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Can students improve performance by clicking more? Engaging students through online delivery

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Abstract

One of the biggest challenges facing educators today is to engage students in an active learning environment. Owing to the diversity of the student cohort, educators need to explore new and exciting ways of engaging students in the course content. One important aspect associated with this ongoing challenge is to reflect on one's own teaching practice. This reflection provides an opportunity to develop innovative ways to guide student learning and to improve overall course performance. The use of asynchronous learning networks is growing in popularity, which provide students with more flexible delivery of courses.

This paper explores the relationship between student engagement through online delivery of materials and assessment and end-of-term examination performance. In addition, comparisons are made between students studying in different modes. The paper presents data from a study involving all students enrolled in FINC19011 Business Finance at Central Queensland University in Winter Term in 2002 and 2003. Initially in 2002, only the course materials were made available to students online through WebCT. Owing to the frequent use of virtual materials by students in 2002, online assessment was introduced in 2003. Inferences are drawn from the study as to whether students who frequently engaged in online learning performed better than students who rarely used the virtual materials.

Introduction

The shift to the knowledge society requires graduates to have a wider range of interpersonal skills, especially the ability to collaborate and negotiate with people from different nationalities, sexes, ethnic groups, religions and cultures (Winzenried, 2002). Students can therefore benefit from engaging in online learning communities where they can interact with students from other locations throughout the globe. Online courses also increase the transparency of course content and assessment, particularly for courses delivered in a multicampus and flexible environment. Thus offering courses online provides an opportunity to

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create digital learning communities that cater to the diverse needs and learning styles of the student cohort. Educators have a responsibility to prepare students for a global environment undergoing massive change within a knowledge society (Winzenried, 2002).

Online communication effectively provides the social aspect of collaborative learning (Goodwin, Graham & Scarborough, 2001; Macdonald 2002), thereby reducing the isolation felt by many distance students (Thomas & Carswell, 2000). In addition, active online participation is found to strengthen learning by developing written communication skills, enhancing in-depth processing and recalling course content. These skills help to prepare students for end-of-term written examinations. Despite the advantages of collaborative learning, some students prefer to learn independently. It is therefore important to consider all learning styles and preferences when designing assessment items, keeping in mind the desired course outcomes.

It appears that many students find it easier to participate actively in discussion board groups than in face-to-face classes (Thomas & Carswell, 2000). Discussion boards provide a medium for students to interact and learn from one another. As Goodwin, Graham and Scarborough (2001) found, students who are not actively engaged in collaborative learning remain within the online environment taking advantage of available resources. The discussion board provides those students who are reluctant to contact their coordinator with a means of having their queries answered by their peers, and in so doing enriching their learning experience.

Teachers can improve their teaching and learning skills and develop their understanding of teaching theory by sharing challenges and solutions with colleagues as reflective practitioners. Reeves (2002) has suggested that there is more to online learning than simply placing one's face-to-face materials on the web. It is possible for educators to reach the heights of best practice in teaching and learning only through both self- and peer-evaluation of their teaching methods. This reflection should include teaching and learning across a range of disciplines, as few academics have all the necessary skills to design and integrate learning networks fully (Winzenried, 2002). WebCT and Blackboard are two popular online course management systems that can be used by academics to enrich the learning experience of students. By sharing our expertise, we can create a knowledge community. As such, the scholarship of teaching can be researched using a pragmatic epistemological approach where researchers and practitioners collaboratively shape theory to solve real problems while constructing design principles that may inform future decisions (Reeves, 2002).

