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USING ONLINE ASSESSMENT TO REPLACE INVIGILATED ASSESSMENT IN TIMES OF A NATURAL DISASTER – ARE SOME ONLINE ASSESSMENT CONDITIONS BETTER THAN OTHERS?

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WORKING PAPER

USING ONLINE ASSESSMENT TO REPLACE INVIGILATED ASSESSMENT IN TIMES OF A NATURAL DISASTER – ARE SOME ONLINE ASSESSMENT CONDITIONS BETTER THAN OTHERS?

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ABSTRACT

As the result of the September 4th 2010 Canterbury earthquake and associated aftershocks on February 22nd 2011 and June 13th 2011, final examinations in the two 100 level economics papers at Canterbury University were cancelled at short notice in semester one 2011. The final examination weightings were spread over the remaining assessments to obtain a final grade for students. This paper attempts to establish how different online assessment conditions affect final grade distributions when online assessments are substituted for an invigilated final examination. Pearson correlation coefficients and Spearman rank order correlation coefficients are used to show that there is a greater correlation between online quizzes and invigilated assessments when those quizzes are only available for a restricted period of time, compared to the whole semester. We find that online quizzes are more closely correlated with invigilated assessments when the first attempt at a quiz is recorded, as opposed to the highest of two attempts. We also find that using the first attempt leads to less grade disruption when compared to a "normal" semester that includes a final examination. Finally, the actual impact on student grades when online quizzes are substituted for a final examination is discussed.

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INTRODUCTION

On September 4th, 2010 an earthquake measuring 7.1 on the Reichter scale struck Canterbury. As a result, the region was subjected to thousands of aftershocks, the most significant of which struck on February the 22nd 2011 and June the 13th 2011, both measuring 6.3 on the Reichter scale. The September earthquake and February aftershock resulted in closures of two weeks each for the University of Canterbury campus. The June aftershock struck just prior to the semester one examination period, and resulted in the cancelation of final examinations for many papers, at short notice.

The cancelation of final examinations at short notice raises questions about how best to calculate final grades. This paper will focus on assessment of the first year economics papers at Canterbury University, (Introduction to Macroeconomics (ECON 105) and Introduction to Microeconomics (ECON 104)) and how well they allocate appropriate grades to students in in an earthquake affected semester. Specifically, this paper will examine the effect of different conditions under which students take online multiple choice quizzes, such as limiting the time they are available for students to complete, or limiting the number of attempts a student has at a particular quiz . The first part of this paper will examine the effect of limiting the availability of online quizzes on the correlation between those quizzes and invigilated assessments such as term tests and final examinations. The second part of this paper will examine the effect of using the quiz "first attempt" vs. the "highest of two attempts" on correlations with invigilated assessments and the impact on grade allocationsThe correlations and grade distributions should provide an insight into how substitutable online quizzes and invigilated assessments are. In simple terms can we gain some insight into the conditions under which online assessments provide the most robust grade allocations, compared to an uninterrupted semester, when a final exam or similar is cancelled?

During the earthquake interrupted semesters at the University of Canterbury, online assessments proved to be invaluable. They could be completed by students without the need to come onto campus (although those with no internet access at home could still use the computer labs on campus), and removed the need to use markers who themselves were earthquake disrupted to meet for moderation meetings, and mark assignments for example.

Hickson and Agnew (2011) cite Benton (2009), Meyer & Wilson (2011), ecampus news (2009), Omar, Liu & Koong, (2008), Foster & Young (2005), Danielson (2009) and SchWeber (2008) who all discuss courses moving to an online format in reponse to hurricanes, war, or virus outbreaks. The above literature however focuses on a shift of predominantly teaching resources to an online environment, rather than assessment becoming predominantly online. There is also no examination of the effect on grade distributions of moving to online assessment in a semester disrupted at short notice by a natural disaster.

