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Exploring the Impact: How Online Exam Proctoring Reduces Cheating and Enhances Course Legitimacy

Daniel Woldeab and Thomas Brothen

Abstract: In this study, we analyze undergraduate student responses in 1,364 surveys to better understand student reactions to online proctoring. We present findings regarding two aspects of student reactions to online proctoring: First, we assess whether students believe that the act of cheating in online exams diminishes the legitimacy of their courses; and second, whether students think online proctoring reduces cheating and enhances the perceived legitimacy of their course performance in the eyes of graduate schools or employers. Additionally, we explore how anxiety interacts with these student perceptions. The data collected in this study support the contention that cheating reduces perceived course legitimacy, and online proctoring minimizes cheating and increases perceived course legitimacy. Finally, the data shows that when asked if they would prefer to take their examinations in the classroom or with online proctoring, students who participated in this study said they would pick online proctored exams.

Keywords: online proctoring, cheating, legitimacy, anxiety

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CC IMAGE SECTION

Exploration de l'impact de la surveillance des examens en ligne : réduction de la tricherie et renforcement de la légitimité des cours

Résumé : Dans cette étude, nous analysons les réponses d'étudiants de premier cycle dans 1 364 enquêtes afin de mieux comprendre les réactions des étudiants à la surveillance en ligne. Nous présentons les résultats concernant deux aspects des réactions des étudiants à la surveillance en ligne : d'une part, nous évaluons si les étudiants pensent que la tricherie dans les examens en ligne diminue la légitimité de leurs cours et, d'autre part, si les étudiants pensent que la surveillance en ligne réduit la tricherie et améliore la légitimité perçue de leurs résultats dans les cours aux yeux des établissements d'enseignement supérieur ou des employeurs. En outre, nous étudions l'interaction entre l'anxiété et ces perceptions des étudiants. Les données recueillies dans le cadre de cette étude confirment que la tricherie réduit la légitimité perçue des cours et que le contrôle en ligne minimise la tricherie et augmente la légitimité perçue des cours. Enfin, les données montrent que lorsqu'on leur a demandé s'ils préféraient passer leurs examens en classe ou avec un système de surveillance en ligne, les étudiants qui ont participé à cette étude ont déclaré qu'ils choisiraient les examens surveillés en ligne.

Mots clés : surveillance en ligne, tricherie, légitimité, anxiété

Introduction

Long before the COVID-19 pandemic brought the world to a standstill, online education was growing rapidly in the United States (US) and globally. According to the National Center for Education Statistics, in the US alone, prior to the pandemic, a third or six million of the total number of students attending US colleges and universities were enrolled in online courses, seeking undergraduate and graduate degrees. During the pandemic, in fall 2020, that number went up to 11.8 million.

Technology has been an integral part of education for centuries. This is especially true for distance education. The creation of the Postal Service in the US made correspondence education possible, and radio and television transformed correspondence education into distance education. In fact, as Kentnor (2015) states, "The early 1920s are seen as the beginning of educational broadcasting" (p. 24); and in 1932 and 1937, institutions such as the University of Iowa, University of Wisconsin, and Penn State began offering college classes using television. However, the robust distance education we have today is the result of the creation of the Internet, which is indeed one of the most disruptive innovations of the 20th century (Woldeab & Brothen, 2021).

Examinations are assessments through an exam and they are as old as formal education itself. The earliest known proctored exams, considered extremely challenging to pass, took place over 2,000 years ago in Imperial

China under the Han Dynasty (206 BCE to 220 CE). These exams were administered to male individuals as part of a merit-based system of finding the most qualified candidates to staff the civil service bureaucracy and also provided a way for individuals to improve their class status (Elman, 1989).

By their very nature, examinations and standardized tests place the person taking them in the position of receiving judgments about themself, which can engender a sense of fear and impeding danger for many—in short, anxiety. Test anxiety occurs when the worry is disproportionate to the underlying threat (Williams & First, 2013), and people may exhibit severe stress and discomfort during or after evaluation situations (Salend, 2012). Test anxiety can negatively affect students' exam performance (Cassady & Gridley, 2005; Rana & Mahmood, 2010). Students with heightened anxiety under evaluation conditions can show lower performance (Chen, 2012), and the fundamental truth is that for many people, exams provoke anxiety.

According to McDonald (2001), studies on standardized testing, test anxiety, and exam performance go back as far as the early 1900s. The work of psychologists Robert Yerkes and John Dodson in 1908 on stress and performance led to the development of the Yerkes-Dodson law, a model of an empirical relationship between stress/pressure and performance. This law demonstrated that moderate levels of arousal led to optimal performance and added to our understanding of students' exam anxiety (Buchwald, 2010). Indeed, the work of Yerkes and Dodson paved the way for the very rich body

of knowledge we have today in the area of exam anxiety and student performance, and their bell-curve model was used successfully by numerous researchers to establish relationships between test anxiety and performance (Abdi et al., 2012).