Many academics criticise the use of multiple choice questions as an effective assessment tool (McKenna, 2001; Struyven Dochy & Janssens, 2002). However, careful planning of questions can lead to the first four levels of Bloom's taxonomy (that is, knowledge, comprehension, application and analysis) being adequately assessed (University of Cape Town, n.d.). Examples of 'knowledge' cognition include terminology, basic concepts and simple recall. Many online tests contain questions that test only skills at this level. However, by the careful construction of questions for online testing, one can examine students' skills more thoroughly. For example, in the finance discipline, 'comprehension' is necessary to interpret charts and graphs correctly. In addition 'application' and 'analysis' can be demonstrated by solving mathematical problems and calculations and by comparing investment opportunities. The ability to test students' skills beyond basic 'knowledge' using multiple choice questions largely depends on the discipline.

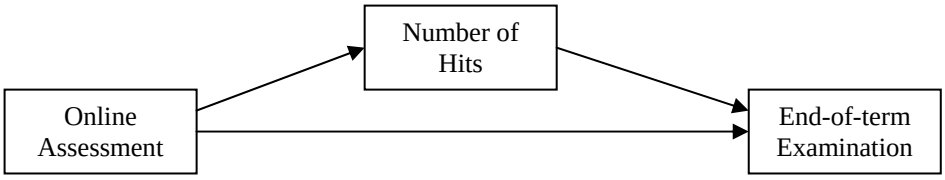
Students benefit from online testing by being able to schedule their test around other commitments, and by obtaining their mark immediately following the submission of their test. Fletcher, Kearney and Bartlett (2002) found that students regarded online practice tests as a worthwhile learning experience that helped to prepare them for their online assessment. But do these benefits encourage students to use the virtual community throughout the term? Additionally, online assessment is frequently used to shape student learning patterns because it provides the capacity to test the breadth of course content (McKenna, 2001). Can this lead to improved end-of-term examination performance?

Conceptual framework

The conceptual framework (see Figure 1 below) evolved from a review of recent literature in the field, resulting in three hypotheses to be tested using empirical data.

- H_1: Students click more when online assessment is included in the course.
- H_2: Following online assessment, students perform better on the end-of-term examination.
- H_3: Students who click more perform better on the end-of-term examination.

Figure 1: Conceptual model



Methodology

In 2002, students in FINC19011 Business Finance had online course materials available. The number of hits from each student on the course website was recorded. Students were assessed by assignments and a final supervised examination at a university examination centre.

In 2003, students had online course materials, and again the number of hits by each student on the course website was recorded. Assessment was changed to include some compulsory online assessment, and student online assessment activity was included in the number of hits each student made on the course website. Assessment for the course comprised assignments (20%), the online assessment (20%), and a final, supervised examination (60%). The online test in 2003 consisted of 40 multiple choice questions available to students over a two week period in WebCT. Students had 75 minutes to complete the test, which examined the course content for the first nine modules. The questions were randomly selected from a large pool which covered the first four levels of Bloom's taxonomy. That is, the questions tested basic knowledge, concepts, problem solving and decision making.

Participants

Participants were all students enrolled in FINC19011 Business Finance during Winter Term 2002 and 2003 and who completed all pieces of assessment. Of the 876 students, 462 students were enrolled in 2002 and the remaining 414 in 2003.

Procedure

Data were collected using the tracking facilities within WebCT and exported into the course results spreadsheet for each of the two terms. The data contained within the two spreadsheets were then imported into SPSS to create one data file with all the required variables.

Measurement concepts

The critical variables in the conceptual model were measured in the following manner to enable the hypotheses to be tested:
Hits: Equalled to the number of hits recorded by WebCT for each student.
Online: Measured as '1' if there was no test and '2' if there was online assessment. Note that there was no online assessment in 2002.
Examination: The percentage obtained for the end-of-term examination, which was a three hour, closed book examination covering all modules of the course.

Results

Students were enrolled internally at nine campuses in 2002 and at ten campuses in 2003 in addition to students studying in the flexible mode. Table 1 summarises the breakdown of students by campus for each year. The largest cohort of students enrolled in this course was at the Sydney international campus. This was followed by students enrolled in the flexible mode and then by those at the Melbourne international campus. The number of students enrolled in this course at each campus for both years was similar at all campuses except Melbourne, where numbers dropped considerably.

