Exam Performance in a Hybrid Course: A Model for Assessing Online and In Class Exam Delivery Modes

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ABSTRACT

This study involved the impact of different assessment techniques in a higher education hybrid classroom. The study assessed the differences in exam results when student exams were proctored in-class versus online. In a freshmen level international business course twenty-four students participated in the study. The study was conducted with three conditions; students were administered four fifty-question multiple-choice exams with periodic retesting (N=24), a post-exam survey was distributed after exam one which provided feedback regarding student perceptions (N=24), and student feedback regarding the preference of the modes of delivery of exams was noted by the professor throughout the course (N=24). The proctored in-class retest scores for the students after taking the exam online indicated that they retained the material better than when the exam was first administered in a proctored in-class format. In general, exam scores were higher when the exam was administered online verses proctored in-class. The implications of these findings and the model developed by the authors to capture them are discussed herein.

Keywords: hybrid classroom, blended teaching, exam delivery method, online exam integrity, student perceptions, higher education, business

INTRODUCTION

Exam Performance in a Hybrid Course: Online versus Proctored In-Class Exams

As assessment of student performance has evolved, so has the research associated with it. A relevant and timely question linked to the issue of assessment is whether the mode of delivery of an exam impacts student performance. In other words, if an exam is administered online rather than proctored in-class, will student performance be affected?

This study involves a comparative analysis of online and proctored in-class assessments in a higher education hybrid international business freshmen level course. For the purposes of this study, a "hybrid course" is considered a course that employs both proctored in-class and online delivery methods (Babson Survey Research Group, Pearson, Sloan-C, 2012). The way in which a professor chooses to incorporate technology in a hybrid course may vary, but they will almost always use a Learning Management Systems and other web-based tools to attempt to add value to the learning experience. Johnson (*NMC Horizon Report, 2013*) states, "technology is going to continue to be a part of the classroom" which should encourage professors to find more ways to incorporate it. The increasing use of technology in the classroom means professors must determine how it can be used effectively for the delivery of course content.   In addition, technology allows students to explore and learn in ways they would not otherwise be able to. For example, going on a field trip to an art museum in a foreign country may not be an option, but a "virtual" field trip to the museum by way of the internet may be feasible.

One of the possible changes caused by the increased use of technology in education is the mode of delivery of assessment activities. Changing from proctored in-class to online exams may allow for increased professor-student interaction during hybrid class time because the exam can now be administered outside of regular class time. This adds more time for student-student and student-professor interaction (or community building.) Responding to the diverse needs and demands of students (e.g., distance learning, reduced travel time and cost, necessity for more flexibility in schedules, etc.), many higher education programs have added more online and hybrid courses. (Garrison & Kamuka, 2004). This provides greater opportunity for creating a collaborative atmosphere filled with engaged discussion in the classroom.

In this study, the primary purpose for assessment activities is to measure the amount of material a student has retained and can recall. The professor administered both online and proctored in-class assessments to determine whether the mode of delivery for exams played a part in learning retention and recall. This study took place at a two-year state school of higher education and involved a total of twenty-four students in two freshmen level international business classes using the same teaching methods (same course).

Literature Review

The transition in the delivery of courses from traditional proctored in-class to online and hybrid in higher education is driving the need for increased research of teaching and assessment techniques. Today, three in ten college students report taking at least one online course, that is up from one in ten in 2003 (Stengel, 2012). The colleges of today need to be prepared to manage the increase in demand for online content. "Existing literature suggests the need to search for pedagogical approaches to online education that improve the quality of student learning, stimulate faculty intellectual growth, and enhance overall academic productivity" (Bishop, 2003). Effective assessment is a critical component of quality learning and academic productivity.

