, 0=enrolled in other program).
International Student	Dummy Variable (1=International , 0=Not-international)
Summative Marks	
Test1…Test12 Mark	Array of 12 variables with the respective weekly test mark out of 5
Test Count	Total number of test attempted (submitted)
Best Ten Test Results	Total of best 10 of 12 test results out of 50 (used in final course grade)
Workshops	
WK1…WK12 Attendance	Array of 12 dummy variables indicating attendance at respective internal workshop
Use Wiki	Total number of contributions to the wiki (posts, comments etc)
View Wiki	Total number of times the wiki was viewed
Practice Quizzes	
Quiz Attempts	Total number of practice quizzes attempted
Review Quiz	Total number of quizzes attempts reviewed
Quiz1 to Quiz 12 attempts (n)	Array of 12 variables with the respective number of attempts for each quiz
Quiz1 to Quiz 12 lowest mark	Array of 12 variables with the respective lowest mark for each quiz
Quiz1 to Quiz 12 average mark	Array of 12 variables with the respective average mark for each quiz
All Quiz Min	Average Minimum Mark across all attempts at all12 quizzes
All Quiz Ave	Average Mark across all attempts for all attempts of all 12 quizzes
Quiz Ave-Min	Difference between the All Quiz Ave and All Quiz Min
Online Forum and News	
View Course News	Total number of times that course news was read
Post to Forum	Total number of postings to the student forum
View Student Forum	Total number of views of the student forum
View Student Discussion	Total number of views of specific student forum discussions
General resources	
How to Use webpage	Total number of views of how to use this web page
View quiz Instructions	Total number of times the quiz /tests instructions were viewed
View Resource	Total number of views of resources pages
Study Guide (online text)	Total number of views of study guide chapters
Workshops Instructions	Total number of views of weekly workshop instructions (with access to workshop resources)

Note: Data set contains data for 199 internal students (201 students enrolled) and 79 external students (80 students enrolled).The three excluded students never accessed the website nor attended class or submitted weekly tests.

Student Activity and Performance Data
Source: Authors
Table 2

internal and external students are not significantly different. Text responses were collated and grouped into broad categories and some specific comments used as examples.

Online hit rate data and quiz results were tabulated and compared to the summed best-10 marks for the weekly tests by using mean scores. The best-10 mark (which was reported to students and used in the final assessment for students along with the project mark) was also used as the dependent variable in a linear multiple regression model where a variety of the hit rate and overall practice quiz indicators were used as independent variables together with some student characteristic indicators. The variables were selected to cover all formative items but to minimise the problem of multicollinearity. The VIF was used to test for multicollinearity. In addition to the model using the best-10 marks as the indicator of the weekly test, individual regressions were estimated for each weekly test result based on the result of that particular practice quiz and the workshop activity during that week.

	Internal		External		
	Male	Female	Male	Female	All
Count	111	88	42	37	278
Elective Student	0.61	0.78	0.74	0.81	0.71
Business Student	0.95	1.00	0.83	0.95	0.95
International Student	0.46	0.60	0.24	0.24	0.44
Student Age	22.10	22.45	24.69	27.68	23.35
Workshops Attended	9.08	9.41	na	na	9.25
How to Use webpage	0.13	0.13	0.24	0.16	0.15
View Resource	58.43	50.74	46.33	85.70	57.80
Book-Study Guide	15.74	14.70	15.57	28.00	16.07
Book Workshops	24.04	23.22	23.60	47.95	26.89
View Course News	2.98	3.76	3.48	6.41	3.76
Post to Forum	0.46	0.80	1.02	1.86	0.84
View Student Forum	10.86	17.07	15.60	24.97	15.42
View Student Discussion	17.61	26.07	27.24	44.03	25.26
Use Wiki	na	na	1.64	2.32	0.56
View Wiki	na	na	6.83	14.95	3.02
View quiz Instructions	2.34	2.91	2.64	3.95	2.78
Quiz Attempts	15.07	14.98	10.90	12.24	14.04
Review Quiz	23.69	22.22	17.31	20.05	21.78
All Quiz Min	2.00	2.20	2.20	2.50	2.16
All Quiz Ave	2.78	2.96	2.66	3.00	2.85
Quiz Ave-Min	0.78	0.76	0.46	0.50	0.69
Best Ten Test Results	30.43	32.48	27.40	32.92	30.95

Mean Variable Values by Course Mode and Gender
Source: Authors
Table 3

RESULTS AND DISCUSSION

The results are presented as summary statistics as well as the statistical modelling. The summary statistics provide a good overview of the material and basic understanding of the nature of the results. Table 3 shows the mean for all relevant variables broken down between internal and external students and by gender.

