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An investigation into the relationship between on-line formative assessments and performance of students

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ABSTRACT

The aim of this study is to investigate the relationship between attempting online formative assessments and performance of students. The study is motivated by the dearth in research in the area of online formative assessment. The study reports mixed result of such relationship. A relationship was reported between attempting online formative assessments and performance in the mid-semester exam and each topic in the mid-semester exam. On the contrary, such relationship was not reported in regard to performance in the final exam and most topics examined in the final exam. The reason behind such findings can be attributed to the difference in the structure of questions in the final exam compared to those provided in online formative assessments, difference in complexity of topics and higher workload of students in studying specific topics. The findings of the present study have implications for accounting educators in regard to the use of on-line formative assessments and development of syllabus.

Keywords: on-line; formative assessments; students' performance.

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PsycINFO Classification: 3530
FoR Code: 1301; 1501

Introduction

Modern society has been transformed by the availability of technologies in everyday life. Advancement in technologies brought opportunities for its use in teaching and learning (Wall and Philips, 2008; Williams, 2002). Availability of technologies has made traditional teaching methods including textbooks, face-to-face and deductive teaching outdated (Garrison and Kanuka, 2004). In order to enhance learning of students and equip them for future employment, educational institutions are embracing a hybrid teaching and learning approach that complements face-to-face teaching with on-line materials. This hybrid form of teaching is known as 'blended learning' (Garrison and Kanuka, 2004). 'Blended learning' is an "integration of face-to-face and online learning experiences-not a layering of one on top of other" (Garrison and Kanuka, 2004, p.99).

Blended learning is a recent development in higher education, which aims to provide students with benefits of both traditional teaching methods and e-learning (Graham, 2004; Harding, Kaczynski and Wood, 2005). Previous studies reported positive effect of blended learning on the performance of students (Boyle, Bradley, Chalk, Jones and Pickard, 2003; Lim and Morris, 2009; O'Toole and Absalom, 2003) and suggested blended learning as opposed to solely traditional face-to-face teaching (Chambers, 199; Graham, 2004; Lebow, 1993; Macedo-Rouet et al., 2009; Radford, 1997; Tam, 2000).

There are several studies that investigated the effect of additional online materials on performance of students (Boyle et al. 2003; Lim and Morris, 2009; O'Toole and Absalom, 2003). However, there is lack of studies investigating the effect of online formative assessments on performance of students in accounting subjects. The present study fulfils this dearth in research. The reason behind concentrating on 'formative assessment' is its ability to provide feedback to students to help their learning (Nicol and Macfarlane-Dick, 2006) without attaching final grades (Harvey, 2004). The present study by focusing on online formative assessments reports the relationship between attempting these assessments and performance of students.

The present study measures performance of students by results in summative assessments. Results of summative assessment were examined as such results have positive influence on future employment of students (Pascarella and Terenzini, 2005; Humphreys and Davenport, 2005), future earnings of students (Smith and Naylor, 2001; Pascarella and Terenzini, 2005) and impacts their self-esteem and self-actualization (Astin, 1999).

The next section outlines the 'conceptual framework' followed by 'literature review and hypotheses development' in section three. Section four outlines the 'research method.' Section five reports the results followed by 'conclusion' of the study in section six. Finally section seven outlines the limitations of the study and delineates the directions for future research.

Conceptual Framework

The present study adopts Biggs' (1989) 3P model to investigate the relationship between 'attempting online formative assessments' and 'results in the summative assessments.' The model proposes relationship between these two variables and hence appropriate for the present study.