For example, in the early 1950s, many studies on the topic of test anxiety and academic performance established that "anxiety present in the testing situation is an important variable in test performance" (Mandler & Sarason, 1952, p. 172). Further studies helped to develop several test anxiety scales for both children and adults, which also led to exponential growth and advancements in test anxiety research. Between 1950 and 1988, there were over 1,000 academic publications on this topic (Zeidner, 1998). Today a simple search for "anxiety and performance" in Google Scholar will bring up over 3.25 million entries. What we know for a fact is that when we are under threatening exam situations, where we cannot predict the outcome, it can induce anxiety and affect exam performance. In short, exam-taking can lead one to experience anxiety and affect how well one performs on their exam.

In part, the same can be said about online proctoring: that it is not the technology that induces anxiety, rather the process of being examined. We learned from our previous studies that two types of anxiety affect student reactions to online proctoring: *state anxiety*, which is the in-the-moment result of events such as exams; and *trait anxiety*, which is a long-term characteristic that people possess. Thus, in addition to the exam-induced (state) anxiety,

students' general level of (trait) anxiety (Woldeab & Brothen, 2021) also has effects. Our previous studies on this topic (i.e., Woldeab & Brothen, 2021, 2019; and Woldeab et.al., 2017) established that a student's trait anxiety may be the largest factor in online exam anxiety and performance. That is, a student's general level of anxiety (including how they usually respond to testing situations) is key to how they react to online proctoring. Therefore, whereas online proctoring may raise students' anxiety, that increase does not necessarily interfere materially with their exam performance. For an extensive review of online proctoring, exam anxiety, and student performance, we suggest readers refer to our previous three studies mentioned above. We next turn to consideration of how students perceive online proctoring, its possible benefits, and how those perceptions are affected by anxiety.

Academic Dishonesty and Online Proctoring

It is safe to say that academic dishonesty or academic misconduct is a universal phenomenon. Indeed, cheating happens in all circumstances, including security measures, exam conditions, assessment designs, and a range of student demographic factors (Henderson et al., 2023). It is also true that the integrity of the course and the standing of the institution must be trusted; without trust, academic credentials are meaningless. It follows then, that exams or tests that are used to verify learning need to be reliable, fair, and trustworthy (Musacchio, 2022).

According to Claybourn (2024), cheating in college is a dangerous activity that carries a lot of potential penalties including failing classes, suspension, and even expulsion. Despite this, however, cheating appears to be more common than ever. A study conducted by Jenkins et al. (2023) investigated cheating before and after the COVID-19 pandemic at one land-grant university in the US and found that first-time cheating increased during the pandemic. Online exams are increasingly being administered in higher education, frequently under the supervision of a proctor (Alin et al., 2023). Peytcheva-Forsyth and Aleksieva (2021) assert that higher education institutions are being forced by the rise of online learning to look for technology that supports e-assessment. As such, the hard work of trying to eliminate academic dishonesty has become a multimillion-dollar industry (Claybourn, 2024).

Online Proctoring and Exam Legitimacy

Over the past few years, a great deal of attention has been focused on students' concerns about being monitored while taking online exams (e.g., Woldeab & Brothen, 2021). We turn here to the issue of what might be changing about students' perceptions of online proctoring. According to Dendir and Maxwell (2020), who compared online course exam performance before and after using webcam recording software, the average performance in both courses decreased when proctoring was done online using webcam recording software. The authors attributed this performance decrease to the

proctored nature of the online examination. On the other hand, an early study in this area conducted by Milone et al. (2017) reported that 88.9% of the 155 students they surveyed said ProctorU was a positive experience for them. Another early study on the same topic conducted by Alessio et al. (2017) assessed test results of 147 students enrolled in multiple online sections, almost half of whom took online proctored exams (the rest took unproctored exams instead). In this study, those who took the proctored online exams completed the exam in half the time of those who took the same exam unproctored (lockdown only), and they scored significantly lower.

According to Honorlock Inc. (2023), "Students prefer online exams because they're similar to a real-world remote work environment, they trust the results, and they provide flexibility" (para. 4). Likewise, a study from Nicola-Richmond et al. (2024), consisting of 481 students and 13 staff, revealed that taking examinations via online proctoring was generally received as a good experience. Alessio and Maurer (2018) analyzed how grade distributions changed in 29 different classes with different instructors on a university campus before and after video proctoring was introduced. The authors found that the average grade point average scores for the courses drastically decreased after implementing the proctoring software, indicating that the use of unproctored online tests may impair academic integrity.