In the general literature on online delivery methods, there is some discussion on the strengths and weaknesses of the online assessment of material. Graff (2003) stated "There are many potential advantages of online assessment to learners. For example, tests are available on demand and at any time. Furthermore, computerised assessment systems give immediate feedback to the user; therefore users learn by taking the test". (p. 22). Robles & Braathen (2002) find that "many different online components and assessment criteria and tools are needed to accurately and

thoroughly assess student learning" (p. 47). They conclude by stating that "assessment should be ongoing and carried out through each chapter throughout the semester, to allow students to determine their own learning outcomes through self-testing" (p. 47). This is less costly to carry out in an online environment compared to running periodic physical tests. Running periodic online tests also provides a greater level of control for the instructor, and a greater incentive for student completion than leaving students to be responsible for their own independent self testing. Gaytan & McEwen (2007) found that "Effective assessment techniques include….weekly assignments with immediate feedback. The role of meaningful feedback cannot be overemphasized" (p. 117). They go on to state that "using effective assessment techniques is an essential part of effective teaching and learning in the electronic environment" (p. 118). This concurs with earlier research from Corocoran, Dershimer & Tichenor (2004) and Stiggins & Chappuis (2005) who stated that monitoring student learning and enhancing teaching were two main purposes of assessment. Gaytan & McEwen (2007) state that several researchers such as Bartlett, Reynolds & Alexander (2000); and Farmer (2005) have found that an online environment assessment fosters a student centered learning environment and allows for more accurate measurement of learning. Gaytan & McEwen (2007) also reference Russell, Elton, Swinglehurst & Greenhalgh (2006) who stress the importance of continuous assessment as it allows instructors to monitor and be familiar with students' understanding.

Perrin & Mayhew (2000) raised some concerns around the validity of online testing based on the ability of students to cheat, giving the example of students printing online tests and sharing them. Robles & Braathen (2002) explain that this undesirable behaviour can be mitigated by restricting the number of times the student can sit an online quiz, how long they have to complete the quiz, and by making the questions unable to be seen once the quiz has been submitted. They suggest distinguishing between online quizzes which are summative assessment items, and having formative online assessment items which have fewer restrictions on access, and can be used as learning tools rather than assessment tools. Olt (2002) researched strategies for minimizing academic dishonesty in online assessment. She cited a survey of American high school students which reported that 80% admitted cheating on an exam (Bushweller, 1999). Kleiner & Lord (1999) using the same survey data found that 50% of the students did not believe cheating was necessarily wrong. They also found that 95% of those that said they cheated had never been caught. Heberling (2002)suggested that it may actually be easier to detect cheating online, however Olt (2002) does suggest some disadvantages to online assessment. This includes "an instructor's inability to control a student's unauthorized use of resources in completing an assessment". (p. 3). She does go on to suggest having open-book assessment as a possible solution. Another disadvantage Olt (2002) suggests is students collaborating with each other on an assessment. One possible remedy she suggests is to have a question pool which questions are randomly selected from, so the chances of two students receiving the same assessment are minimal. Collusion can also be reduced by having restrictions on assessment availability, and setting time limits. Rowe suggests it is often easier to cheat online, and asks the question "When a student scores well for an online assessment, does that mean they know the material?" (p. 1). He cites Bork (2001) when stating that it is less cost-effective for students to cheat when assessment is continuous. If the concerns raised in the literature around student cheating in online assessments are legitimate, this raises concerns around the reliability of student grades as a greater weighting is applied to online assessments. Hickson & Agnew (2011) certainly found a

greater level of grade disruption from a non-earthquake affected semester when a greater weighting was placed on online quizzes.

The contribution this paper aims to make is not to debate the relative merits of online assessment. Rather, the paper will aim to establish the ability of online assessment to deliver a grade distribution consistent with a 'normal' semester, in the event of the cancelation of a final exam at short notice.

ASSMENTS, DATA AND METHODS

From 2005 to 2010 assessment in both ECON 104 and 105 consisted of an invigilated three hour final examination (60%)[1], an invigilated 90 minute term test (20%), a take home assignment (10%), and online quizzes (10%). The online quizzes each consisted of 10 multiple choice questions, drawn from a test bank of hundreds of questions provided by the publisher of the textbook.

In ECON 105 in 2011, 10% was also introduced for tutorials, with the weighting on the final examination being reduced from 60% to 50%. The effect of the earthquake disruption in semester one 2011 was the cancellation of the final examination and take home assignment, with the weighting redistributed across other assessments.

A crucial change was made to the online quizzes in ECON 105 for 2009 semester 2 onwards. From 2005 to 2009 semester 1, the quizzes were all available for the duration of the semester and could be completed multiple times. The highest mark was the counting mark for each quiz. The quiz availability was changed from semester 2 of 2009, when each of the ten quizzes was open only for a short window around the time the topic was being covered rather than open for the whole semester. With the cancellation of assessments in semester one 2011, a greater weighting was placed onto the online quizzes when final grades were calculated. We are able to use this break in the online quiz conditions to examine how correlations between online quizzes and invigilated assessments is affected.   There are 2440 observations for the pre 2009 semester 2 period and 618 for 2009 semester 2 onwards.