Table 1: Student numbers by year of study

Campus / mode of study	Number of students (N) in each year of the study		
	2002	2003	2002 + 2003
Bundaberg	20	21	41
Brisbane	6	11	17
Fiji	34	37	71
FLEX (distance education)	106	97	203
Gold Coast		6	6
Gladstone	7	5	12
Hong Kong	22	17	39
Melbourne	74	41	115
Mackay	26	16	42
Rockhampton	35	24	59
Sydney	132	139	271
TOTAL	**462**	**414**	**876**

Note: Flexible mode students study as distance education students—on-campus attendance is not required for these students.

Table 2 isolates the two groups of students according to whether there was online assessment during the term. The average percentage for the end-of-term examination and the average number of hits per group of students for each of the campuses and the flexible mode are included in the table. Only Brisbane and Bundaberg students on average clicked less often than students at these campuses

the previous year when there was no online assessment. Note that at several of the campuses (such as Fiji, Sydney and Rockhampton) the average number of hits doubled in 2003. The biggest users in 2002 were students at the Bundaberg campus, whereas the Sydney students clicked the least. In 2003 these statistics changed, with Melbourne students clicking the least and students at Hong Kong scoring the most hits on the WebCT site. The average number of hits for all students in 2002 was 32. There was a dramatic increase in this figure in 2003 to 50 hits.

Table 2: Mean statistics per year by campus

Campus	Mean examination results by campus …			Mean number of hits on course website by campus …		
	For students not taking online test (2002)	For students who took online test (2003)	For all students (2003/ 2004)	For students not taking online test (2002)	For students who took online test (2003)	For all students (2003/ 2004)
Bundaberg	64.7	85.1	75.2	99.0	97.9	98.4
Brisbane	60.5	60.9	60.8	59.5	19.1	33.4
Fiji	59.0	65.7	62.5	16.6	48.5	33.3
FLEX	64.0	70.4	67.0	48.1	69.6	58.4
Gold Coast		64.7	64.7		20.8	20.8
Gladstone	63.4	73.9	67.8	24.1	39.2	30.4
Hong Kong	66.9	78.5	72.0	57.1	103.7	77.4
Melbourne	47.2	54.3	49.7	12.9	13.3	13.1
Mackay	60.8	63.2	61.7	57.5	86.0	68.3
Rockhampton	65.9	79.7	71.5	37.8	80.3	55.1
Sydney	58.3	61.5	59.9	11.7	28.2	20.2
TOTAL	**59.4**	**66.5**	**62.7**	**31.9**	**49.9**	**40.4**

To test the first hypothesis, that students click more when online assessment is included in the course, an Independent Samples *t* test was conducted (see Table 3). The mean difference on the test variable 'number of hits' of –18 indicates that students in 2003 clicked more than those in 2002. The *t* value indicates that the average hits for the 2003 students is significantly ($p < 0.001$) greater than those for the 2002 students.

Table 3: Output from independent samples t test for number of hits

Analysis of number of hits on course website	Levene's test for equality of variances		*t* test for equality of means						
	F	Sig.	*t*	df	Sig. 2–tailed	Mean differ-ence	Std. error differ-ence	95% confidence interval of the difference	
								Lower	Upper
Equal variance assumend	9.396	0.002	–4.543	874	0.000	–18.0	3.962	–25.774	–10.222
Equal variance not assumed			–4.524	845.311	0.000	–18.0	3.978	–25.806	–10.190

To test the second hypothesis, that students perform better on the end-of-term examination after completing online assessment, an Independent Samples *t* test was conducted (see Table 4). The mean difference on the test variable 'examination result' of –7.09 indicates that students in 2003 performed better on the end-of-term examination than those in 2002. The *t* value indicates that the average examination performance for the students in 2003 was significantly ($p < 0.001$) better than the average examination performance for the students in 2002.