Table 3 shows some differences in the characteristics of the students who studied internally and externally. Means that vary greatly from the overall class average are in darker shades. Higher proportions of internal students were male and generally younger. There was also a higher proportion of international students studying internally. External students were generally older, particularly females. International students made up a small percentage of the external students but there was still a significant number.

Formative activities and use of the web resources were reasonably consistent across internal students and external male students. External females showed a considerable difference with external female students utilising the online facilities at far higher rates. This was particularly highlighted by a greater propensity to use the online wiki. Internal students were more likely to take the practice quizzes more often but this did not reflect in higher average marks. Externals students attempted the practice quizzes less often but had higher minimum and average marks suggesting that they studied the material more prior to attempting the quiz. Generally, female students outperformed males in the weekly tests (as reflected by the best-10 test result) with females averaging just over 32/50 for both internal and external students, while males were notably lower with 30.4 for internals and only 27.4 for externals.

The results are broken down between local and international students in Table 4.What is noticeable is that international external students had similar characteristics to internal students particularly in terms of formative items. While they tended to have typically higher interactions with online resources that did not require interactions (notes, instructions, etc.) they were noticeably less inclined to use online discussions and the wiki. Although the international external students used the practice quiz in a similar manner to local externals, they scored lower marks. The marks for the best-10 weekly tests were almost identical for internal local and international students, slightly lower for external local students but considerably lower for external international students.

The results from this analysis suggest that internal students were more homogenous in terms of characteristics and online behaviour than external students. External students' behaviour varies depending upon gender and if they are international As a result of these preliminary findings, further analysis was split between internal and external students.

	Internal		External		
	Local	Intnatl	Local	Intnatl	All
Count	95	104	60	19	278
Elective Student	0.44	0.91	0.72	0.95	0.71
Business Student	0.94	1.00	0.85	1.00	0.95
Male Student	0.63	0.49	0.53	0.53	0.55
Student Age	21.82	22.65	27.02	23.16	23.35
Workshops Attended	9.06	9.41	na	na	9.25
How to Use webpage	0.11	0.14	0.25	0.05	0.15
View Resource	43.16	65.88	62.95	70.53	57.80
Book-Study Guide	12.20	15.56	21.97	19.58	16.07
Book Workshops	17.66	29.16	34.32	37.16	26.89
View Course News	3.27	3.37	5.27	3.53	3.76
Post to Forum	0.77	0.46	1.75	0.37	0.84
View Student Forum	14.13	13.12	22.10	13.32	15.42
View Student Discussion	21.56	21.16	37.47	27.63	25.26
Use Wiki	na	Na	2.25	1.05	0.56
View Wiki	na	Na	11.32	8.47	3.02
View quiz Instructions	1.97	3.16	2.87	4.47	2.78
Quiz Attempts	13.21	16.69	11.43	11.84	14.04
Review Quiz	21.81	24.16	18.67	18.37	21.78
All Quiz Min	2.19	1.99	2.45	1.99	2.16
All Quiz Ave	2.84	2.88	2.89	2.59	2.85
Quiz Ave-Min	0.65	0.89	0.44	0.60	0.69
Best Ten Test Results	31.28	31.38	30.83	27.32	30.95

Mean Variable Values by Course Mode and International Status
Source: Authors
Table 4

Regression Modelling – Best Ten Weekly Test Mark Against Formative Assessment

Two regression models were estimated to test the relationship between student and activity characteristics and the best-10 weekly test result.

Both internal and external student models show a statistically significant relationship between the dependent variable (best-10 weekly test mark) and at least one indicator independent variable. Multicollinearity was avoided through variable selection except in the case of two variables which were mathematically correlated and hence could not be interpreted independently. There were some clear structural differences in the models suggesting that some outcomes vary between internal and external students while others were relatively constant.

	Internal		External	
RSquared	.388		.588	
F	10.33***		14.15***	
Variable	Coefficient	VIF	Coefficient	VIF
(Constant)	8.30**		5.62**	
Workshops Instructions	-0.01	1.17	-0.02	1.77
Workshops Attended	0.53***	1.15	N/A	N/A
Use Wiki	N/A	N/A	0.29	1.55
Post to Forum	0.4	1.26	1.28***	1.15
All Quiz Ave	4.18***	1.27	3.49***	2.00
Quiz Attempts	0.64**	20.94	1.19***	11.65
Quiz Attempts^2	-0.013**	20.29	-0.020***	8.54
Elective Students	1.68	1.08	4.11**	1.12

Dependent Variable: Best-10 Weekly Test mark out of 50.