Assessment in ECON 104 in 2011 also changed. In ECON 104 2011 semester two, assessment in ECON 104 consisted of an invigilated three hour final examination (55%), an invigilated 90 minute term test (25%), an online progress test (5%), online multiple choice quizzes provided by the publisher (5%) and weekly online tutorial quizzes tailored to the course (10%). The ten weekly online tutorial quizzes, consisting of 15 multiple choice questions drawn from a test-bank of questions used in previous term tests and examinations. Each quiz was worth 1%, and was open for on average one week. Students were allowed two attempts on each of the tutorial quizzes, with their highest score recorded. For the purpose of this paper, the tutorial quizzes were also remarked, taking the students' first attempt rather than their highest of two attempts. To establish the impact on the level of correlation between the invigilated term test and final examination, and the tutorials quizzes under the two marking scenarios, both the Pearson

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[1] Note that prior to 2007 the term test was worth 35% and the final exam was worth 45%.

correlation coefficient and the Spearman rank order correlation coefficient were calculated. Hypothetical final grades for ECON 104 2011 semester two were also calculated under each tutorial quiz marking scenario, under the scenario the final examination is cancelled and the weighting it carries redistributed across the term test and tutorial quizzes. The sample size for these correlations was 320.

RESULTS:

In the four semesters since ECON 105 quizzes went to limited windows of availability (2009 S2, 2010 S1, 2010 S2 & 2011 S2), the Pearson correlation coefficients for the online MC quizzes and final exam have been at the top, or exceeding the top of the range of Pearson correlation coefficients for the period when the quizzes did not have limited windows of availability (2005 S1 to 2009 S1). The Pearson correlation coefficients for the online MC quizzes and term test for the five semesters since the ECON 105 quizzes went to limited windows of availability (2009 S2, 2010 S1, 2010 S2, 2011 S1 & 2011 S2), have all exceeded the Pearson correlation coefficients for the period when the quizzes did not have limited windows of availability (2005 S1 to 2009 S1). The spearman rank order correlation coefficients for the online quizzes and both the exam and the term test for the period 2009 S2 to 2011 S2 have all exceeded the Spearman rank order correlation coefficients for the period 2005 S1 to 2009 S2 when the quizzes did not have limited windows of availability. This is shown in table one below. All coefficients are significant at the 1% level of significance.

TABLE 1
Range of Correlation Coefficients for Assessment Items (2005-S1 to 2009-S1)

Table 1(a)   Pearson Correlation Coefficients

	Term Test	*Exam*
2005-S1 to 2009-S1 ECON 105 MC Quiz	**0.27 – 0.47**	**0.48 – 0.66**
2009 S2 ECON 105 MC Quiz	0.55	0.65
2010 S1 ECON 105 MC Quiz	0.55	0.66
2010 S2 ECON 105 MC Quiz	0.49	0.67
2011 S1 ECON 105 MC Quiz	0.57	N/A
2011 S2 ECON 105 MC Quiz	0.66	0.77

Table 1(b)   Spearman Rank Order Correlation Coefficients

	Term Test	*Exam*
2005-S1 to 2009-S1 ECON 105 MC Quiz	**0.24 – 0.41**	**0.35 – 0.50**
2009 S2 ECON 105 MC Quiz	0.51	0.52
2010 S1 ECON 105 MC Quiz	0.55	0.61
2010 S2 ECON 105 MC Quiz	0.45	0.55
2011 S1 ECON 105 MC Quiz	0.46	N/A

2011 S2 ECON 105 MC Quiz	0.63	0.74

Table two shows that for the period 2009 S2 to 2011 S2 (excluding 2011 S1, when an examination was not held), both the Pearson correlation coefficients and the Spearman Rank Order coefficients for the term test and the examination have shown no discernable change between the semesters with unlimited windows of availability for the quizzes, and the semesters of limited windows of availability. This suggests that the standard of invigilated assessment is staying relatively constant, as it is unlikely both would change by the same amount. We can therefore be confident that the improved correlation coefficients for the MC quizzes is due to them becoming more closely correlated to the invigilated assessments, rather than both the invigilated assessments becoming more closely correlated to the MC quizzes. Note that the both the Pearson correlation coefficients and the Spearman Rank Order coefficients are higher for the term test and the examination, compared to the quizzes and the term test, and the quizzes and the examination. This is an intuitively obvious result, that the invigilated term test and exam are more closely correlated to each other, than to the non-invigilated MC quizzes.