Table 4: Output from independent samples t test for examination result

Analysis of examination results	**Levene's test for equality of variances**		***t* test for equality of means**						
	F	Sig.	*t*	df	Sig. 2–tailed	Mean differ-ence	Std. error differ-ence	95% confidence interval of the difference	
								Lower	Upper
Equal variance assumend	0.821	0.365	–5.504	874	0.000	–7.09	1.289	–9.625	–4.565
Equal variance not assumed			–5.508	865.983	0.000	–7.09	1.288	–9.623	–4.567

To test the third hypothesis, that students who click more perform better on the end-of-term examination, bivariate correlation analysis was conducted (see Table 5). The *Pearson r* coefficient of 0.321 indicates that there is a strong positive relationship between the number of hits and the examination result achieved. Thus students who clicked more onto the WebCT site for the course performed significantly ($p < 0.001$) better on the end-of-term examination than students who used the online materials infrequently.

Table 5: Correlation matrix for number of hits and examination result

Combined data for 2002 and 2003		**Number of hits**	**Examination result**
Number of hits	Pearson correlation (r)	1	0.321**
	Significance (1–tailed)	.	0.000
	Number of students (N)	876	876
Exam result	Pearson correlation (r)	0.321**	1
	Significance (1–tailed)	0.000	.
	Number of students (N)	876	876

Note: Correlations are for combined 2002 and 2003 data.
** Correlation is significant at the 0.01 level (1–tailed)

A similar strong positive relationship existed for 2002 ($r = 0.26$) and 2003 ($r = 0.347$) as existed for the groups combined ($r = 0.32$) (see Table 6).

Table 6: Correlation matrices for 2002 and 2003

Correlations for 2002		**Number of hits**	**Examination result**
Number of hits	Pearson correlation (r)	1	0.260**
	Significance (1–tailed)	.	0.000
	Number of students (N)	462	462
Exam result	Pearson correlation (r)	0.260**	1
	Significance (1–tailed)	0.000	.
	Number of students (N)	462	462

** Correlation for 2002 is significant at the 0.01 level (1–tailed)

Correlations for 2003		**Number of hits**	**Examination result**
Number of hits	Pearson correlation (r)	1	0.347**
	Significance (1–tailed)	.	0.000
	Number of students (N)	414	414
Exam result	Pearson correlation (r)	0.347**	1
	Significance (1–tailed)	0.000	.
	Number of students (N)	414	414

** Correlation for 2003 is significant at the 0.01 level (1–tailed)

Owing to the small number of students at several of the campuses, further analysis was conducted with the students divided into four groups: flexible mode; regional campuses; Australian international campuses; and offshore international campuses. Each of these groups had correlation coefficients that were highly significant ($p \leq 0.001$), with moderate to strong positive relationships (see Table 7).

Table 7: Correlation for number of hits and examination result by campus

Campus	**Pearson *r***	***p* (1–tailed)**	**N**
Flexible mode	0.316	< 0.001 **	203
Regional	0.262	0.001 **	154
Australian international	0.173	< 0.001 **	409
Offshore international	0.354	< 0.001 **	110

** Correlation is significant at the 0.001 level

Discussion

The present study extends on research conducted by Fletcher, Kearney and Bartlett (2002) in which students regarded online practice tests as beneficial in preparing them for their online assessment. A side effect of this appears to be that students participate online more frequently if an online test is included in their course, as indicated by support for H_1. Further tracking of students' activities within the virtual community may indicate the purpose of each visit that they make to the course site.

Online assessment is frequently used to shape student learning patterns because it provides the capacity to test the breadth of course content in examinations (McKenna, 2001). The current study suggests that students appear to gain a broader knowledge of course content after online assessment, as demonstrated by superior end-of-term examination performance for courses that include online assessment.

In addition, the present findings support past research that indicated that active online participation strengthened learning which helped to prepare students for end-of-term written examinations (Goodwin, Graham & Scarborough, 2001; Macdonald, 2002).

