An Integrated Approach to Preempt Cheating on Asynchronous, Objective, Online Assessments in Graduate Business Classes

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Abstract

Cheating, left untended, erodes the validity of evaluation and, ultimately, corrupts the legitimacy of a course. We profile an approach to manage, with an eye toward preempting, cheating on asynchronous, objective, online quizzes. This approach taps various technological and social solutions to academic dishonesty, integrating them into a technology-centered, socially-sensitive pedagogy. The resulting design engages a battery of technology tools, within a social context moderated by the testing effect, to minimize the practicality, productivity, and hence, students' propensity to cheat. Operationally, we used the Canvas LMS to generate a differentiated series of objective quizzes from question banks holding several hundred potential items. We assess cross-sectional data from 178 MBA students spanning eight online-only classes. The results support the effectiveness of an integrated blend of technology tools and social methods to encourage students' consciousness of the resulting uselessness of cheating. We review the implications of the results to test anxiety, student engagement, learning effectiveness, and workflow efficiency.

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Introduction

Whether the context is online or in-class, few dispute the persistence and prevalence of academic dishonesty (Spaulding, 2009; Stogner, Miller, & Marcum, 2012; Bing, Davison, Vitell, Ammeter, Garner, & Novicevic, 2011; Beck, 2014; Simha, 2014). Reports suggest that efforts to curtail cheating; increasingly fall short. Cheating, besides a "crisis on campus" (Burke, Polimeni, & Slavin, 2007, p. 55) and the "most commonly reported challenge in online assessment" (Hollister & Berenson, 2009, p. 272), is "reaching virtually pandemic proportions" (Bing et al., 2011, p. 28). The expanding scale and scope of online education complicates circumstances. Forecasts have predicted that roughly half of all college classes will be e-learning-based by 2019, with that figure steadily on its way to 75% (Allen & Seaman, 2014). Safeguarding academic honesty, along with tangential implications to student engagement, performance anxieties, learning effectiveness, and workflow efficiency, fan escalating concern (McCabe, Butterfield, & Trevino, 2006; Stogner et al., 2013; Fask, Englander, & Wang, 2014).

Dealing with academic dishonesty, in the form of cheating on asynchronous, objective, online assessments, is the focus of this paper. Minimizing, if not ideally, preempting, students' propensity to cheat makes online objective evaluation a sound, if not arguably superior, alternative to conventional in-class assessments. Left untended, however, its corrosive influence on students' perceptions of equity and legitimacy diminishes the integrity of the evaluation. Ultimately, the effectiveness of the learning experience fades (McCabe et al., 2006).

Managing the "Pandemic"

Preventing cheating on asynchronous, objective, online assessments elicits a range of remedies. Some advocate fighting fire with fire, reasoning that technological countermeasures deter technological opportunism. Recommendations include low-technology methods, such as using timestamps on exam submissions, requiring passwords to activate evaluations, regulating browser parameters, staggering the release of a quiz, or proctoring exams within a regulated testing environment (Brown, Bull, & Race, 2013; Schwartz & Webb, 2014). Some point to higher-technology options, notably video capturing a 360° view around the online test-taker, monitoring off-site assessments via microphone systems, or engaging biometrics, such as fingerprint scans, optic–retinal tests, facial recognition, and keystroke pattern analysis (Harmon, Lambrinos, & Buffolino, 2010; Howell, