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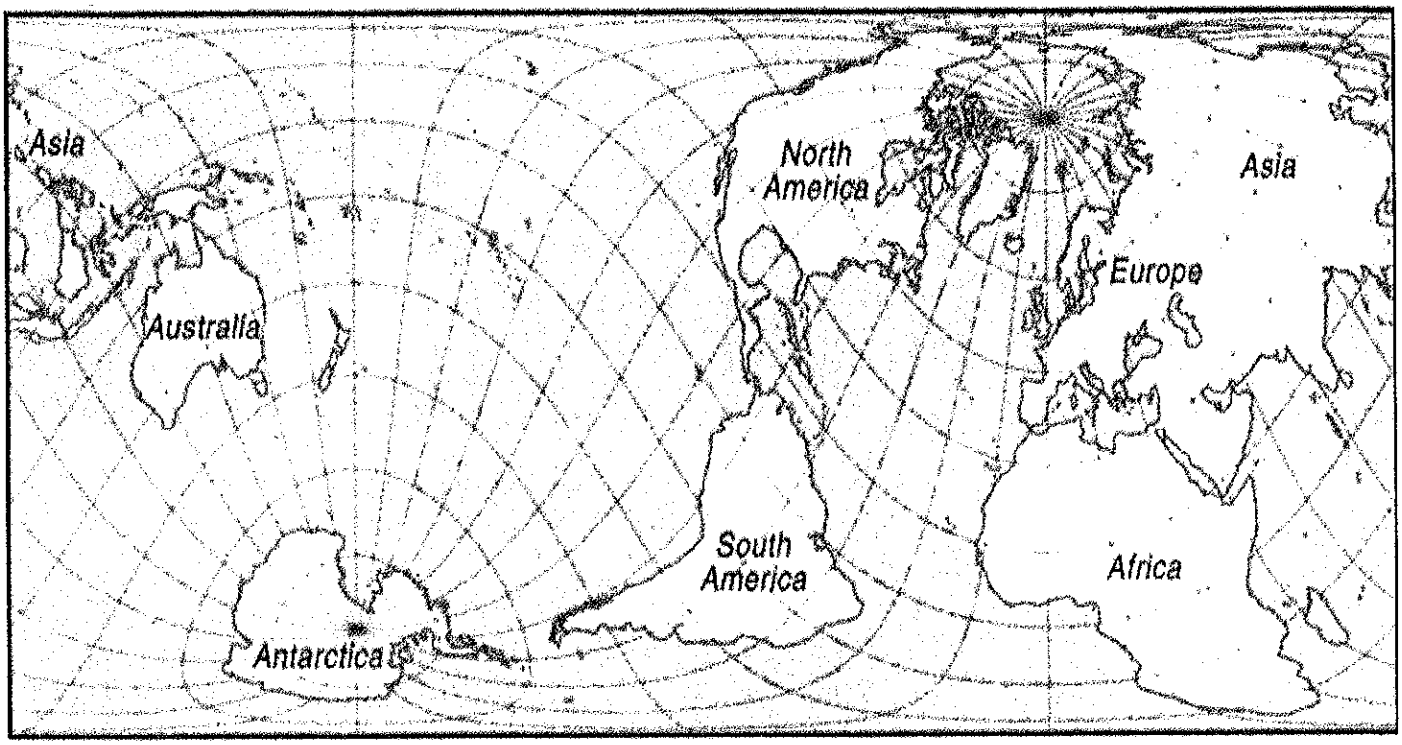

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GRADE DISTRIBUTIONS UNDER DIFFERENT TESTING ENVIRONMENTS – EVIDENCE FROM AN UPPER LEVEL ACCOUNTING CLASS

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ABSTRACT

With the spread of online education, as more and more courses are being offered online, the important question of whether grade distributions in these online sections are comparable to in-class sections of the same course remains to be answered. Also, as online education expands and quality learning management systems (LMS) provided by major publishers are readily available, many instructors of even face to face (F2F) courses are administering exams and quizzes online on these platforms. This study proposes and empirically tests differences in grade distributions under the different testing environments, namely, online proctored, online un-proctored, and in-class proctored.

Data analysis using ANOVA indicated that the test scores were significantly different among the three types of testing environments (in-class proctored exams, online proctored exams, and online un-proctored exams). Post hoc comparison suggested that the test scores were highest in the online un-proctored exam group followed by online proctored exam group and then the in-class proctored exam group. Data were collected over a period of several years at a major university in northeastern USA. All research hypotheses are supported. The study also provides a meaningful insight into the effect of testing environments on test scores.

Keywords: *Grade Distributions, Test Environment, Proctored Exams, Online*

1. INTRODUCTION

Traditional face to face classroom instruction is gradually giving way to online education. Several studies have been conducted on the impact of online education on outcomes and quality of student learning. Bettinger, Fox, Loeb, and Taylor (2015) report that online courses, on average, reduce student learning by one-third to one quarter of a standard deviation when compared to face to face traditional courses. Bettinger et.al (2015), also assert that online course taking further reduces student learning in future courses. The Department of Education ranked online students in the 59th percentile whereas traditional F2F students ranked in the 50th percentile. A study conducted by Columbia University Community College Research Center found that students enrolled in online courses, received lower grades, on average, than in traditional face to face classes (Daily Free Press Admin, 2013). This finding is in direct contradiction to the expectations of higher average grades in online courses. However, it appears that in spite of progress in technology, some element of communication is lost when a course is placed online. Traditional face to face instruction appears to allow for increased flexibility of communication. An important measure of student learning is performance as measured by the final grade in the course. This is only true as long as the test environment integrity is maintained. There can be no connection between student learning and their performance as measured by the final grade in a course absent of test environment integrity. A common complaint regarding online courses has been the lack of integrity of the testing environment. Since students take exams at their own convenience from the comfort of their homes, the common perception is that a majority of students resort to dishonest methods including outright cheating on the exams. Students report that they are up to four times more likely to cheat in online classes compared to traditional classes (e.g., Moten et al., 2013).

Previous research (Lanier, 2006; Morton, Fitterer, Brazier, Leonard & Brown, 2013) notes higher self-reported instances of cheating in online classes when compared to the F2F modality.

Advocates of traditional, face to face classroom instruction are of the opinion that a majority of the students taking online courses cheat. These faculty point to the easy availability online of test bank questions and solutions, etc. They further allege that even if the solutions are not easily available online, the students can get someone else to take their exams and do the graded work in the course. Similarly, finance faculty members believe that online finance classes are likely to lower the quality of education compared to traditional classes (Farenella, Hobbs, and Weeks 2000).

Supporters of online instruction including online testing, argue that the availability of test bank questions (and solutions) is not a valid factor in quantitative courses since every single question on the exam can be an algorithmic one that generates new values for every version of the test. Thus, for exams comprised of only algorithmic value questions, there cannot be any solutions available, since the question values are generated by the software only after the student access the exam. Faculty that present this argument have even gone as far as to challenge the faculty (that allege widespread cheating in online courses) to take their exams and see if they can find the solutions to the questions on the internet. Of course, this argument may not be a good one when it comes to non-quantitative courses where essays and descriptive answers are the norm. For these courses the algorithmic option is not possible and thus using publisher provided questions may pose a problem if the test bank and solutions are available on the Internet.

While it appears that algorithmic questions might pose a challenge to cheating on online exams, they might not completely eliminate cheating on online exams. One possible solution to the question of cheating on online exams would be to have the tests proctored. With the explosion of online education and the related concerns about test integrity, several test proctoring services have emerged. These include a variety of products which add a whole slew of options and prices to the proctoring dimension. The idea is to limit, if not completely eliminate, cheating by having every single exam taken by every student proctored. Proctoring services range from a simple lock down of the browser while students are taking an exam which prevents them from opening another window to search for the solutions, to a proctor monitoring the exam real time. The prices for these products are also very varied with real time proctoring being the most expensive one.

However, even this is not a foolproof approach. Newton (2015) says that one Orlando Craigslist ad offered to "provide excellent support for all online classes' needs including discussion boards, tests, quizzes, and assessments, including plagiarism free papers that assured top grades, written by a team of highly qualified professionals." A simple web search for "professional test takers for hire" brings up sites like NoNeedtostudy.com, BoostMyGrade.com, paymetodoyourhomework.com, etc. Each site promises to do all kinds of assignments from homework, quizzes, tests, etc. Smith (2016) provides instructions on "Beating, Cheating, and Defeating Online Proctoring." Although it is entirely possible that despite the best security measures adopted, some students will always find ways to circumvent the system and earn a dishonest grade, this is however, not the norm. Most students are honest hard-working individuals and are interested in learning as opposed to simply getting a passing grade by any means possible.

We saw merit in the arguments presented by both sides. We believe that conjecture and opinions, in of themselves, do not justify taking any decision either in favor of, or against, online testing. Only empirical testing can shed light on this question of cheating in online courses. Therefore, we hypothesize and test for dissimilarities in grade distributions across the different testing environments.

2. LITERATURE REVIEW

Higher education enrollments in the U.S. are now one third online (Allen & Seaman, 2013) with approximately 7 million students taking at least one course online. Distance Online education is the fastest growing segment of higher education (Allen & Seaman, 2011). The common perception is that online students use dishonest methods more frequently and lack knowledge when compared to traditional F2F students. Since exams are given online with no supervision, students are perceived to perform better than in traditional F2F classes where exams are proctored.

Shachar and Neumann (2003) meta analysis showed online students scoring higher on the standardized final exam than the F2F class. Means, Toyama, Murphy, Bakia, and Jones (2010) report higher academic performance in online classes than the F2F modality. Gratton-Lavoie and Stanley (2009) noted final exam scores were higher in an online microeconomics class than a traditional class setting. Ritchie and Newby (1989); Farber (1998) report higher grades for online classes as opposed to traditional class formats. Harmon and Lambrinos (2006) provide similar findings.

Stack (2015) found students in the online course did no better on the final exam than the F2F class. Bowen, Chingos, Lack, and Nygren (2014) find no difference in student outcomes when comparing online and hybrid courses at a four-year public institution. Other research suggests that online education does not differ significantly from F2F classroom education (Bernard et al., 2009; Means et al., 2010; Tallent-Runnels et al., 2006; Zhao, Lei, Yan, Lai, & Tan, 2005).

Grade inflation may exist in online courses due to the opportunity of cheating. Gondhalekar, Barnett, and Edwards (2004) found 78% of online students and 83% of in-class students received an A or B for the final course grade. Using a proctored test for online classes might mitigate the risk of grade inflation.

Previous research does not include the presence of proctoring exams in online courses (Brown & Liedholm, 2002). Stack (2015) brings attention to the lack of proctoring exams in online versus traditional classes. Wachenheim (2009) represented that in an online introductory economics students taking an exam without a proctor did score one letter grade higher, on average, than ones taking exams that were proctored. The absence of proctored testing in online courses may help explain why online students perform higher than traditional F2F students. Students cannot take the exam with the aid of notes and the use of the web in a F2F class. Most research does not report on the presence of exam proctoring. Our study controls the testing environment by proctoring exams in face to face classes as well as in online courses. Proctored exams were given in online sections, as well as, F2F sections of a particular course.

3. HYPOTHESES

The following set of research hypotheses were developed and tested.

Hypothesis 1: Students' test score is significantly affected by the testing environment adopted by the instructor.

Hypothesis 2: The tighter the testing environment, the lower the test score will be.

H2a: Student test scores in an online, un-proctored testing environment will be higher than test scores in an online, proctored one.

H2b: Student test scores in an online, proctored testing environment will be higher than test scores in an in-class proctored one.

H2c: Student test scores in an online, un-proctored testing environment will be higher than test scores in an in-class proctored one.