On the eLearning Industry publishing platform, Norris (2021) asserted that one important aspect of online proctoring often disregarded is the fact

that proctors are impartial observers—and not just out to catch cheaters—which is why students should demand it. We believe that such seemingly inconsistent results and potentially unsupported claims need more exploration, which is what we have undertaken in this study.

Furthermore, the companies that deliver online proctoring sell their products by emphasizing, in part, that proctoring reduces cheating and thus increases the legitimacy of students' course performance. We wanted to determine if that thinking has penetrated students' perceptions of online proctoring. We also wanted to understand whether, as our research has shown in the past, online proctoring interacts with the students' individual characteristics, particularly as they relate to anxiety.

Therefore, we conclude from our extensive literature search that two issues bear looking into. Our previous work showed how student characteristics (primarily anxiety) affect student behaviour under online proctoring. Our research in this study deals with why students might be positive about online proctoring and how that interacts with anxiety. As part of a larger study, we asked two overarching research questions:

- *Do students believe that cheating in online exams undermines the legitimacy of the course?*
- *Do students believe that online proctoring reduces cheating, thereby enhancing the legitimacy of course performance in the eyes of graduate schools or employers?*

Our literature search highlights a dearth of empirical evidence on these two overarching constructs. Beneath all the criticisms of it being unfair, and the hype about wrongful accusations of cheating, we wanted to understand why students might think online proctoring is fair and welcome it in their courses. We approached this by examining relevant correlates obtained from a survey approach.

Research Method

Participants

To address the research questions considered in this study, we examine the survey responses of undergraduate students enrolled in a public land-grant research university in the upper Midwest region of the US. The data used in this study was collected during the fall 2023 semester. All those who participated in this research were enrolled in a 400-student, totally online, introduction to learning course delivered through the Canvas course management system, and they took their exams individually via Proctorio, a webcam-based online proctoring service. The class was based on the Personalized System of Instruction (PSI) (Kulik et al., 1990) plan, in which students read their textbook assisted by a study guide and take a series of three mastery quizzes for each chapter.

During the semester, the students in this study took three short midterm exams (20 multiple-choice questions) and one 65-question final exam

monitored by Proctorio. Before the final, students could take a practice final exam as many times as they liked, to gauge their level of preparation. The data collection took place after students had finished each midterm and the final exam and had seen their scores. Upon completion of each exam, a survey automatically opened for them to complete. Three hundred twenty-one students took all four exams, completed all four surveys, and thus served as the primary study participants.

The total database for this study is drawn from 1,364 surveys completed by students. Each of the four surveys included a consent form, which stated that involvement in the study was entirely voluntary and included a comprehensive explanation of the study's objectives as well as the advantages and disadvantages of participating in the research study. Thus, only data provided from those who consented for their data to be used for research was included for analysis in this study. The surveys were conducted using Qualtrics® Core XMTM, which is an online survey tool with a mobile interface. To promote and guarantee sufficient participation, research participants were given one point after completing each of the first three surveys and an additional three points for completing the fourth and final survey (out of 261.5 total regular points possible).

Measures

For the first three surveys, participants completed an eight-item questionnaire we developed for this study. For the fourth and final survey, in

addition to the eight items on the first three surveys, participants completed an additional 11 questions that we designed to be answered after students had experience with the proctored exams and filling out the surveys, bringing the total items on it to 19. The items assessed four areas of concern that we have gleaned from our research:

- Anxiety/fear about being wrongly accused of cheating
- Worry about whether the technology would work well
- Worry that the test might not be fair
- Anxiety about the proctoring/online surveillance

As in our previous studies and similar to other studies of such issues, we asked students to respond to statements that differed in amount of agreement (1 =Strongly Disagree, 2=Disagree, 3=Neither Agree or Disagree, 4=Agree, 5=Strongly Agree).

Further, for the final survey, in addition to the 19 items we designed, participants also completed the Westside Test Anxiety Scale (Westside), developed by Driscoll (2007) that we have used in our previous research as a measure of trait anxiety. The 10 items that make up the Westside use a five-point rating system from "5=Extremely or Always True" to "1=Not at all or Never True" to evaluate students with anxiety impairment. While six items of the scale measure *performance impairments* related to anxiety, (i.e., poor memory, worry, or lack of attentiveness), the remaining four items measure dread and worry. Thus, according to Driscoll (2007), the scale has high face

validity in that it omits the marginally relevant over-arousal factor, but includes the highly relevant cognitive and impairment factors. Overall, the Westside is regarded as a very relevant and highly reliable and valid measure of test-anxiety impairment. A total of 1,364 completed surveys (survey 1 n=349, survey 2 n=345, survey 3 n=349, and survey 4 n=321) were used in this study.