One way colleges are addressing the increased demand for online content delivery is by offering hybrid courses. A hybrid or blended course is a course where a "substantial proportion of the content (30-79%) is delivered online, typically uses online discussions, and typically has a reduced number of proctored in-class meetings" (Allen & Seaman, 2011). The offering of hybrid courses reduces the amount of proctored in-class class time and challenges students to work with the material outside of the traditional classroom. The hybrid format allows the administration of exams to be moved to an online format (from proctored in-class) if the professor chooses. In addition, with appropriate controls in place, it maintains the summative assessment environment as a final display of student learning (Morgan & O'Reilly, 1999). The decision to administer exams online (verses proctored in-class) in a hybrid class allows the opportunity for greater student-professor interaction during the proctored in-class time. However, students may not be as familiar with study habits for preparation of an online test as they are for a traditional in-class test (Hawk, 2007).

The hybrid environment challenges students to take greater ownership of their learning because they often must login and work with the material on their own schedule. In this environment, students may be given control over the timing and environment of their exam by designing the class to include online assessments. This can decrease stress and aid students in more efficiently completing their exam tasks. It may allow students to optimize their sleep-wake cycle "resulting in better exam performance" (Hartley & Nichols, 2008). In addition, the professor-student interaction can increase in the classroom because students should be better prepared after completing the deep thinking activities during the online portion of the hybrid course (Kahneman, 2011). It becomes critical to employ the appropriate tool for the task when asking students to work on their own to learn the material (Graham, 2005) (Kenney, 2012).

Kirtman (2009) found that "change does not… necessarily mean a reduction in learning." Learning is important to the student when they are invested in it and feel that they have the time to do it (Prince & Felder, 2006).

When a professor administers an exam online, his/her students can take it when it is most convenient for them to do so (within the window of the exam time). "Different people function more efficiently at different times of day, and this can affect their performance on any task." (Smith et al., 2002). In terms of teaching and learning, this means that some professors, and some students, will function better at different times of day. It also means some students will be more successful on exams at different times of day (Hartley, 2008).

Hollister and Berenson (2009) found there were no differences in course or exam performance when comparing a proctored verses unproctored online exam environment using activity-based exams. However, it should be noted the Hollister and Berenson study did not use multiple-choice exams, as was done in this study.

Though test environment has received significant attention from researchers, no instances of previous work were found where the mode of exam delivery (online vs. proctored in-class), test/retest, and hybrid classroom criteria were combined. These topics are the focus of this study.

Method

The population under study consisted of undergraduate students enrolled in two fifteen-week hybrid freshmen level international business courses at a two-year college. The research team consisted of a classroom professor teaching the two international business courses in which the study was conducted and two collaborating members from a nearby four-year masters granting institution. The first was a faculty developer with knowledge and interest in the area of online testing. The second was an accounting professor who was interested in learning more about the integrity of online assessment.

The classroom professor taught two sections, back to back, of the same international business course. The earlier section will be referred to throughout this study as Class A and the later as Class B. The professor administered four exams throughout the semester. Each exam consisted of fifty multiple-choice questions; was of equal value in terms of volume, complexity and contribution to the overall grade of the class; and none were comprehensive in nature. The exams were administered in two different modes, online and proctored in-class, and at different times throughout the semester.

The exam dates (excluding retests) were provided to students on the syllabus at the beginning of the semester with an explanation that any of the exams could be administered online or proctored in-class. As they entered classroom on the day of the exam, students were notified whether they would be taking the exam proctored in-class (at that time) or online (they had until midnight that night to complete the exam online in the Learning Management System). As such, all students should have been prepared for the proctored in-class exam when they arrived to class on the pre-announced exam day. This design was employed as at attempt to overcome the reduced performance of online exams associated with overconfidence and associated limited preparation. In other words, if students know an exam will be online there may be a tendency not to prepare as well for the exam because they know they will have access to outside resources while taking the exam. By not knowing which format would be employed and what time of day it would be administered (either in-class at the time of the class of after class until midnight on the day of the exam), the students prepared as if it was an in-class exam. This preparation is likely to have been more rigorous than if they knew the exam was going to be online.