4. METHOD

Data collection was carried out at a major business school located in the northeastern region of the USA. Data, in essence, were drawn from a faculty's gradebook of an upper level accounting course. The faculty, using the same textbook and resources, taught several sections of the same course over a ten-year period. The exams that were administered under the three different testing environments, namely, online proctored, online un-proctored, and in-class proctored, were largely similar. Thus, the possibility of the differences in grade distributions being attributable to different instructors, different courses, different content coverage on exams, and different types of exams, has been successfully controlled. Furthermore, the faculty member

used the same textbook, used the same resources, covered the same chapters, and gave the same number of exams during the course of each semester, and used the same grading scale each time the course was taught. Each exam also covered the same chapters and was of equal length and difficulty. Thus, given that most other factors were almost identical, the differences in grade distributions could be attributable mainly to the differences in testing environments.

5. RESULTS

This study attempts to investigate whether the testing environment contributes to a difference in test scores among students taking an upper-level accounting class. Test scores of the three types of testing environments (in-class proctored exams, online proctored exams, and online un-proctored exams) are presented in Table 1. To test the hypotheses of the study, data analysis using ANOVA and post hoc comparisons were carried out. First, data analysis using ANOVA indicated that the test scores were significantly different among exams under the three types (in-class proctored exams, online proctored exams, and online un-proctored exams) of testing environments (exam proctor, $F = 143.31$, $p<.01$). Thus, hypothesis 1 which postulates the significant influence of exam proctor type on student test scores is supported. To scrutinize the relationships between the testing environment and the test score at a more detailed level, we investigate whether the proctoring tightness of the test environment makes a differences in students' test scores. Following common wisdom regarding the tightness of the test environment, we assume that proctoring tightness is highest in traditional in-class proctored exams, followed by online-proctored exams and then by online un-proctored exams. Three separate post hoc comparisons were conducted. From the comparisons, we found that the test scores were highest in the on-line un-proctored exam group, followed by online proctored exam group and then the in-class proctored exam group. The differences of the test scores among the three groups were all significant, supporting Hypotheses H2a, H2b, and H2c. Yet, it is interesting to note that the difference between the on-line proctored group and in-class proctored group was found to be only marginally significant (mean difference = 2.34, $p<.1$).

Table 1. Descriptive Statistics on Test Scores of Three Testing Environments

Testing Environment	Sample size	Test Score*	Standard deviation
In-class proctored exam	346	74.85	11.04
Online proctored exam	64	77.20	12.37
Online un-proctored exam	183	90.67	7.81

*Test scores were obtained as an average of three individual tests.

6. CONCLUSIONS

Among many alternative means of education services that higher education institutions have been exploring, online course offerings are perhaps the most widely accepted and fastest growing ones. This popularity stirs up concerns in the academic community and the general public alike, as to whether online courses can be a legitimate alternative for traditional F2F classes. The critical point is whether there is compatibility between them in terms of process, quality, and outcomes of learning.

This study attempts to examine the compatibility of online and traditional courses in terms of test scores by using a strict perspective. Compared to existing studies that used cross-sectional observations where the scores of online and offline test were examined at a given time, this study adopted a longitudinal approach where scores were collected over several years and then observed test scores under three testing environments (in-class proctored, online proctored, and online un-proctored). This particular approach as used in the current study is expected to provide more conclusive evidence for the controversy.

Findings of the current study provide an additional support to the notion that online courses and traditional courses are not comparable at least in terms of test scores. From the multiple comparisons, we found that the test scores were highest in the on-line un-proctored exam group, followed by online proctored exam group and then by the in-class proctored exam group. Thus, student test scores were significantly affected by proctoring tightness. In the end, it is obvious that grade inflation would be a norm in online classes.

Such findings of the current study urge higher education institutions to equip their online courses with additional mechanisms to control dishonest actions during test taking. As new methods for academic misconduct are constantly being invented, colleges need to develop and maintain mechanisms that guarantee the test environment integrity for their online educational services. Such a mechanism may require adoption of new proctoring technologies or use of offline proctoring methods just for the tests, and so on. Unless the test environment integrity is maintained, grade inflation would be an inevitable and persistent phenomenon. Once the public perceives cheating, academic misconduct, and grade inflation as a part of online education, higher education institutions would have very limited selling point for their online courses to the public, job market, and even student prospects.

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