Results and Discussion

Two statements on only the survey administered with the final examination dealt with the primary issue raised in this paper. Item #17 stated, "Students who cheat on online exams reduce the legitimacy of those courses". Item #18 stated, "Online proctoring reduces cheating and makes my course performance more legitimate to graduate schools or employers." The mean response for the 321 students who completed all four surveys (having finished the final examination and thus the course) for item #17 on the final survey was 3.71 (*sd*=.959), meaning that students tended to agree with the statement. Those students' mean response for item #18 was 3.48 (*sd*=.997), which also indicated agreement. We proceeded under the assumption that these two legitimacy questions were significant factors affecting students' overall perception of online proctoring. Our goal was to get a sense of what factors in the online proctoring situation affected those perceptions and suggested further research approaches.

Based on our past research findings, we thought anxiety might affect student concerns about legitimacy because it is so central to testing situations

and whether tests and proctoring are fair measures of what students have learned. One might also expect that high performing students would be more likely to agree with the legitimacy items because they are doing well under that regimen. To determine whether the agreement with our legitimacy items varied by student trait anxiety and actual course performance, we first calculated students' Westside scores and found the mean to be 32.93 (*sd*=8.87), which is very similar to our previous research, and according to Driscoll (2007), a moderate average level of anxiety. For the analyses of variables related to legitimacy, we also examined the effect of trait anxiety (the Westside score) on each relationship.

First, we computed correlations between agreement on the two legitimacy items and students' scores on the Westside. Then, we computed correlations between the two legitimacy items and three course performance variables (total points on the four course exams, total points on weekly quizzes and assignments, and total course points). None of these eight resulting correlations were statistically different from zero, ranging from -.10 to +.09. The lack of relationships between Westside score and course performance indicators with our two main variables of interest that measure perceived legitimacy suggests student views on the two legitimacy issues were driven by other factors.

Although students' actual course performance was not related to assessments of online proctoring affecting legitimacy, we found that it was

related to agreement with Item #1 "the exam went well for me" on each of the exams (Exam 1: *mean*=2.91, *sd*=1.17; Exam 2: *mean*=3.11, *sd*=1.11; Exam 3: *mean*=3.31, *sd*=1.08; Final Exam: *mean*=3.83, *sd*=.96). On the survey following the final exam, Item #1 correlated with the Westside r=-.151, p<.001 and replicated the findings in our previous research that trait anxiety is negatively related to exam performance. The means on Item #1 increased with each exam, with the largest increase for the final exam. A statistical test of within-subjects contrasts showed a linear increase in mean student exam perceptions of the exams (F=124.15, p<.001). And students actually did perform better as the exams proceeded as shown by a significant linear trend (F=218.84, p<.001) in percentage correct on each exam. Also, the correlation between Item #18 and Item #1 on the final survey was statistically significant (r=.167, p<.01). Taken together, these data indicate that students who completed all four surveys felt they did better (and did so) on exams as the semester progressed. Also, by the last exam, the better they felt they performed, the more they thought online proctoring made their performance more legitimate. The less anxious the students were, the more they said the exams went well, which is consistent with our previous research.

For our concerns in this study, these results indicate that as students felt more positive about their exam performance, they became more concerned about legitimacy. Also, perceiving that the exam went well (Item #1) was related to perceived fairness (Item #5) with r=.409, p<.001. Perceived

fairness and perceived performance together are significant correlates with perceived legitimacy of online proctoring. These results present the question as to why actual exam performance was not related to our legitimacy questions but was related to increased students stating that their exam went well as their scores went up. We believe that students' assessments of the exam were affected by more than their scores. It also depended on whether they thought the exams measured their actual knowledge of the material; in other words, whether they thought the exams were fair.

We therefore looked further to determine whether student responses to the legitimacy items related to whether they agreed that Proctorio is fair to them (Item #5, *mean*=3.70, *sd*=1.04) and whether it made them feel anxious (Item #7, *mean*=3.57, *sd*=1.16; responses to Item #7 correlated +.200, $p < .001$ with the Westside and indicate concordance of our two anxiety measures). The correlation between Item #17 and fairness was r=.230, p<.01 and with anxiety was r=. 094, *n.s.*, once again indicating a lack of a relationship to anxiety, but indicating that students who thought the online proctoring was fair to them thought cheating reduced legitimacy. The correlation between Item #18 and fairness was r=.369, p<.01 and anxiety was r=. 023, *n.s.*, indicating students who thought online proctoring increased legitimacy perceived online proctoring to be fair, and this was unrelated to felt anxiety about the proctoring. Perceived fairness was thus related to the legitimacy items, whereas anxiety played no direct role. Furthermore, the perceived fairness

score increased linearly over the four surveys with the statistical test of within-subjects contrasts showing a linear increase in means (F=32.65, p<.001). This indicates that perceived fairness increased over the semester.