Limitations of the study

The study examined the relationships between online involvement and end-of-term examination performance for students enrolled in one course over a two year period. Further study should involve students in other disciplines. Students who clicked more and who performed well on the end-of-term examination may well be the more highly motivated students who would perform well regardless of the mode of study adopted.

Conclusion

After analysing the results of this study, one thing that surprised me was the significant difference in the end-of-term examination performance when online assessment was introduced, in view of the fact that many academics suspect a high level of plagiarism during online tests (Kerka & Wonacott, 2000). Yet if this was occurring shouldn't the difference be insignificant or in the other direction? The findings suggest that plagiarism was not a problem as students performed better on the end-of-term examination after doing online tests. It appears that learning is taking place by students in this setting. These findings imply that multiple choice questions in online tests may still be a suitable tool to guide student learning and to test lower level competencies.

Security measures can be put in place to encourage academic honesty (Dickinson, 1997; Gray, 1997; King, 1998; Zirkle & Ourand, 1999). Examples of measures often used include: having the online test password protected; randomisation of questions; and considering online tests in the same manner as workplace problem solving. The first two of these were used for the online test used in this study. However, the third measure is worthy of further consideration.

The mere suggestion of considering online assessment as an exercise similar to workplace problem solving would be likely to astound many academics. However, assessment items need to prepare students adequately for their future employment. In the workplace, employees would be permitted access to reference material and allowed to collaborate with colleagues to solve problems (Nelson, 1998). Why not replicate this workplace setting for online tests by permitting students to complete these tests in a group? Collaboration skills are highly regarded in the workplace, so shouldn't assessment encourage the development of these skills?

Academics should consider using the contemporary teaching and learning practice of encouraging collaboration in their courses. Maybe the online tests could be assessed as an optional group test where students could choose to be assessed either individually or as a small group. Shouldn't academics place more emphasis on learning and creating a collaborative virtual community that leads to superior

end-of-term outcomes than on ensuring that online assessment is undertaken individually by each student?

Assessment needs to be designed so that it directs student learning towards attaining key competencies within the discipline. Thus it needs to prepare students adequately for work within the field. The online environment provides opportunities to structure assessment to simulate workplace problem solving activities. Considering the importance attached to collaborative problem solving in the workplace, some component of the assessment should aim to develop these skills in our students as well as the core technical proficiencies.

The biggest challenge facing educators is how to design online assessment so that it enhances workplace performance. One such method is through the simulation of workplace problem solving activities, using the advantages of an online learning environment.

Using a finance course as an example, a group task could be set where students first need to select investments from a wide range of options. Every three to four weeks the economic conditions could change, requiring students to reexamine their investment strategy and to make changes to their investment if desired. These changing conditions could easily be made as an announcement in WebCT or Blackboard at times specified in the course profile.

This type of assessment would require students to collaborate online using discussion boards or chat rooms set up for each group. Students would need to justify their investment strategies by applying the finance concepts covered in the course. Each group of students could end up with different investment portfolios depending on their initial investment, which would be mostly made based on their prior knowledge and experience. Thus the likelihood of plagiarism would be minimal. The aim would be for students to increase the value of their portfolio during the term. Alternatively online tests could include various types of questions including short answer, discussion, multiple choice and true/false questions that students could complete as a group.

Both of these suggested methods would require students to demonstrate their skills in the discipline, written communication, collaboration, computer systems and time management. These skills are all desirable in the workplace and worthy of inclusion in course assessment.

We need to pause for a moment and to analyse our teaching methods at the conclusion of every term. This study showed that students do become engaged through the online delivery of materials, which resulted in improved performance. This reflection helps to determine what changes may be made to keep at the forefront not only of our discipline but also of contemporary teaching and learning methods. We need to ensure that we adequately prepare our students with the essential tools to succeed in the global community of today.

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