TABLE 2
Range of Correlation Coefficients for Assessment Items (2009-S2 to 2011-S2)

Table 2(a)   Pearson Correlation Coefficients

	Exam
2005-S1 to 2009-S1 ECON 105 Term Test	**0.73 – 0.81**
2009 S2 ECON 105 Term Test	0.79
2010 S1 ECON 105 Term Test	0.80
2010 S2 ECON 105 Term Test	0.69
2011 S1 ECON 105 Term Test	N/A
2011 S2 ECON 105 Term Test	0.83

Table 2(b)   Spearman Rank Order Correlation Coefficients

	Exam
2005-S1 to 2009-S1 ECON 105 Term Test	**0.76 – 0.83**
2009 S2 ECON 105 Term Test	0.80
2010 S1 ECON 105 Term Test	0.82
2010 S2 ECON 105 Term Test	0.73
2011 S1 ECON 105 Term Test	N/A
2011 S2 ECON 105 Term Test	0.84

These results suggest that in the event of assessment disruption, the quizzes that have limited windows of availability are more closely correlated to, and thus potentially better predictors of, both the term test and the examination and therefore produce more robust grades.

To examine the impact of different online assessment conditions on student grades, ECON 104 data from 2011 semester two is used. As mentioned in the methods section, students had two attempts at the online tutorial quizzes, with their highest mark recorded. Their responses were then remarked using their first attempt only. Table three below shows the Pearson correlation coefficients and Spearman rank order correlation coefficients for the online tutorial quizzes correlated against the term test and exam, for both the highest attempt and their first attempt.

TABLE 3
ECON 104 (Microeconomics) 2011-S2

Table 3(a)   Online Tutorial Quiz - First Attempt Recorded

	Tutorial Quiz	*Term Test*	*Final Exam*
		Pearson Correlation Coefficients	
Tutorial Quiz	1.00	0.65	0.68
Term Test	0.62	1.00	0.83
Final Exam	0.65	0.85	1.00
	Spearman Rank Order Correlation Coefficients		

Table 3(b)   Online Tutorial Quiz – Highest of Two Attempts Recorded

	Tutorial Quiz	*Term Test*	*Final Exam*
		Pearson Correlation Coefficients	
Tutorial Quiz	1.00	0.63	0.64
Term Test	0.59	1.00	0.83
Final Exam	0.60	0.85	1.00
	Spearman Rank Order Correlation Coefficients		

In ECON 104 2011 semester 2, the Pearson correlation coefficients for the online tutorial quizzes compared to both the term test and examination were slightly higher when the first of two attempts was recorded as the student's quiz mark compared to when the highest of their two attempts were recorded. The Spearman rank order correlation coefficients also found a higher correlation on the first attempt. Table four shows the impact on student grades of using the highest compared to the first attempt. The shaded cells represent the number of students who received the same grade as they would have in an uninterrupted semester which included a final exam.

TABLE 4
Percent of Students – Using Raw Scores Highest Tutorial Quiz Mark Used

Table 4(a)   **Weighting:**   **(Term Test 80%)**

		Alternative Grade										
		A+	A	A-	B+	B	B-	C+	C	C-	D	E
True Grade	A+	39	1									
	A	16	5	3								
	A-	9	11	7	1							
	B+		11	7	3	1						
	B	1	1	8	7	9	3					
	B-		2	5	2	8	3	3				
	C+		1	2	4	5	8	6	1	1		
	C				2	2	3	7	10	2	1	
	C-					1	3	8	2	6	2	
	D						3	3	1	5	2	4
	E					2	1	2	2	9	4	39

Table 4(a) shows the grade distribution if the final exam had been cancelled at short notice, and the 55% weighting from the final exam were placed onto the term test. The calculation of the students' grade under both scenarios includes 10% on the online tutorial quizzes, using the highest of two attempts as the student mark. Of the 320 students in the course, 70.3% of them received a grade within +/- 1 GPA[21] number of their grade including a final exam, and 88.4% received a grade within +/- 2 GPA numbers. These percentages reflect the high correlation between the term test and the examination, both of which were invigilated.

Table 4(b)   **Weighting:**   **(Tutorial Quizzes (Highest Attempt) 65%)**

	Alternative Grade

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[2] GPA is awarded as follows: A+=9, A=8 etc down to E=-1.