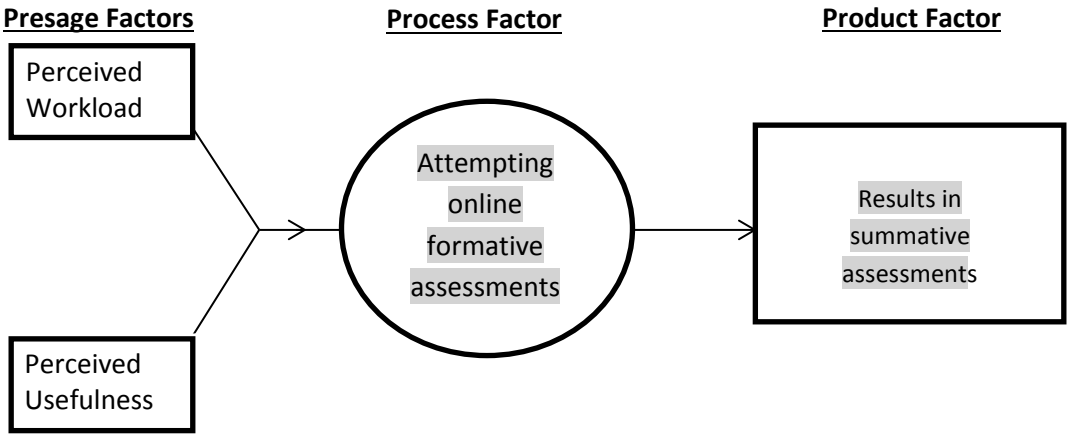
Biggs' (1989) 3P-model suggests that various 'presage factors' relating to student and teaching environment influences students to adopt a specific learning approach (process factor) that affects the quality of the product factor (academic outcome) (Tam 1999).

'Presage factors' include those variables that exist prior to the actual engagement in learning (Huang , 2008; Nield, 2007; Raadt, Hamilton, Lister, Tutty, Baker, Cutts, Hamer, Petre, Simon, Box, Fincher, Haden, Robins, Sutton, Tolhurst, 2005; Delahaye and Ehrich, 2008; and Zhang, 2000). Tempone (2001) defined 'presage factors' as prior experience that students bring into the learning experience and their expectations of the new experience. Biggs (2003), Tam (1999), and Lizzio, Wilson, and Simons (2002) identified two types of 'presage factors,' those relating to students that are, prior knowledge, intelligence, values, and personality characteristics and those relating to the teaching environment that are unit structure and content, workload assessments and teaching method. Prior research reported that 'presage factors' interact with each other and affect the 'process factor' (Jones, 2002; Tam, 1999; Biggs, 1987; Freeth and Reeves, 2004).
'Process factor' refers to the learning approaches adopted by students (Biggs 1987; Lizzio, Wilson, and Simons 2002). Lizzio, Wilson, and Simons (2002) reported that 'presage factors,' such as perceptions of students influence their approach to learning (process factor). The 'process factor' then affect the 'product factor' that is, the outcomes of learning (Freeth and Reeves 2004).

Finally, the 'product factor,' refers to learning outcomes, such as academic performance (Biggs 2003; Biggs and Moore 1993). Lizzio, Wilson, and Simons (2002) described 'product factor' as the learning outcomes that students derive from the learning process. These outcomes may be objective such as, marks and grades or subjective such as, the level of satisfaction with one's own performance (Nield 2007; Raadt et al. 2005).

The scope of the present study is limited to the 'process factor' (attempting online formative assessments) and 'product factor' (results in the summative assessments). The scope of the study is highlighted in Figure-1 below:

Figure-1:
Factors affecting performance of students



Literature Review and Hypothesis Development

Use of additional online materials

'Additional online materials' refer to materials provided to students as a complement to the lecture and tutorial content (Horton, Wiederman, and Saint 2009). Jordan (2010) defined 'additional online materials' as a multimedia enhanced environment which enriches the textual lecture materials. 'Additional online materials' include on-line lectures (Buchanan, MacFarlane, and Ludwiniak, 2011), notes and additional readings (Drennan, Kennedy, and Pisarski 2005), additional homework (Kilbane, Moebs, and McManis, 2009), surveys (Anderson and Serra 2011), and quizzes (Galizzi, 2010). The present study focuses on additional online materials in the form of formative assessment provided as quizzes. Previous studies adopted varying methods to measure 'usage' (DeNeui and Dodge 2006; Cliff, Freeman, Hansen, Kibble, Peat, Wenderoth, 2008). In the present study 'usage of online formative assessments' is measured by referring to the number of times the online quizzes have been attempted by students. These online quizzes were provided to students as formative assessments.

Previous studies investigating the relationship between 'usage of additional online materials' (process factor) and 'final grades' (product factor) reported mixed results. McFarlin (2008) transformed a large undergraduate physiology course from a traditional teaching format into a form of blended learning that provided students access additional learning materials. The author found that final grades of students were 9.9% higher when the course was delivered in a blended learning environment compared to traditional teaching format. Cliff et al. (2008) reported that students who did not use the online quizzes scored significantly lower in summative examinations than those who did attempt the quizzes. Similarly, Aravinthan and Aravinthan (2010) reported a strong positive correlation between 'number of online quizzes attempted' and 'overall grade.'