Finally, we examined whether students' perception of online proctoring being fair to them, along with perceiving that their exams were going well, predicted whether they would agree with the statement, "If given the option of taking my exams in the classroom or with online proctoring, I would choose online proctoring" (Item #14, *mean*=3.08, *sd*=1.23; averaging modest agreement). The correlation between this variable and Item #18 (r=.354, p<.001) indicated that perceived fairness led to preference for online proctoring. In this case, the perception of fairness was related to less felt anxiety with the Westside score and perception of fairness being negative (-.204, p< .001). Students who perceived online proctoring as fair were less anxious and indicated preference for online proctoring.

In summary, as shown in Table 1 below, we ended up with six interrelated variables that we believe are important to understanding how students think about online proctoring:

- Whether online proctoring increases legitimacy (Item #18)
- Whether cheating in online exams reduces legitimacy (Item #17)
- Perceived fairness of online proctoring (Item #5)
- Perception that the exam went well (Item #1)
- Whether students would prefer online proctoring (Item #14)
- Course performance (total course points)

Table 1:

Correlations of the Items Considered for Predicting Increases in Legitimacy

#	Variable	1	5	14	17	18	TotPts
1	Considering everything, this exam went well for me (Ex wnt well)	1	-	-	-	-	-
5	The Proctorio exam delivery system is a fair assessment tool for me (PrSys fair)	.409**	1	-	-	-	-
14	If given the option of taking my exams in the classroom or with online proctoring, I would choose online proctoring (Prefer OLex)	.152**	.331**	1	-	-	-
17	Students who cheat in online exams reduce the legitimacy of those courses (Cht – Legit)	.088	.230**	.100	1	-	-
18	Online proctoring reduces cheating and makes my course performance more legitimate to graduate schools or employers (OL+ Legit)	.167**	.369**	.354**	.357**	1	-
TotPts	**Total course points (TotPts)**	**.419****	**.169****	**.017**	**.061**	**.041**	**1**

** p < .01, two-tailed. * p < .05, two-tailed

To get a sense of what leads to student beliefs that online proctoring increases legitimacy, we entered "increases legitimacy" (Item #18) as the dependent variable in a stepwise linear multiple regression with the other five variables as predictors (we did not include our anxiety measures because of their lack of correlation with Items #17 and #18). Table 2 below shows the results from the ANOVA and analysis of variance. The result (R=.521, F=39.42, p<.001) included three significant variables in the following order:

- Perceived fairness (Item #1)

- Cheating reduces legitimacy (Item #17)
- Preference for online proctoring (Item #14)

This suggests that students who perceive online proctoring as fair, believe cheating reduces legitimacy, and prefer online proctoring should also believe online proctoring increases legitimacy.

Table 2:

Results from the Model Summary for Stepwise Multiple Regression of Increases in Legitimacy

Mode: l	Mode: R	Mode: R2	Mode: Adjusted R Square	Change Statistics: F	Change Statistics: Sig.
1	.369[a]	.136	.134	50.387	<.001
2	.463[b]	.215	.210	31.737	<.001
3	.521[c]	.272	.265	24.772	<.001

a. Predictors: (Constant), PrSys fair
b. Predictors: (Constant), PrSys fair, Cht - Legit
c. Predictors: (Constant), PrSys fair, Cht - Legit, Prefer Olex

Furthermore, Table 3 below shows the stepwise multiple regression analysis coefficients and their corresponding statistical significance. From the multiple regression analysis output, we can see the three variables and their beta weights that significantly predict increases in legitimacy.

Table 3:

Stepwise Multiple Regression of Increases in Legitimacy

Model		Unstandardized Coefficients		Standardized Coefficients		
		B	Std. Error	Beta	t	Sig.
1	(Constant)	2.176	.191		11.383	<.001
	PrSys fair	.353	.050	.369	7.098	<.001
2	(Constant)	1.302	.240		5.433	<.001
	PrSys fair	.290	.049	.303	5.937	<.001
	Cht - Legit	.299	.053	.288	5.634	<.001
3	(Constant)	.991	.239		4.139	<.001
	PrSys fair	.211	.050	.221	4.255	<.001
	Cht - Legit	.292	.051	.281	5.709	<.001
	Prefer OLex	.204	.041	.253	4.977	<.001

a. Dependent Variable: (OL+ Legit) Long Description

The results of this study are correlational to be sure, but they are useful in understanding what might be changing with student perceptions about online proctoring and what variables need further examination. Students evince concerns over cheating reducing the legitimacy of their grades in online courses and also have perceptions about online proctoring related to these concerns. Our results indicate that fairness is primary and additionally their concern about cheating and preference for online proctoring.