*** Significant at 99% Level of Confidence

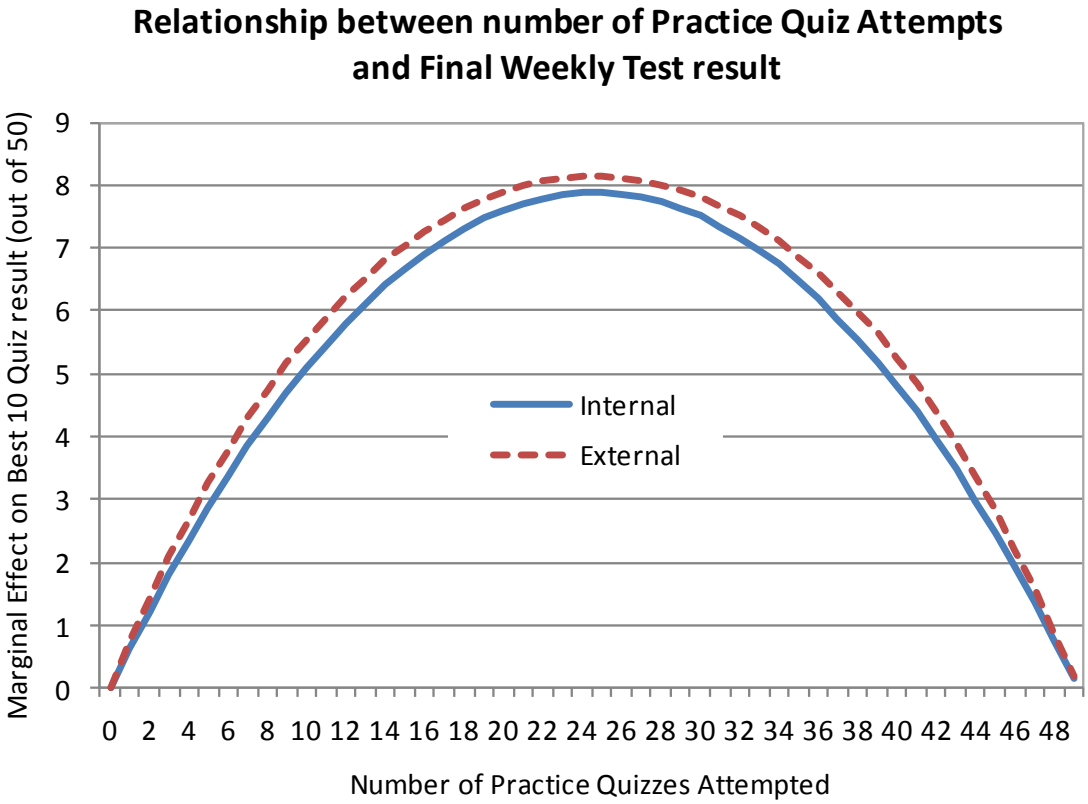
** Significant at 95% Level of Confidence

Regression Model - Best Ten Weekly Test Mark as Dependent Variable
Source: Authors
Table 5

For both internal and external students there was not a statistically significant relationship between simply accessing the workshop instructions and the best-10 mark (Table 5). "Hitting" the instructions did not lead to better outcomes. However internal students who attended the workshops had a strong positive relationship with the test result. The coefficient of .53 (significant at 99%) suggests an increase of roughly ½ mark for each of the 12 workshops that was attended, a total of around 6/50 marks. This result supported Buchanan's (2000) findings that student performance is significantly correlated with class attendance. The internal workshop was useful as informal formative assessment such as in-class discussion (Yorke 2003) helped students to improve their understanding on the course material, hence contributing to their better performance.

While it was more difficult to assess if external students had worked on the workshop, the wiki and forums posts would give some indications as around half of the workshops involved some specific input through these online vehicles and there was a forum available for each topic. The model shows no significant relationship between the wiki and the best-10 mark but a significant relationship for the forum. This could be because many external students used the online forum to ask questions whenever they faced difficulties and feedback provided had been helpful for them. As Laurillard (2002) says, discussion with teacher is essential to make feedback effective. In this case, the online forum was obviouslyuseful in enhancing students learning. In line with Burrow et al's (2005) suggestion, students enrolled in this course had been encouraged to use the online forum whenever they need assistance. There was no significant relationship found for internal students as they were discouraged from asking specific workshop questions via the online forum since they were better addressed in class.

