Quantitative Impact on Learning Achievement by Engaging High Integrity Testing using Lockdown Assessment for Online Delivery

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Abstract

Maintaining academic integrity standards during assessments is a widespread and longstanding challenge, especially in online formats with remotely-located students, which may negatively impact learning achievement and can be difficult to quantify or detect. Herein, proctored and un-proctored quizzes are compared within an online undergraduate course, *Engineering Analysis: Dynamics*, encompassing 276 students. The least average difference between the proctored and un-proctored quizzes was 32%. Lockdown computer-based assessment was used in a proctored testing and tutoring facility called the Evaluation and Proficiency Center (EPC) and scores were collected in a secure manner using Canvas Learning Management System (LMS). Students' perceptions regarding online courses and digitized exams were surveyed before and after the course took place, resulting in a Welch's t-test result of p=0.0176 that un-proctored quizzes inflate grades. The students also agreed that the EPC is an effective monitor of cheating (p=0.0121).

Keywords

Proctored testing, Online assessment, Grade inflation, Lockdown assessment.

Introduction

Maintaining academic integrity while conducting remote testing has been a challenge for many educational institutes over the years. It arises from an online environment that is aggressively revolutionizing the education system as per K. K. Hollister[1] et al. for its affordability and for its ease in reaching out to a large student population while reducing the teaching load, explained by D. L. Prince[2] et al. Some researchers, such as R.W. Yates[3] et al. found no difference between proctored and un-proctored testing results. Others, like M. M. Lanier[4], A. Fask[5] et al., as well as P. Charlesworth[6] et al., report findings of potential differences. Evidence of differences between proctored and un-proctored quizzes in terms of reliability and integrity may involve multiple factors. Results may vary depending on the subject matter: for example, work done on a computer such as a typing test, or working with an Excel sheet to compose unique solutions for an online test may not benefit significantly from proctoring to maintain testing integrity[3]. One method to harbor academic honesty with online delivery is for off-campus students to complete proctored quizzes on paper within approved testing centers and have the solutions delivered to the university for grading. Another is the use of an interwoven testing and tutoring facility identified by T. Tian

and R. DeMara as an Evaluation and Proficiency Center (EPC)[7]. A recent study by V. Beck[8] showed that un-proctored quizzes tend to inflate students' performance and the purpose of this article is to quantify such impacts within an *Engineering Analysis: Dynamics* course of a large online class enrolling 273 students at a large accredited state university during Summer 2018.

Course Overview

The course was available in a fully-online format designed with pre-assignments that included LearnSmart (LS) of Connect-McGraw Hill[9] and pre-prepared videos by the lecturer, regular assignments, a weekly live conference, four quizzes and four tests. Prior to a live conference, students watched YouTube videos, accessed only via the Canvas LMS, and answered a set of ten pertinent questions every week, while completing the LS adaptive learning assignment. The live conferences involved problem solving demonstrations where the instructor explained relevant concepts, explained the problem context, and demonstrated how the problem was solved. These problems came from the regular assignments with different numbers to assist the learning process. Ample time was provided for questions and answers from students at the end of each live conference. Four quizzes and four tests were spanned from Week 5 to Week 12. Each quiz prepared students for the subsequent test during the following week. In this way, the quizzes served as a pre-test practice activity. Assessments totaled four quizzes and four tests delivered to two groups. If on a given week Group A was proctored for a quiz, Group B was not, then in the next assessment cycle Group B was proctored and Group A was not, to ensure fairness to all via crossover design.

Assessment Delivery Mechanisms

Off-campus students were allowed to take their proctored quizzes and tests in approved testing centers close to where they resided or worked. However, the majority of students came to the campus-based testing facility known as the EPC. In general, the on-campus students had a three-day window to complete their quizzes and tests in the EPC. The off-campus students were only given a comparable accommodation when they asked for it. The reason behind the latter is to deter and minimize any possibility of cheating in an uncontrolled environment, i.e. friends sharing what they got in their tests/quizzes via cell phones or the like. There were usually three versions of quizzes for the eight off-campus students, most of whom took proctored quizzes simultaneously.

R. DeMara[10] et al. showed that to better understand testing integrity, it is important to understand the authenticity, uniformity, and repeatability of the assessment environment. The EPC used in this study delivers tests asynchronously from 9:00AM– 9:00PM daily via 120 computer-based workstations. Testing is monitored via cameras and enforced via in-room proctors during test delivery. The EPC provides a quiet and comfortable setting with computing software that restricts activities to only taking the test, called Lockdown Browser. When students arrive at the EPC, they place all their belongings in lockers and then check in with their ID. They subsequently receive blank scratch paper on which they write their names, ID numbers, the quiz/test number and eventually use them to complete their quizzes or tests. Once a student is seated at a computer, she/he logs in to start the quiz. Since the computers are equipped with lockdown browsers, they cannot access the internet and other communication/recording devices are prohibited. Offering

students the flexibility of a 3-day window during which they can complete their tests decreases their anxiety and provides adaptable accommodation during peak times like midterm and final exam weeks. Once a quiz is submitted, it is graded automatically and the results are immediately available with Canvas. As for the off-campus students, once they finished their quizzes/tests, their testing centers sent back their scanned solution paper to the university. Grading was done soon afterwards and papers were sent back to the students to provide formative feedback.