On the contrary several studies reported no relationship between 'usage of additional online materials' and 'student grade' (Peat and Franklin, 2003; Mehlenbacher, Miller, Covington and Larsen, 2000). Peat and Franklin (2003) reported no significant relation between 'usage of additional online materials' and 'student grades.' Contrary to the expectation, a greater proportion of the students who failed the subject used the additional online materials compared to those who passed the subject. Mehlenbacher et al. (2000) found no significant difference in grades of students between those who used additional online materials and those who did not use such materials.

There are some studies that investigated the relationship between attempting formative assessment and results in summative assessment. Peat, Franklin, Devlin and Charles (2002) and McFarlin (2008) reported that students using the self-assessment modules, which were provided as a form of formative assessment, scored on average 3.96 marks higher in their final grades compared to students who did not use the self-assessment modules. Similarly, Watty, Nichol, Kerstjens and Yu (2008) found that formative assessments contributed to a 14% increase in the pass rate.

There is a dearth in studies that investigated the relationship between attempting online formative assessments and results of students in summative assessments. Study by Heffner and Cohen (2005) and Stull, Majerich, Bernacki, Varnum and Ducette (2011) reported that

attempting formative assessments in the form of online quizzes had a significant positive effect on student performance.
Following the dearth in studies investigating the relationship between usage of 'online formative assessments and results in summative assessments the present study investigates such relationship. It is expected that 'attempting online formative assessments' will have a positive effect on 'results in summative assessments.' This is because students who attempted more online formative assessments are expected to have a better understanding of the subject material and spent more time on reflecting on the subject contents compared to those who did not use formative assessments. Hence the following hypotheses are framed:

H_1 : There is a positive relationship between attempting 'online formative assessments' and 'score in the mid semester exam.'
H_2 : There is a positive relationship between attempting 'online formative assessments' and 'scores in each topic in the mid semester exam.'
H_3 : There is a positive relationship between attempting 'online formative assessments' and 'score in the final exam.'
H_4: There is a positive relationship between attempting 'online formative assessment' and 'scores in each topic in the final exam.'

Results of summative assessments

According to Kokkelenberg, Dillon, and Christy (2008, 224), student results indicate the quality of a student's performance. Chamorro-Premuzic and Furnham (2003) defined 'student results' as a multiplicative function of intelligence and motivation. Sabot and Wakeman-Linn (1991) stated that results are the knowledge of students in a subject. For the purpose of the present study, student results are defined as the scores received by a student.

Studies by Smith and Naylor (2001) and Pascarella and Terenzini (2005) reported that grades have a net positive impact on both occupational status and future earnings. Employers usually make job offers to applicants achieving at least an upper second class honors degree as it reflects the graduate`s ability indicating a measure of human capital (Smith and Naylor 2001). Therefore, students who have a desire to achieve a higher occupational status and higher future earnings concentrate on achieving higher scores in their summative assessments.
Humphreys and Davenport (2005) suggested that student results are important to students because they are aware that results are important to succeed in the present competitive job market. Students also understand that good results are not only important for obtaining a first job but also for future career advancement and success as they progress in their career (Humphreys and Davenport 2005).
Hence 'student results' has been adopted as the indicator of performance of students in the present study.

Research Method

The sample of the present study includes 80 students enrolled in a second year Management Accounting subject at an Australian educational institution in semester one 2011.

The 'online formative assessments' provided to the students is known as 'Connect.' 'Connect' was provided by the publisher of the prescribed text book. Students were able to attempt quizzes from respective topics as formative assessments and received instant feedback.

The study included monitoring attempt to online formative assessments in semester one, 2011. Tracking method was used to monitor the attempting of online formative assessments. This was followed by monitoring results of to determine whether attempting online formative assessments had an impact on results of students in their summative assessments.

Prior to the commencement of the study, ethics approval was sought and obtained from the organization. At the beginning of the semester, the students were asked to sign a consent form mentioning their student identification number allowing the tracking of their use of Connect and accessing marks in summative assessments. Results of students in mid-semester and final exam were analyzed to investigate the relationship between 'attempt of online formative assessments' and 'results in summative assessments.'