The major similarities between internal and external students were in terms of the impact of the formative practice quiz. In both models the indicators for the number of quiz attempts and the performance (average score) had statistically significant impacts on the final test mark. This result was in line with results of previous research (see Buchanan 2000; Sly 1999; Yam and Rossini 2012) which found students who did the practice quiz performed better than those students who did not do the practice quiz. Quiz attempts were modelled using both the number of attempts and that number squared. This allowed to test for decreasing marginal mark improvement with multiple attempts which might be expected if some students took the quiz an excess number of times in order to "rote learn" the material. The model shows both the number of attempts and the attempts squared to be significant.



Relationship Between Marginal Effect on Best Ten Weekly Test Mark and Number of Practice Quizzes Attempted
Source: Authors
Figure 2

The implied marginal marks increase resulting from the number of quizzes attempted is shown in Figure 2 which indicates that, on average, students benefit from multiple attempts up to around 24 but then suffer a decreased result. Analysis of the number of attempts and student logs shows that most students made at least one attempt for each quiz prior to taking the weekly test (12 attempts in total) and this would on average result in around 5-6 higher marks overall in the weekly tests. A further group of students took each quiz roughly twice (24 in total) with a 1-2 hour time lag suggesting some further study in between. These students maximised the outcome for the weekly tests at around an eight mark marginal increase. The final group of students took most quizzes on

multiple occasions, (around 4 per week or 48 in total), often spending little time on each attempt. The model shows that students taking this approach had little or no impact on the final weekly test result. This reinforced the argument put forward by Bangert-Drowns et al (1991) that,although student performance improved with frequent testing, the performance will decline once it exceeds a certain number of attempts. This issue is pursued further in the discussion of student perceptions of the quiz.

The impact of the average mark of the practice quiz was somewhat greater than the number of attempts. The average mark seems to be a good indicator of the work completed by students prior to self-testing via the formative quiz (Yam and Rossini 2012). On average, an internal student with a one mark higher average quiz result would achieve 4.2 additional marks in the best-10 weekly tests while an external would achieve an additional 3.5 marks. This result, when considered in combination with the diminishing return for attempting the quiz, shows that simply taking formative quizzes does not in itself assist students in achieving better results. It is the study undertaken to understand the material prior to taking the formative quiz and between quiz attempts that leads to higher average marks in both the formative quiz and the weekly test.

Regression Modelling – Individual Weekly Test Marks Against Formative Assessment

The previous models show the effect of a range of student and behavioural characteristics against the best-10 test mark. One problem with this analysis is that, by amalgamating the test results, a spurious relationship may be produced. The relationship between the practice quiz (and workshop for internal students) and the weekly online test results was further investigated by considering individual regression estimates for each weekly test against the formative material that relates specifically to that weekly quiz. In this manner the individual results for the week 1 quiz were related to the particular student's performance in the practice quiz for that week as well as if they attended that particular workshop (in the case of internal students). This examined a much more direct link between the individual weekly formative activity and the summative outcome.

Table 6 shows the regression models for internal students and Table 7 the results for external students. Each table shows the individual regression results as well as the result when the data was "stacked" (for example, each of 12 weekly tests for each of 199 internal and 79 external students).

These models support the earlier findings that the average practice quiz mark was a key indicator of performance in the weekly test (Yam and Rossini 2012). For each model in both the internal and external situations, the coefficient for the average quiz mark was positive and significant. For internal students the workshops had a significant effect overall (when considering all tests) but it appears that only certain workshops were being significant in affecting the respective weekly test results. This makes sense when the nature of the weekly tests was considered. For example, in weeks 4, 6, 9, 10, 11 and 12, all of which show a significant effect, there were calculations involved in the weekly test and these were similar to those carried out in the workshops. As with earlier analysis, the number of quiz attempts was less significant, especially for internal students.