Student Surveys

All students were asked to complete surveys regarding their perception of EPC-based testing at the beginning and at the end of the course. The first part of each survey was common to all students while the latter portion of the survey flow utilized "skip logic" to decorrelate either the on-campus or off-campus cohort, accordingly. Initial perceptions were taken as a baseline and Welch's two-sample t-test was performed to test the null hypothesis: "There is no change in student perception of the EPC between the beginning and the end of the course." The null hypothesis was rejected on two survey items at the 5% significance level, as listed in Table 1. Students had five answer choices for each survey item: "strongly agree" (-2), "agree" (-1), "neutral" (0), "disagree" (1) and "strongly disagree" (2). The numerical value corresponding to each choice was used to compute averages listed in Table 1. Overall, students agreed more at the end of the course that un-proctored testing can cause grade inflation. Even off-campus cohort students, who used the EPC less, agreed more at the end that EPC-based testing can be effective at monitoring cheating.

Table 1: Student perceptions that changed significantly throughout the course.

Survey Item	Cohort	Initial Perception (-2, -1, 0, 1, 2)	Final Perception (-2, -1, 0, 1, 2)	p-Value
1. Online computerized exams taken at home would cause grade inflation i.e., even despite the use of webcams, scores will be higher than the actual learning which occurred.	All	0.16	-0.20	0.0176
2. EPC-based testing can be effective to monitor cheating while providing a uniform testing process.	Off-campus	-0.34	-0.89	0.0121

Results

Four quizzes were delivered across two groups, A and B. In both cases, proctored or un-proctored, the computer randomly selected problems from a large pool of questions of equal difficulty[11]. Students were then allotted 90 minutes to complete the quiz. The question banks were based on problems from the book *Vector Mechanics for Engineers: Dynamics* by P.J. Cornwell et al.[12] Figure 1 shows the trends for the average quiz scores for proctored and un-proctored quizzes. It clearly illustrates that when Group A was proctored for quiz 1, the students scored 48 points less

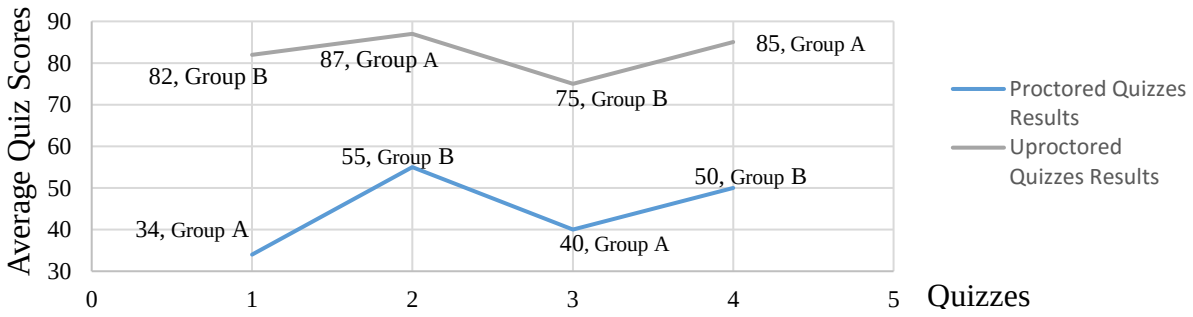

Figure 1: Student scores in proctored and un-proctored modes.

than Group B which was un-proctored, i.e. Group B had a take-home quiz with 90 minutes' duration. The trend is reversed for Quiz 2: when Group B was proctored, their average score was lower by 32 points. The trend of Figure 1 is consistent with the fact that the proctored quizzes always yielded much lower scores, presumably attributed to dishonest activities. Note also that the differences in results for all quizzes are consistent in values except for Quiz 1, which may suggest that the students did not know what to expect in Quiz 1 and for the majority it was their first time sitting for a quiz in the EPC, i.e. a new testing environment, and perhaps they were uncomfortable. The average difference of four quizzes is 37.5%, which is quite significant.

Discussion and Conclusion

From the above results, it can be concluded that the students could have cheated in un-proctored quizzes by finding online solutions to the same or similar problems or by using Chegg[13], especially since the questions were based on the course textbook[12] problems. Moreover, un-proctored quizzes forgo reasonable means to prohibit students from solving the problem with the assistance of others. Even with webcams, there can be cases where the enrolled student looks at the screen while the keyboard is given to a friend solving the quiz questions. It is worth noting that inflated grades can purport unrealistic results for student assessments. In addition, the credibility of the degree program from which the students are graduating may become diminished.

A partial resolution to some of these concerns is to develop and then "clone" large banks of questions whose solutions are not readily available to the students. These question banks require continual maintenance and development with a trusted delivery system that prevents students from reproducing them and distributing their solutions. Unfortunately, it takes years to build a large pool of questions for assessment. Overall, utilization of a sufficient amount of proctoring can be vital to maintain the integrity of online course delivery within problem-solving oriented curricula.

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