In part, this study is a response to the call for more research by the Hollister and Berenson (2009) study, the difference being multiple-choice questions were employed herein while Hollister and Berensen (2009) used activity-based assessment techniques. Xu and Jaggars (2013) found that if students knew in advance the kind of test they were going to take, the outcome was affected. Therefore, in this study students were not pre-notified of the exam format. However, it should be noted that because students did not know the format of the exam ahead of time they were likely prepared to take the in-class exam. If the exam was then announced

to be online they had extra time (until midnight that day) to study more (if desired) before completing the exam.

All online exams were administered with controls provided by the Learning Management System used for this course. These controls were put in place to maintain construct validity (Shuell, 1986). More specifically, construct validity was maintained by using the same test questions and answer choices, then scrambling the order of both in the different testing environments. This was done to help ensure exams would be equally rigorous during any future retesting of the material. However, because the same exam questions and answers were used for initial exams and retests, there was the risk that "question memorization" (Squire, 1992) and/or "priming" might affect the outcomes of the study. Priming refers to the phenomenon that once an object has been perceived or processed, it can be more easily perceived or processed the next time it is encountered (Baddeley, 2004).

The Learning Management System was set to limit the time a student could spend on an online exam to sixty minutes and to randomize the questions and answers for each student taking the exam. All proctored in-class exams were administered with the same controls for time (sixty minutes) and the same questions and answers as the online exam, but the questions were not randomized for each student taking the exam. During th online exam, students viewed the entire exam at once allowing for backtracking to emulate the paper and pencil testing environment. However, due to the scrambling feature of the Learning Management System for online exams, questions and answers for proctored in-class exams were delivered in a different order than for online exams. Samavati et al (2012) recommends reducing the time allowed for online exams to 65-75% of the time allowed for proctored in-class exams to account for the fact that students have access to outside resources while taking online exams. This was not done in this study. Hillier and Fluck (2013) note there is apprehension on the part of academics and management adopting new fully electronic processes for high stakes exams instead of the familiar paper based processes. This is a barrier that needs to be addressed with reliable digital systems and procedures to make a smooth transition from pen to keyboard. During the time a professor chooses to convert an exam the support of the teaching and learning center and experienced colleagues are imperative because of the uncertainty and learning curve with new technology the professor is experiencing.

To minimize the impact of question memorization and/or priming, all retests were administered one week after the initial exams. Test-retest reliability is a measure of the consistency of a psychological test or assessment (Shuell, 1992). This is used to determine the consistency of a test across time. Retest method, where a test is given to the same individuals after a certain amount of time has passed, is one of the easiest ways to ascertain the reliability of measurements. Normally the correlation of measurements across time will not be perfect because of the different experiences and attitudes that respondents have encountered from the time of the first test (Key, 1997). In this study, this means students' experiences throughout the week may have affected their performance on the retest.

The hybrid course under study was designed so 60% of the final grade was equal to the average of the four exams (15% each). The students could not do harm to their grade during retesting, but there was an incentive to try to perform well on a retest because the higher of the two scores (the initial take or the retest) was averaged into their final grade. The remaining 40% of the course grade consisted of a series of case study activities that was supplemental to these assessment activities.

The exam delivery mode for Class A was online then a proctored in-class retest for exam one, online (no retest) for exam two, proctored in-class then a proctored in-class retest for exam three, and online (no retest) for exam four. Exam delivery mode for Class B was proctored in-class then a proctored in-class retest for exam one, online (no retest) for exam two, proctored in-class then a proctored in-class retest for exam three, and online (no retest) for exam four (see Table 1: Exam Results).

Following the exam one proctored in-class retest, all students were asked to complete a short survey relating to the different exam delivery modes. The survey consisted of eight demographic and open-ended questions. Students completed the survey in class while they were waiting to receive their retest score on exam one from the professor. The purpose of the survey was to collect feedback on the mode of delivery and expected results from the students in the class.