	R Sqd	F	(Constant)	Coefficient Workshop Attendance	Coefficient Quiz Attempts	Coefficient Quiz Ave Mark
Test 1	.234	19.8 ***	1.388 ***	0.515 *	-0.028	0.551 ***
Test 2	.216	18.0 ***	1.349 ***	0.225	-0.057	0.446 ***
Test 3	.183	14.5 ***	2.098 ***	0.290	0.077	0.349 ***
Test 4	.206	16.9 ***	1.998 ***	0.757 ***	0.040	0.265 ***
Test 5	.273	24.5 ***	1.344 ***	0.134	-0.136 *	0.457 ***
Test 6	.230	11.7 ***	2.171 ***	0.569 **	0.153	0.252 ***
Test 7	.277	24.9 ***	0.816 ***	0.193	0.021	0.315 ***
Test 8	.159	12.3 ***	1.610 ***	0.084	0.075	0.270 ***
Test 9	.251	21.9 ***	1.420 ***	0.431 **	0.16	0.423 ***
Test 10	.359	36.6 ***	1.601 ***	0.395 **	0.127 *	0.360 ***
Test 11	.375	39.1 ***	1.387 ***	0.489 ***	0.146 *	0.418 ***
Test 12	.281	25.5 ***	1.594 ***	0.408 **	0.025	0.351 ***
All Tests	.255	264.0 ***	1.460 ***	0.437 ***	0.044 *	0.396 ***

*** Significant at 99% Level of Confidence
** Significant at 95% Level of Confidence
* Significant at 90% Level of Confidence

Internal Students Regression Models - Weekly Test Marks vs Workshop and Quiz
Source: Authors
Table 6

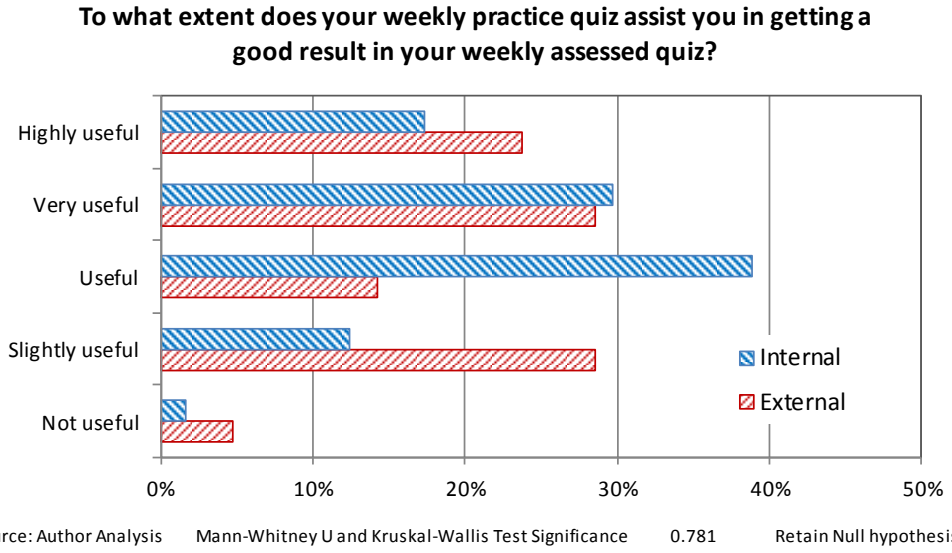
	R Sqd	F	(Constant)	Coefficient Quiz Attempts	Coefficient Quiz Ave Mark
Test 1	.207	9.948	1.744 ***	0.069	0.472 ***
Test 2	.296	15.9 ***	1.429 ***	-0.035	0.567 ***
Test 3	.314	17.3 ***	2.087 ***	0.236	0.423 ***
Test 4	.266	13.7 ***	1.853 ***	0.203	0.430 ***
Test 5	.170	7.7 ***	1.533 ***	0.451 *	0.192 *
Test 6	.401	25.4 ***	1.495 ***	0.357 *	0.563 ***
Test 7	.423	27.8 ***	0.830 ***	0.161	0.381 ***
Test 8	.440	29.8 ***	1.063 ***	0.333	0.460 ***
Test 9	.512	39.9 ***	0.851 ***	0.439 *	0.731 ***
Test 10	.427	28.2 ***	1.111 ***	0.290	0.444 ***
Test 11	.538	44.2 ***	0.992 ***	0.870 ***	0.440 ***
Test 12	.379	23.2 ***	1.531 ***	0.395 *	0.377 ***
All Tests	.351	255.6 ***	1.354 ***	0.254 ***	0.471 ***

*** Significant at 99% Level of Confidence
** Significant at 95% Level of Confidence
* Significant at 90% Level of Confidence

External Students Regression Models - Weekly Test Marks vs Practice Quiz
Source: Authors
Table 7

Relationship Between the Formative Practice Quizzes and Weekly Summative Test

In the previous section, the results and number of attempts at practice quizzes have been identified as having a significant influence on the weekly test mark. This section compares these results with the students' perception of how the practice quiz had assisted the weekly test.