		A+	A	A-	B+	B	B-	C+	C	C-	D	E
True Grade	A+	39	1									
	A	21	3									
	A-	17	5	3	1	2						
	B+	5	4	5	4	2	2					
	B	6	7	8	5	1		1	1			
	B-	4	5	2	5	1	4	1			1	
	C+	5	5	9	1	2	2	1	1	1	1	
	C	2	5	2	4	4	2	1	1		1	5
	C-	1	3	2	1	3	3		1	5		3
	D			3	1	2	1	4	2	3	1	1
	E		2	1		2	2	4	2	8	5	33

Table 4(b) shows the grade distribution if the exam hadn't run, and the 55% weighting was put onto the online tutorial quizzes rather than the term test, using the students' highest of two attempts. Using this approach, only 47.2% of students received a grade within +/- 1 GPA number of their grade if a final exam were included, with 65.3% receiving a grade within +/- 2 GPA numbers.

Percent of Students – Using Raw Scores First Tutorial Quiz Mark Used

Table 4(c)   Weighting: (Term Test 80%)

		Alternative Grade										
		A+	A	A-	B+	B	B-	C+	C	C-	D	E
True Grade	A+	32	1									
	A	17	6	3								
	A-	9	9	4	1							
	B+	2	11	5	8	1						
	B		1	6	7	5	2					
	B-		2	3	6	9	4	3	1			
	C+		2	2	3	7	5	6	1			
	C				3	3	6	9	5	2	1	1
	C-						21	5	6	6	2	
	D						4	1	4	5	3	3
	E					1	2	3	2	7	10	40

Table 4(c) shows the grade distribution if the exam hadn't run, and the 55% weighting was put onto the term test, with 10% weighting still on the online tutorial quizzes, using the students'

first attempt at the tutorial quizzes as their mark. This approach, yielded similar results to table 4(a), with 68.8% of students received a grade within +/- 1 GPA number of their grade if a final exam were included, and 88.4% receiving a grade within +/- 2 GPA numbers.

Table 4(d)   Weighting: (Tutorial Quizzes (First Attempt) 65%)

		Alternative Grade										
		A+	A	A-	B+	B	B-	C+	C	C-	D	E
True Grade	A+	24	7	2								
	A	12	5	6	2	1						
	A-	4	4	6	5	3		1				
	B+	3		6	4	4	7	3				
	B		2	4	5	6	2	2				
	B-			2	2	5	10	3	4	1	1	
	C+			1	5	7	5	4	1		2	1
	C		1	2	5	3	5	2	3	1		8
	C-			1	1	1	3	1	2	3	4	5
	D				2	3	1	2	2	2	2	6
	E		1			2		2	1	5	8	46

Table 4(d) shows the grade distribution if the exam hadn't run, and the 55% weighting was put onto the online tutorial quizzes rather than the term test, using the students' first of two attempts. Using this approach, 63.4% of students receive a grade within +/- 1 GPA number of their grade if a final exam were included, with 79.1% receiving a grade within +/- 2 GPA numbers. This is an improvement on when the highest of two attempts was used, where the corresponding percentages were 47.2% and 65.3%.

Table five shows that in the absence of a final exam, as more weighting is put onto online tutorial quizzes, the more grade disruption there is when the highest of two tutorial quiz attempts is used relative to when the first of two tutorial quiz attempts is used. This confirms the earlier results in table three, which showed that online tutorial quiz marks are more closely correlated to both the term test and final exam, when the first of two attempts is used rather than the highest of two attempts. Table five can also be used to show the level of grade inflation under each of the different assessment scenarios. This information is summarized in table five below.

TABLE 5

Percent of Students Receiving a Grade Higher, Lower or the Same as their Grade When an Examination Does run

Highest Attempt Tutorial Quiz Mark	Higher	Same	Lower
80% Term Test	52.5%	40.3%	7.2%
Tutorial Quizzes 65%	62.5%	29.7%	7.8%
First Attempt Tutorial Quiz Mark			
80% Term Test	55.9%	37.2%	6.9%
Tutorial Quizzes 65%	39.1%	35.3%	25.6%

All approaches result in grade inflation, which reflects the fact that the mean for the final exam in ECON 104 semester two 2011 was lower than all the other assessments. It is clear from the table that using the first of two attempts on the online tutorial quizzes results in less grade inflation than using the highest of two attempts, as more weighting is put onto the online tutorial quizzes.