Findings

Below is a table outlining the average exam scores achieved by students in the two international business classes under study. The delivery mode of the exam is listed where OL=online and IC=proctored in-class. If an exam was retested, there are two exam scores in the box and the delivery mode of both exams is also reported in the same box. For example, Class A exam one was originally administered as an online exam, but was retested unannounced in-class a week later. Essentially, there were a total of four unannounced retests

Table 1: Exam Results

	Class A (n = 12)	Class B (n = 12)
Exam one	OL 81.38% / IC 63.8%	IC 74% / IC 59.5%
Exam two	OL 80%	OL 71.6%
Exam three	IC 58.4% / IC 58%	IC 55.4% / IC 61%
Exam four	OL 78.4%	OL 73.6%

As indicated in Table 1, exam one was initially administered in Class A online (81.38%) and proctored in-class as a retest (63.8%) exactly one week later. The students earned a class average of 17.58% points more on the initial online exam than they did on the proctored in-class retest. The same exam was administered to Class B proctored in-class both times (74%/59.5%) and the class average was 14.5% points more on the initial proctored in-class exam than on the proctored in-class retest. Exam two was administered in Class A (80%) and Class B (71.6%) online only (no retest). Exam three was administered in Class A (58.4%/58%) and Class B (55.4%/61%) proctored in-class for both the initial and retest exams. Exam four was administered to Class A (78.4%) and Class B (73.6%) online only (no retest). Both classes earned higher average scores on all online exams when compared to the respective proctored in-class equivalent exams. The exam scores are consistent with other assignments in the course where Class A consistently outperformed Class B.

A lower score on the proctored in-class retest for Class A on exam one (initial online/retest proctored in-class) may have occurred because students had access to additional resources when taking the exam online. A lower score on the proctored in-class retest for Class B on exam one (initial proctored in-class/retest proctored in-class) might be explained by the fact that retention dissolves quickly when students move away from the testing date (Johnson & Mayer, 2009). Class A outperformed Class B on both the initial exam (online for Class A and proctored in-class for Class B) and the proctored in-class retest (proctored in-class for both Class A and Class B.) This may indicate that the online delivery of the exam in some way helped the Class A students better learn and recall the material.

Survey Results

After administering the retest on exam one, students were given a short survey to complete. A majority of students who completed the survey (n = 24) shared positive remarks about online testing (see Appendix A for the survey). There was very little variation between the responses in Class A when compared to Class B. For example, when asked to finish the following sentence, "The difference between the grades is most likely because…", students responded with answers demonstrating their awareness of the possibility of greater learning taking place during online testing as follows:

- A comfortable environment helps students with test anxiety do better on tests and retain more information.

- Investigation of the material while taking the test increases the learning of the material.

- Students like the independence of online test taking.

- Parallels real-life experience in the field of training

- Less stressful

- Prefer the ability to research the material that they are not familiar with

- Learn more in-depth as they read the material they did not know on the test

Students were also asked on the survey if they felt the grades earned online were a true indicator of student understanding of the material. They answered as follows:

- You need to understand the material to work online efficiently.

- It is up to the student to take responsibility to study without being in class.

- You must review more because there is less teacher interaction.

- I wouldn't have gotten an 84 on the second test/retest if I hadn't done any studying for the previous test. I remembered most of the material.

- You are on your own most of the time and it is up to you to learn it.

Two positive aspects of online testing were revealed through the student survey. First, online testing is often less stressful for students and, second, the ability to research the questions within specified time constraints mimics the real world business environment. These results were consistent with those reported in a study by Greenberg, et al. (2008).

Discussion

In this study, the average grades for online exams were higher in every case. The difference in exam scores between online and proctored in-class exams could be explained by different preparation techniques that students use for online versus proctored in-class exams (Hawk, 2007).   Hawk found that students are more familiar with proctored in-class exams and know how to study and prepare for them. However, in another

study access to outside resources compensated for the unfamiliar format of online exams (Miller, Rainer & Corley, 2003).