Source: Author Analysis Mann-Whitney U and Kruskal-Wallis Test Significance 0.781 Retain Null hypothesis

Student Perception Survey - How Does Your Practice Quiz Assist Your Weekly Test?
Source: Authors
Figure 3

Students generally perceived that the practice quiz was at least slightly useful in getting a better result in the weekly test with over 85% of internals and almost 70% of externals finding it useful to highly useful (Figure 3). The Mann-Whitney and Kruskal-Wallis tests show no significant difference between the internal and external groups in terms of this perception. This result is, to some extent, contradicted by the regression modelling which shows that the practice quiz can have a significant effect on the weekly test results. A better understanding of the difference between the perception and the summative outcome can be derived from the comments that accompanied this question in the student survey.

Students who perceived the practice quiz to be highly useful had positive comments about the practice quiz but made few or no negative comments. Examples of comments about the best aspects of the quiz from such students are:

> *"Gives you a feel of what to expect in the real quiz. Allows you to review any areas of concern if need be"*
>
> *"Gives a good indication of what will be in the real quiz. Allows us to go back and studying what I got wrong. Points out what I haven't understood clearly".*

Student who found the practice quiz to be only slightly useful or not useful focused on negative comments such as:

> *"Every question is different and unrelated so a practice quiz doesn't really prepare you for the real quiz except on few occasions e.g. those involving calculations"*

and

> *"questions from practise quiz never come up in my actual quiz"*

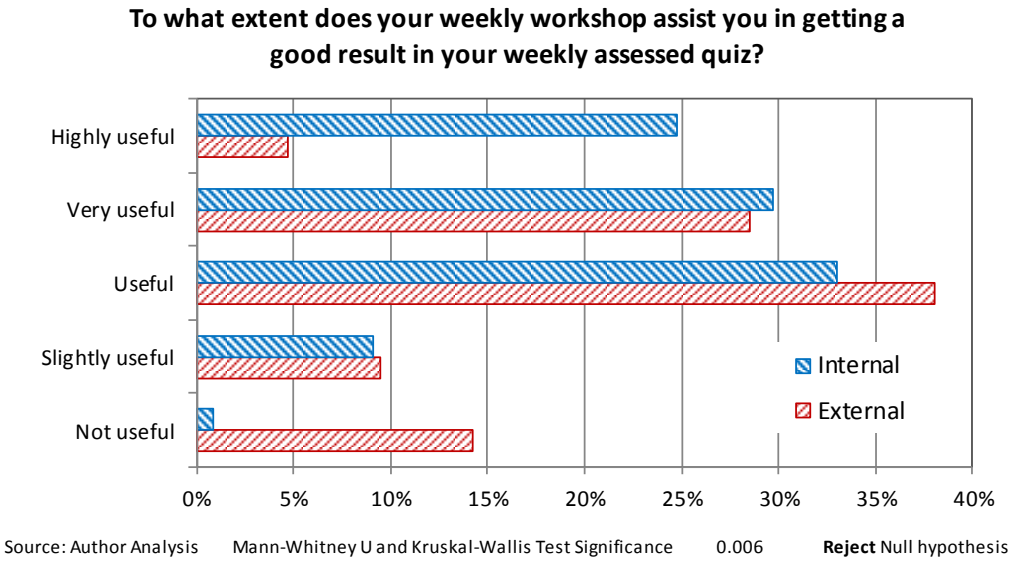
also

> *"amount of time between attempts; this does allow for learning in between, but may not suite every students time frames"*

Noticeably, those students who found the practice quiz to be useful focused on understanding the material and using the quiz for self-testing, while the negative comments came primarily from students who perceived it to be less useful and focused on using the practice quiz in a "rote learning" role. In this regard, the results from the student perception survey were consistent with the summative modelling results in that the models suggest that using the practice quiz as a rote learning tool will not result in higher marks and hence a negative perception from those students looking to use it that way.

Relationship Between the Formative Weekly Workshop and Weekly Summative Test

The analysis of summative results suggested that attendance at internal workshops had a positive effect on test marks for internal students, but for external students the use of the wiki was not significant and the importance of the online forum, while significant, may be smaller in magnitude than internal attendance at workshops.