CONCLUSIONS

The data from ECON 105 suggests that online quizzes will provide a greater correlation to invigilated assessments if they are available for a shorter time period of around a week rather than the whole semester a course runs. The result will be less grade disruption if weightings are increased on online quizzes in the event of a cancelled examination or term test.

In ECON 104, online quizzes that record a student's first attempt rather than their highest of two attempts also show a closer correlation to invigilated assessments, and result in less grade disruption when weightings on online quizzes are increased. Had the entire examination weighting of 55% been placed onto the online quizzes using the highest of two attempts, only 47% of students would have received a grade within plus or minus one GPA point of the grade they would receive with a final examination. This compares to a corresponding figure of 63% for the first attempt when the quizzes are marked using the first attempt. The respective percentages of students that get the same grade as they would have in a normal semester with all assessment completed are 29.7% and 37.2% respectively. It is important to note that this isn't just a case of students getting higher than usual grades if online quizzes are substituted for invigilated assessments. The Spearman coefficient is measuring the rank order of students under different assessment regimes. In ECON 104 2011 semester two the final examination was harder than the other assessments, meaning grades were inflated when the alternative assessments were used to substitute for the final examination. This may not be the case in every semester however. In ECON 104, the term test often has a lower mean than the final examination.

Online quizzes that were marked using the first attempt yielded a better correlation to invigilated assessments, and therefore less grade disruption when compared to a normal semester of assessment. Interestingly, if the weighting from a cancelled final exam had been put solely onto

the online quizzes, 25.6% of students would have received a lower grade than in a normal semester, compared to only 7.8% if the highest of two quiz attempts had been recorded. Using the first attempt results in less disruption to grades, and maintains the rank ordering of students more effectively, but any grade disruption that does exist is more likely to result in a lower grade for some students compared to using the higher of two attempts.

We cannot state the reasons for the differing correlations when the window of availability or the number of attempts are varied. However, as mentioned in the introduction, Robles & Braathen (2002), Olt (2002) and Burke (2001) suggest that the undesirable behaviour of cheating can be mitigated by restricting the number of times the student can sit an online quiz, how long they have to complete the quiz.

The goal of this paper is not to suggest that one type of assessment is 'better' than another. What this paper does find however is that online assessments are more substitutable for invigilated assessments in the event of invigilated assessments having to be cancelled at short notice, if certain restrictions are placed on them such as period of availability and number of attempts. This should inform the decision making of course instructors when assessment is being designed for a course, especially is there is an increased risk of some future disruption to assessment items at short notice.

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Table 1(a)   **ECON 105 (Macroeconomics) 2005-S1 to 2009-S1**

	Online MC	*Term Test*	*Final Exam*
Pearson Correlation Coefficients			
Online MC	1.00	0.27 – 0.47	0.48 – 0.66
Term Test	0.24 – 0.41	1.00	0.73 – 0.81
Final Exam	0.35 – 0.50	0.76 – 0.83	1.00
Spearman Rank Order Correlation Coefficients			

Table 1(b)   **ECON 105 (Macroeconomics) 2009-S2 and 2010-S1**

	Online MC	*Term Test*	*Final Exam*
Pearson Correlation Coefficients			
Online MC	1.00	0.55 – 0.55	0.65 – 0.66
Term Test	0.51 – 0.55	1.00	0.79 – 0.80
Final Exam	0.52 – 0.61	0.80 – 0.82	1.00
Spearman Rank Order Correlation Coefficients			

Table 1(c)   **ECON 105 (Macroeconomics) 2010-S2**

	Online MC	*Term Test*	*Final Exam*
Pearson Correlation Coefficients			
Online MC	1.00	0.48	0.67
Term Test	0.45	1.00	0.69
Final Exam	0.55	0.73	1.00
Spearman Rank Order Correlation Coefficients			

Table 1(d)   **ECON 105 (Macroeconomics) 2011-S1**

	Online MC	*Term Test*	*Final Exam*
Pearson Correlation Coefficients			
Online MC	1.00	0.57	n.a.
Term Test	0.46	1.00	n.a.
Spearman Rank Order Correlation Coefficients			

Table 1(e)   **ECON 105 (Macroeconomics) 2011-S2**

	Online MC	Term Test	Final Exam
Pearson Correlation Coefficients			
Online MC	1.00	0.66	0.77
Term Test	0.63	1.00	0.83
Final Exam	0.74	0.84	1.00
Spearman Rank Order Correlation Coefficients			