Conclusion and Recommendations for Future Studies

Before our first empirical research was published in 2017, there was not much evidence to speak of in this area; however, today the research studies in this area are maturing both in terms of substance and reach. Most recently,

the limited research on online proctoring and students' experiences has attracted considerable interest and participation from scholars across the globe, as well as academic interest in online proctoring, a recent phenomenon that is growing rapidly.

In the current research, we set out to study two central areas of concern:

- *Do students believe that cheating in online exams undermines the legitimacy of the course?*
- *Do students believe that online proctoring reduces cheating, thereby enhancing the legitimacy of course performance in the eyes of graduate schools or employers?*

In both areas, the data shows research participants believe online proctored exams reduce cheating and cheating in online exams undermines the legitimacy of their course. Therefore, since the legitimacy of academic work is important to students, educators, and academic institutions, one way of engaging and assuring students and academic institutions of the benefits online exam proctoring offers is to reiterate that students see online proctoring as a safeguard to the legitimacy of online exams and the exam environment itself.

Likewise, though there have been concerns around students being wrongly flagged in online proctored exams, which may have caused some academic institutions to re-evaluate their engagements with online proctoring,

our research continues to show that online proctoring is not only growing, but students are increasingly accepting it. The latter is because it is in students' best interests, given that online proctoring provides both convenience and legitimacy. In short, students are making choices about how examinations are conducted. In our first study (Woldeab et al., 2017), which was conducted during fall 2015 and spring 2016, only 44 out of the 836 who participated in the study took their exams through online proctored service. Today, that proportion is quite different. All of the 321 students who completed all of the four surveys after the exams took all four exams under online proctoring. Also, when presented with the statement, "If given the option of taking my exams in the classroom or with online proctoring, I would choose online proctoring," the majority of study participants said they would prefer to take their exams through online exam proctoring services.

Additionally, we found that trait anxiety continues to be a crucial issue in online proctoring as in our previous three investigations. However, given that our study was conducted at an institution with a developed online proctoring environment, we believe that this speaks more about the students than the circumstances. In the current study, we assessed trait anxiety with the Westside and course performance using students' final exam scores, which resulted in statistically insignificant results in terms of this study's two overarching questions. This reinforces our previous suggestions that future studies around online exam proctoring, test anxiety, and exam performance

should examine whether the monitoring or their trait anxiety is the cause of students' problems with online proctoring.

To put it briefly, there has not been enough research done so far on the connection between the online proctoring environment and student characteristics. For example, as we noted before (Woldeab & Brothen, 2019, 2021), the Personalized System of Instruction (PSI) allows for feedback and a mastery learning process that is designed to increase student learning and their confidence to achieve. This is likely to reduce anxiety. Our results not only suggest this is the case, but that online proctoring is a way to reduce the proctoring anxiety of students with high test anxiety. Therefore, we believe that researchers should place more focus on students' identities and the ways in which their traits interact with the testing and proctoring environment.

Additionally, all research participants completed their exams through Proctorio; therefore, we feel that future research should evaluate the two main areas of concern raised by this study using a diverse sample and proctoring services, especially in light of the crowded online proctoring market and the rapid advancement of artificial intelligence. One of the aspects that is missing from online proctoring and student exam performance is a reliable measure or scale to evaluate students' experience in the online exam proctoring environment. We are considering this for a future study.

References

Abdi, H. M., Bageri, S., Shoghi, S., Goodarzi, S., & Hosseinzadeh, A. (2012, November). The role of metacognitive and self-efficacy beliefs in students' test anxiety and academic achievement. *Australian Journal of Basic and Applied Sciences, 6*(12), 418–422. https://www.ajbasweb.com/old/ajbas/2012/

Alessio, H. M., Malay, N., Maurer, K., Bailer, A. J., & Rubin, B. (2017). Examining the effect of proctoring on online test scores. *Online Learning*, *21*(1), 146–161. https://doi.org/10.24059/olj.v21i1.885

Alessio, H., & Maurer, K. (2018). The impact of video proctoring in online courses. *Journal on Excellence in College Teaching*, *29*(4), 183–192. https://eric.ed.gov/?id=EJ1195526

Alin, P., Arendt, A., & Gurell, S. (2023). Addressing cheating in virtual proctored examinations: Toward a framework of relevant mitigation strategies. *Assessment & Evaluation in Higher Education*, *48*(3), 262–275. https://doi.org/10.1080/02602938.2022.2075317

Buchwald, P. (2010). Test anxiety and performance in the framework of the conservation of resources theory. *Cognition, Brain, Behavior: An Interdisciplinary Journal*, *14*(4), 283–293.