Student Perception Survey - How Does Your Workshop Assist Your Weekly Test?
Source: Authors
Figure 4

The perception of students towards the usefulness of the workshops for the result in the weekly test shows a statistically significant difference between the two groups (internal and external) based on

the Mann-Whitney and Kruskal-Wallis tests. While 24.8% of internal students found the workshop to be highly useful, only 4.8% of externals perceived this to be the case (Figure 4). By comparison, 14% of external students found the workshops to be not useful while only 0.8% of internal students perceived this. The analysis of the actual usage of the web resources showed that certain groups of external students, particularly males and international students, had a lower propensity to access workshop resources and to contribute to active learning opportunities such as the wiki. This may be due to the perception that they were not useful to the weekly test or the perception may arise from the failure to use these resources and seeing a resulting improvement in test results.

These perceptions are further enhanced by consideration of the comments made by external students. Students who found the workshops to be useful have no negative comments but made the following positive comments about the workshops:

> *"Gives great examples of what we are studying. Let's us see processes in action. Helps a lot with the project."*
>
> *"The opportunity to communicate with each other, understand the exercises and ultimately apply them to the quiz and project"*

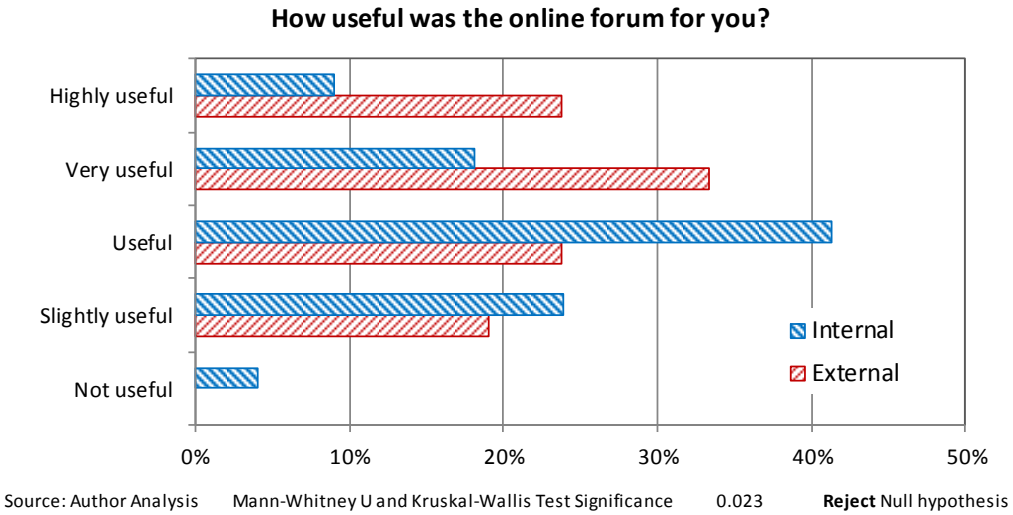
On the other hand, there were a larger group of external students who found it to be not useful and had a very different view of the same activities:

> *"I didn't really see how externals could join the workshop"*
>
> *"Answers are not provided for external students and we miss out on that class discussion."*

The second group contributed to the low participation rate for external students and were probably made up primarily of final year internal students taking the course as a final elective in external mode, being students only familiar with in-class environment for discussion and finding "answers". All workshops had some mechanism for feedback, either through worked solutions, wikis or the forum. The varied responses suggest that, to engage a wider range of students, these formative assessments may not be sufficient and other strategies such as a virtual class room may be preferred.

Relationship Between the Online Forum and Weekly Summative Test

Posting to the online forum was found to be a positive indicator for external students resulting in higher weekly test scores. For internal students, there was no significant effect. This is the expected result given that internal students were encouraged to ask questions and make discussion within classes while this was the "go-to" place for external students. The student perception survey shows a comparable result.



Student Perception Survey - How Useful Was the Online Forum?
Source: Authors
Figure 5

The perception of students towards the online forum shows a statistically significant difference between the internal and external students based on the Mann-Whitney and Kruskal-Wallis tests. A total of 57.1% of external students found the forum to be very useful or highly useful while only 27.3% of internals found this to be the case (Figure 5). However, 42.7% of internals found it to be useful suggesting that, while they did utilise the workshop tutors to a major extent, they also found some additional benefit from the online forum. These finding support the results from the modelling of the weekly test marks.

Student comments provide further insight. External student provided no negative comments about the forum but they made many thoughtful and positive comments when asked about the online forum. The following two are excellent examples:

> *"Each student has the freedom to post problems/questions that are also applicable to other students and brings problem solving, learning, understanding, online communication and collaborative working into the course."*

> *"Realisation that while we are all different as are the property's being analysed, there were many points I could empathise with. So that shows the process works. The forum acknowledges that we are not being abandoned and left to our own resources."*

Internal students made a range of comments both positive and negative. Several students suggested that it was not useful:

> *"Don't really use it."*

and

"Not really useful as the workshop tutor is faster and provided more efficient feedback."