Results

As 51 out of 80 students (63.75%) enrolled in the subject used Connect the relationship between 'attempting online formative assessments' and 'results in summative assessments' is restricted to the sample of 51 students.

The results from the Pearson correlation reported a positive relationship between 'attempting on-line formative assessments' and 'score in the mid-semester exam.' Pearson correlation was r = 0.470 (p=0.000) (Table-1) which means the relationship between 'attempting online formative assessments' and 'score in the mid semester exam' is as expected. Hence the H_1 is confirmed.

Table 1:
Relationship between 'attempting online formative assessments' and 'score in the mid semester exam'

		Usage of Additional Online Material for MST	MST Grades
Usage of Additional Online Material for MST	Pearson Correlation	1	.470
	Sig. (1-tailed)		.000
	N	51	51
MST Grades	Pearson Correlation	.470	1
	Sig. (1-tailed)	.000	
	N	51	51

Pearson correlation reported significant relationship between '*attempting online formative assessments*' and *'scores in each topic covered in the mid semester exam'* (p=0.005 for

topic one; p=0.002 for topic two and three; p=0.002 for topic four) (Table-2). Hence H_2 is confirmed.

Table 2:
Relationship between 'attempting online formative assessments' and 'score in each topic in the mid semester exam'

		Number of attempts for Topic One	MST Grades Topic One	Number of attempts for Topic Two and Three	MST Grades Topic Two and Three	Number of attempts for Topic Four	MST Grades Topic Four
Number of attempts for Topic One	Pearson Correlation	1	.377	1.000	.423	.839	.500
	Sig. (1-tailed)		.005	.000	.002	.000	.000
	N	45	45	45	45	35	45
MST Grades Topic One	Pearson Correlation	.377	1	.377	.443	.271	.522
	Sig. (1-tailed)	.005		.005	.001	.057	.000
	N	45	51	45	51	35	51
Number of attempts for Topic Two and Three	Pearson Correlation	1.000	.377	1	.423	.839	.500
	Sig. (1-tailed)	.000	.005		.002	.000	.000
	N	45	45	45	45	35	45
MST Grades Topic Two and Three	Pearson Correlation	.423	.443	.423	1	.247	.560
	Sig. (1-tailed)	.002	.001	.002		.076	.000
	N	45	51	45	51	35	51
Number of attempts for Topic Four	Pearson Correlation	.839	.271	.839	.247	1	.468
	Sig. (1-tailed)	.000	.057	.000	.076		.002
	N	35	35	35	35	35	35
MST Grades Topic Four	Pearson Correlation	.500	.522	.500	.560	.468	1
	Sig. (1-tailed)	.000	.000	.000	.000	.002	
	N	45	51	45	51	35	51

Pearson correlation reported no significant relationship between *'attempting online formative assessments' and 'score in the final exam'* (p=0.398) (Table-3). Hence, the H_3 is rejected.

Table 3:
Relationship between 'attempting online formative assessments' and 'score in the final exam'

		Usage of Additional Online Material for Final Exam	Final Exam Grades
Usage of Additional Online Material for Final Exam	Pearson Correlation	1	.037
	Sig. (1-tailed)		.398
	N	51	51
Final Exam Grades	Pearson Correlation	.037	1
	Sig. (1-tailed)	.398	
	N	51	51

Pearson correlation reported that the relationship between 'attempting *online formative assessments'* and '*scores in each topic in the final exam.'* is not significant for most (4 out of 6) topics (p=0.233 for topic five; p=0.105 for topic six; p=0.211 for topic nine and ten). A significant relationship was reported between *'attempting online formative assessments'* and '*score in each topic in the final exam'* for two topics that are topics seven and eight (p=0.020) (Table-4). Hence the H_4 is rejected.