Cassady, J. C., & Gridley, B. E. (2005). The effects of online formative and summative assessment on test anxiety and performance. *The Journal of Technology, Learning and Assessment*, *4*(1). n1.

Chen, H. (2012). The moderating effects of item order arranged by difficulty on the relationship between test anxiety and test performance. *Creative Education*, *3*(03), 328–333. http://dx.doi.org/10.4236/ce.2012.33052

Claybourn, C. (2024, January 23). *How cheating in college hurts students*. U.S. News. https://www.usnews.com/education/best-colleges/articles/how-cheating-in-college-hurts-students

Dendir, S., & Stockton Maxwell, R. (2020). Cheating in online courses: Evidence from online proctoring. *Computers in Human Behavior Reports*, *2*, 100033. https://doi.org/10.1016/j.chbr.2020.100033

Driscoll, R. (2007, March 1). *Westside Test Anxiety Scale validation*. Online Submission. ERIC. https://eric.ed.gov/?id=ED495968

Elman, B. A. (1989, October). Imperial politics and Confucian societies in late imperial China: The Hanlin and Donglin Academies. *Modern China*, *15*(4), 379–418. http://dx.doi.org/10.1177/009770048901500401

Henderson, M., Chung, J., Awdry, R., Mundy, M., Bryant, M., Ashford, C., & Ryan, K. (2023). Factors associated with online examination cheating. *Assessment & Evaluation in Higher Education*, *48*(7), 980–994.

Honorlock Inc. (2023, May 1). *Online proctoring isn't just for online courses*. eCAMPUS NEWS. https://www.ecampusnews.com/teaching-learning/2023/05/01/online-proctoring-isnt-just-for-online-courses/

Jenkins, B. D., Golding, J. M., Le Grand, A. M., Levi, M. M., & Pals, A. M. (2023). When opportunity knocks: College students' cheating amid the COVID-19 pandemic. *Teaching of Psychology*, *50*(4), 407–419. https://psycnet.apa.org/doi/10.1177/00986283211059067

Kentnor, H. E. (2015). Distance education and the evolution of online learning in the United States. *Curriculum and Teaching Dialogue*, *17*(1), 21–34.

Kulik, C., Kulik, J., & Bangert-Drowns, R. (1990). Effectiveness of mastery learning programs: A meta-analysis. *Review of Educational Research*, *60*(2), 265–285. https://doi.org/10.2307/1170612

Mandler, G., & Sarason, S. B. (1952). A study of anxiety and learning. *The Journal of Abnormal and Social Psychology*, *47*(2), 166–173. https://psycnet.apa.org/doi/10.1037/h0062855

McDonald, A. S. (2001). The prevalence and effects of test anxiety in school children. *Educational Psychology*, *21*(1), 89–101. http://dx.doi.org/10.1080/01443410020019867

Milone, A. S., Cortese, A. M., Balestrieri, R. L., & Pittenger, A. L. (2017). The impact of proctored online exams on the educational experience. *Currents in Pharmacy Teaching and Learning*, *9*(1), 108–114. https://doi.org/10.1016/j.cptl.2016.08.037

Musacchio, M. (2022, June 22). *How to balance security and student experience with online proctoring.* PSI Knowledge Hub. https://www.psiexams.com/knowledge-hub/how-to-balance-security-and-student-experience-with-online-proctoring/

Nicola-Richmond, K., Dawson, P., & Partridge, H. (2024). Online proctored exams: Rhetoric vs reality. *Higher Education Research & Development*, *43*(2), 392–405. https://doi.org/10.1080/07294360.2023.2234310

Norris, A. (2021, January 4). *Why students should insist on remote test proctoring. eLearning Industry*. https://elearningindustry.com/why-students-should-insist-on-remote-test-proctoring

Peytcheva-Forsyth, R., & Aleksieva, L. (2021, March). Forced introduction of e-assessment during COVID-19 pandemic: How did the students feel about that? (Sofia University case). In AIP Conference Proceedings (Vol. 2333, No. 1). AIP Publishing. https://doi.org/10.1063/5.0041862

Proctorio. (n.d.) Our platform. https://proctorio.com/

Qualtrics. (n.d.). *Qualtrics AI + the XM platform*. https://www.qualtrics.com/

Rana, R., & Mahmood, N. (2010, December). The relationship between test anxiety and academic achievement. *Bulletin of Education and Research*, *32*(2), 63–74.