However common complaints were focused around the nature of the forum and having to read a wide range of discussions not specific to individual students. These included:

"Have to read though too many discussions to find answer"

and

"They don't answer question – just send back to previous answer"

This compares with other diametrically opposed opinions such as:

"People keep asking the same question rather than checking if it has already been asked and answered."

These results suggest, that although the online forum was a vital learning tool for external students, it was seen as a useful addition for internal students as it was inferior to the workshop discussion and the tutor.

CONCLUSIONS

Findings from this research demonstrate that both groups of students, internal (blended) and external (online) students, have benefited from the range of formative assessments offered in this first-year property course, albeit to a different extent. This paper aimed to examine the effect of both traditional and online formative assessments on summative performance of these two student groups. The following research questions and hypotheses have been addressed:

1. students who attended the face-to-face workshop performed better in the summative test than those students who did not attend the face-to-face workshop.
   Both regression models show that workshop attendance had a significant positive relationship overall with the weekly test results of the internal students;

2. students who did the online formative quiz performed better in the summative test than those students who did not do the formative quiz.
   Students who did the practice quiz performed better than those who did not do the quiz. The test results improved with more number of attempts but declined after exceeding a certain number of attempts. Generally, students who completed the practice quiz twice maximised the outcome in the weekly test. This applied to both groups of students;

3. students who achieved higher marks for their formative quiz performed better in the summative test than those students who had lower marks.
   In all regression models, the average mark of the practice quiz was significantly related to their performance in the summative test. On average, students with a one mark higher average in practice quiz resulted in about four additional marks in the best-10 test marks;

4. external students who posted questions in the online discussion forum performed better in the summative test than those students who did not post questions in the online discussion forum.
   The online discussion was the only effective platform where external students could ask academic related questions and this has been proven useful for them. There was no significant relationship found for internal students as they were encouraged to discuss problems in the workshop with their tutor;

5. how did the students perceive the usefulness of the formative quiz in assisting them in the summative test?
   Both internal and external students generally found that the formative quiz was useful to highly useful for the summative test and there was no statistically significant difference between the two groups;

6. how did the students perceive the usefulness of the weekly workshop in assisting them in the summative test?
   There was a statistically significant difference between internal and external students in their perception towards the usefulness of workshop for their summative test. Most of the internal students found workshop to be useful with only 1% suggesting it was not useful. By comparison, 14% of external students thought the online workshop was not useful to assist them in their summative test. Unlike the internal students who had the face-to-face contact with their tutor and peers, there was a small group of external students who had found difficulty to interact in an online workshop environment; and

7. how did the students perceive the usefulness of the online discussion forum in assisting them in the summative test?
   There was a statistically significant difference between internal and external students with the majority of the external students finding the online forum to be useful while only 27% of the internal students found it useful. This was because the in-class workshop provided internal students with greater support with the interaction with their tutor and peers.

This study is limited by the use of student perception survey which can be biased as students might be reluctant to say something negative about the teaching. To arrest this concern, all survey was anonymous so that students felt free to voice their opinion. Data from the student survey was important for informing how useful the formative assessments were and how improvement can be made for further engagement.

Although both internal and external students found formative assessment to be beneficial in improving student performance, it was useful to find out that there was a group of external students who felt that they had been left out and did not know how to participate in the online environment. To further engage these groups of external students, a virtual workshop (using a virtual classroom) may be a solution for property academics where students can communicate with the tutor and other cohorts directly in real time in a similar manner to a face-to-face classroom.

It was not unexpected to find that the traditional face-to-face discussion in the workshop was an effective form of informal formative assessment where internal students found it useful for their summative weekly test and that class attendance was significantly related to student performance.

For internal students, clearly the traditional workshop in this case was superior to the online workshop. This could be because the learning style of internal students was more attuned to traditional settings in which they gained more from the face-to-face interaction.

Without doubt, the findings suggest that, moving forward, formative assessment should play a significant role in property education to improve student learning in both blended and online modes. However, there are challenges in its implementation. The main challenge is the amount of workload involved in designing formal formative assessment and feedback mechanisms. Even though the online practice quiz was vital for student performance, a concern lies in how many hours are actually allocated for academics to create a robust formative assessment framework.

To investigate how formative assessment can be further developed in property education to enhance student engagement, it may be worthwhile for future research to examine how other components of formative assessment, for example workshop exercise, can contribute to student performance and learning outcomes.

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