Table 4:
Relationship between 'attempting online formative assessments' and 'score in each topic in the final exam'

		Number of attempts for Topic Five	Final Exam Grades Topic Five	Number of attempts for Topic Six	Final Exam Grades Topic Six	Number of attempts for Topic Seven and Eight	Final Exam Grades Topic Seven and Eight	Number of attempts for Topic Nine and Ten	Final Exam Grades Topic Nine and Ten
Number of attempts for Topic Five	Pearson Correlation	1	-.131	.544	-.282	.761	-.344	.186	-.056
	Sig. (1-tailed)		.233	.002	.056	.000	.025	.203	.378
	N	33	33	26	33	17	33	22	33
Final Exam Grades Topic Five	Pearson Correlation	-.131	1	-.395	.322	-.150	.483	-.287	.440
	Sig. (1-tailed)	.233		.019	.012	.270	.000	.097	.001
	N	33	49	28	49	19	49	22	49
Number of attempts for Topic Six	Pearson Correlation	.544	-.395	1	-.245	.666	-.405	.506	-.176
	Sig. (1-tailed)	.002	.019		.105	.001	.016	.008	.185
	N	26	28	28	28	19	28	22	28
Final Exam Grades Topic Six	Pearson Correlation	-.282	.322	-.245	1	-.108	.478	.213	.483
	Sig. (1-tailed)	.056	.012	.105		.330	.000	.170	.000
	N	33	49	28	49	19	49	22	49
Number of attempts for Topic Seven and Eight	Pearson Correlation	.761	-.150	.666	-.108	1	-.475	.139	.146
	Sig. (1-tailed)	.000	.270	.001	.330		.020	.298	.276
	N	17	19	19	19	19	19	17	19
Final Exam Grades Topic Seven and Eight	Pearson Correlation	-.344	.483	-.405	.478	-.475	1	-.229	.343
	Sig. (1-tailed)	.025	.000	.016	.000	.020		.153	.008
	N	33	49	28	49	19	49	22	49
Number of attempts for Topic Nine and Ten	Pearson Correlation	.186	-.287	.506	.213	.139	-.229	1	.211
	Sig. (1-tailed)	.203	.097	.008	.170	.298	.153		.173
	N	22	22	22	22	17	22	22	22
Final Exam Grades Topic Nine and Ten	Pearson Correlation	-.056	.440	-.176	.483	.146	.343	.211	1
	Sig. (1-tailed)	.378	.001	.185	.000	.276	.008	.173	
	N	33	49	28	49	19	49	22	49

Discussion and Conclusion

The study reports that 'attempting online formative assessments' was positively correlated to 'score in the mid semester exam.' As usage of the online formative assessment increased, scores of mid semester exam increased. The respective topic based analysis reported consistent result. On the contrary, no relationship was reported between 'attempting online formative assessments' and 'score in the final exam.' This is due to non observance of such relationship in topics five, six, nine and ten.
A possible explanation for this result could be due to the structure of the summative assessments. 'Connect' provided students with multiple choice and structured questions. The mid semester exam consisted of 50 multiple choice questions while the final exam consisted of four structured questions. As the mid semester exam consisted of multiple choice questions similar to those provided in the online formative assessment provided in 'Connect', students memorized the answers to questions in their formative assessments without understanding the concepts and replicated or applied the answers memorized while attempting multiple choice questions in their mid-semester exam. This finding is consistent with Stull et al.'s (2011) suggestion that students do not use the additional online materials to enhance knowledge but to familiarize themselves with structure and format of the questions. On the contrary, as the final exam included structured questions students could not memorize or replicate or apply their answers in online formative assessments. Students needed to possess an in-depth knowledge of concepts to answer structured questions in their final exam.

Another possible reason may be due to the differences in complexity of topics. The result indicates that the relationship between 'attempting online formative assessments' and 'scores in each topic in the final exam' did not hold in regard to four topics tested in this exam. These are topics five, six, nine and ten. In spite of students attempting the 'online formative assessments' relating to these topics, due to the level of complexity their results did not improve. Finally, another reason behind such result may be due to workload. Perhaps students observed high workload in studying these four topics and resorted to 'on-line formative assessment' to learn these topics rather than spending time to read the text book and other learning resources. Hence they lacked in-depth knowledge leading.

The result reported in this study has implications for accounting educators. Providing 'on-line formative assessments' does not itself improve results of students. Accounting educators need to communicate to students about the need to learn concept and engage in deep learning. Another implication of the findings is in regard to setting syllabus of accounting subjects. Accounting educators need to consider the workload of their syllabus considering that students need to study other subjects. A high workload results in availability of less time hindering deep learning.

Limitations and Directions for Future Research

The study is limited to only one subject in accounting discipline in one semester. Future replication studies are suggested to facilitate generalization of results.

The present study provides mixed results of relationship between 'attempting online formative assessments' and 'performance of students.' Future studies are suggested to interview students to investigate the reason behind such relationship.

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