Salend, S. J. (2012, March 1). Teaching students not to sweat the test. *Phi Delta Kappan*, *93*(6), 20–25. https://doi.org/10.1177/003172171209300605

Williams, J. B., & First, M. (2013). Diagnostic and statistical manual of mental disorders. *Encyclopedia of Social Work*. https://doi.org/10.1093/acrefore/9780199975839.013.104

Woldeab, D., & Brothen, T. (2019). 21st century assessment: Online proctoring, test anxiety, and student performance. *International Journal of E-Learning & Distance Education, 34*(1), 1–10. http://www.ijede.ca/index.php/jde/article/view/1106/0

Woldeab, D., & Brothen, T. (2021). Video surveillance of online exam proctoring: Exam anxiety and student performance. *International Journal of E-Learning & Distance Education*, *36*(1), 1–26. https://www.ijede.ca/index.php/jde/article/view/1204

Woldeab, D., Lindsay, T., & Brothen, T. (2017). Under the watchful eye of online proctoring. In I. E. Alexander & R. K. Poch (Eds.), *Innovative learning and teaching: Experiments across the disciplines* (pp. 147–160). University of Minnesota Libraries Publishing.

Zeidner, M. (1998). *Test anxiety: The state of the art*. Kluwer Boston.

Long Description

Table 3: Stepwise Multiple Regression of Increases in Legitimacy.

The table presents the results of a stepwise multiple regression analysis where the dependent variable is labeled as "OL+ Legit."

The table is organized into five columns:

- **Model:** Lists the different models (1, 2, 3) used in the regression analysis.
- **Unstandardized Coefficients:** Divided into two subcolumns:
- **B:** Represents the unstandardized coefficients for each predictor variable.
- **Std. Error:** Shows the standard error associated with each unstandardized coefficient.
- **Standardized Coefficients (Beta):** Provides the standardized coefficients, allowing for the comparison of the relative importance of each predictor variable in the model.
- **t:** Displays the t-statistic for each predictor variable, used to test the significance of the coefficients.
- **Sig.:** Indicates the p-value (significance level) for each predictor variable, with a significance threshold typically set at 0.05.

Details by Model:

- Model 1:
  - (Constant): B: 2.176; Std. Error: 0.191; t: 11.383; Sig.: < 0.001;
  - PrSys fair: B: 0.353; Std. Error: 0.050; Beta: 0.369; t: 7.098; Sig.: < 0.001;
- Model 2:
  - (Constant): B: 1.302; Std. Error: 0.240; t: 5.433; Sig.: < 0.001
  - PrSys fair: B: 0.290; Std. Error: 0.049; Beta: 0.303; t: 5.937; Sig.: < 0.001
  - Cht - Legit: B: 0.299; Std. Error: 0.053; Beta: 0.288; t: 5.634; Sig.: < 0.001
- Model 3:
  - (Constant): B: 0.991; Std. Error: 0.239; t: 4.139; Sig.: < 0.001
  - PrSys fair: B: 0.211; Std. Error: 0.050; Beta: 0.221; t: 4.255; Sig.: < 0.001
  - Cht - Legit: B: 0.292; Std. Error: 0.051; Beta: 0.281; t: 5.709; Sig.: < 0.001
  - Prefer OLex: B: 0.204; Std. Error: 0.041; Beta: 0.253; t: 4.977; Sig.: < 0.001

Notes:

- The dependent variable for the regression analysis is "OL+ Legit."
- Each model adds additional predictor variables, demonstrating their contribution to the regression model.
- The significance levels for all predictor variables across all models are below 0.001, indicating a high level of statistical significance.

Back to Table 3

Authors

Daniel Woldeab is an Associate Professor in the College of Individualized Studies at Metropolitan State University. He holds a bachelor's degree in computer information systems, a master's degree in education, and a doctoral degree in Work and Human Resource Education (adult education). His research interests include online education, adult literacy and adult education, technology and pedagogy, technology and culture, cultural competency, acculturation, acculturative stress and anxiety, and online exam proctoring. E-mail: *daniel.woldeab@metrostate.und.edu*

Thomas Brothen is a Morse-Alumni Distinguished Teaching Professor in the Department of Psychology at the University of Minnesota-TC and holds bachelor and PhD degrees in psychology. His primary research has involved developing and examining online course management systems, and other technology, to improve post-secondary student learning; the teaching of psychology and how technology can be utilized to improve it; and the use of psychological theory to guide large-scale educational interventions. Email: *broth001@umn.edu*