Another possible explanation for better test results in the online environment could be time of day (Hartley & Nichols, 2008). Students were required to take online exams after class on exam day but before midnight. They were informed of which it would be only when they entered the classroom on the day of the exam. If the exam was to be online, they could choose the time that best fit their schedule and moderated their stressors. If this was a factor in the difference in performance in this study, it implies that convenience should be built into the structure of a hybrid class. With flexibility of time the researchers did look at submission times for online exams and found submission times were not close to one another leading to the conclusion that students in the classes did not work together while actually completing the exam.

In this study the in class retest grades were essentially the same regardless of whether students took the initial exam in class or online. This is true for exam one and exam three. These results are consistent with those found in the 2008 study by Greenberg, et al. where they stated:

Our quantitative analysis resulted in no significant differences between the mean scores of the content items on the comprehensive final that were initially assessed with a proctored in-class exam and those initially assessed with an online exam. This was an important finding because it suggested that traditionally administered exams did not necessarily result in better performance on a traditionally administered comprehensive final-and the same degree of usefulness in terms of performance on final exams for online exams.

Numerous studies have proposed that student performance on online and proctored in-class assessments is statistically the same (Hollister & Barenson, 2009), (Larson & Chung-Hsien, 2009), (Stowell & Bennett, 2010), (Mentzer, et al., 2007). Larson and Sung (2009) employed controls for proctoring in the online section of the course. The study required students to find a proctor at a university or college, library, or military installation and the proctor was required to check photo identification. Hollister and Berenson (2009) found there were no differences in course or exam performance when comparing a proctored verses unproctored online exam environment using activity-based exams. However, as mentioned earlier, the Hollister and Berenson study did not use multiple-choice exams, as was the case in this study.

Comments from the survey administered in this study indicated that a comfortable environment helps students perform better on exams and helps them to better retain the information being tested on. This may be because the students of today are often more comfortable with technology than they are with pencil and paper. "Research on testing via computer goes back several decades and suggests that for multiple-choice tests, administration via computer yields about the same results as via paper and pencil." (Bunderson, 1989). "However, more recent research shows that for young people who have gone to school with computers, national and state tests administered via paper and pencil can yield severe underestimates of students' skills as compared with the same tests administered via computer. "(Russell, 1999). Test anxiety during an online assessment is shown to be lower than that felt by students when taking pencil and paper assessments (Stowell & Bennett, 2010).

Perhaps the most significant contribution of this study is the design of the retest. In the study, students entered the classroom on exam day without knowing whether they would be taking the exam proctored in-class at that time or online later in the day. This meant they needed to prepare as if it was going to be a proctored in-class exam. If it turned into an online exam (later that day) they had the benefit of both proctored in-class exam preparation and the use of outside resources while taking the online exam. This may be the best structure for a hybrid class assessment. In other words, if a hybrid class is designed so students are unaware of whether the exam will be proctored in-class or online, they will have to prepare for a proctored in-class exam. If the exam becomes an online exam (later that day,) performance will likely be greater than if it

was either an expected online or expected proctored in-class exam because students will have the benefit of the more rigorous exam preparation (expected proctored in-class exam) and the use of outside resources (online assessment resources such as textbook, notes, Internet, etc.)

Limitations and Recommendations for Future Research

This study was limited by the small sample size (n=24) and because it was conducted at a single institution and in a single course. A recommendation for future research efforts in this area would be to administer to a larger group across institutions and departments or replicate the study in multiple courses. The limitation of a small sample size may also have affected the survey results if the students felt identifiable. As such, future research in this area using student perception surveys would benefit from the use of online anonymous surveying.

The possibility of students studying for the second retest is also a limitation and may have affected the exam two proctored in-class retest score. In other words, the element of surprise may have been lessened after the retest process had been used earlier in the course. To control for this factor, exams should be proctored online and retested multiple times if possible. This should be employed in both classes as Class B did not have the online exam followed by an in-class retest for this study.

It is also important for future researchers in this area to maintain construct validity if they decide to change exam questions and answers to further eliminate the potential for question memory. Retesting on every exam, though possible, is not recommended because students would expect the opportunity to improve their grade and would likely prepare for the retest. However, this would occur only if students were not pleased with their initial exam score. This may skew the retest results. It is possible this was an issue on the retest of exam three in this study.

A change in exam format may also improve the validity of the results. For example, rather than utilizing all multiple-choice questions, future studies may choose to administer short-answer or essay questions for initial or retests. Future studies may also consider the use of a secured online testing environment such as Lockdown Browser or live proctoring to minimize the use of outside materials.

Conclusion

A 2011 study by Allen concluded the level of student satisfaction is approximately the same for both online and face-to-face courses. Students participating in this study reported that they were satisfied with the online testing environment and that it decreased test anxiety. Overall the professor and students in this study had positive experiences with online testing. This supports the hypothesis that mode of delivery of exams does affect overall performance. Based on the qualitative and quantitative data collected in this study, the students earned a higher average grade and performed better when they were assessed using online exams. This was supported by all online exam scores when compared to their proctored in-class equivalents.

Online exams allow for greater flexibility in scheduling. In addition, students enjoy using modern technology and receiving immediate feedback of their test performance. These factors mean online exams are often less stressful for students However, students are also more comfortable preparing for traditional in-class proctored exams (Hawk, 2007). This is likely because the majority the exams they face early in life are administered in this format. As such, we recommend designing hybrid courses with random testing modes, alternating between online and proctored in-class formats. This will allow students to prepare for exams in a manner that is most comfortable and familiar to them (in-class) and to "take" at least some portions of their exams in a manner that is less stressful to them (online.)   This provides a "best of both worlds" assessment approach to a hybrid class. In addition, the randomization of mode of delivery may increase performance on all exams.

The primary purpose of this study was not to quantitatively prove or disprove whether in-class or online assessment is superior, rather it was to establish and apply a process/model for doing so. The researchers feel

this was accomplished and that this surprise retesting model has value. However, we acknowledge that further application of the model on a much larger scale and using proven quantitative methodology would be of great benefit to an academic community that is steadily and intentionally marching toward a world with much greater emphasis on hybrid and online teaching and learning. Assessment procedures in this new world must be validated and "best practice" models need to be developed. All of this must take place very quickly because the pace of change to online and hybrid classes is rapid. This study created a model to be employed on a larger scale across institutions to move forward this rapidly changing field.

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Appendix A:

Post-Exam Survey

1) My **ACTUAL** "online" exam grade was (please circle)
100-90,   89-80,   79-70,   69-60,   59-50,   49-40,   39-30,   29-20,   19-10 or 9-0

2) I **EXPECT** to earn a (please circle) *higher or lower* "in-class" exam grade.

3) The difference between the grades is most likely because…

PLEASE STOP HERE UNTIL YOU HAVE RECEIVED YOUR GRADED "IN CLASS" EXAM
4) My **ACTUAL** "in-class" exam grade is _____

5) This difference between the ***expected*** and ***actual*** "in-class" exam grade is most likely because…
6) This exam grade difference between the ***online and actual in-class*** is most likely because…

7) Do you expect the grade differences you have seen for yourself to be similar or different when compared to those of your classmates?
Circle: Similar   Different
Please give at least three reasons why this may be.
   1)
   2)
   3)
   8) Do you feel grades earned in online/hybrid classes are a true indicator of a student understanding of the material? Please explain.

(Optional Question) Your emotions as you completed this survey can best be described as:
(Optional Question) In general, how do you feel about online/hybrid classes verses traditional classes?
THANK YOU FOR YOUR PARTICIPATION IN THIS VERY IMPORTANT SURVEY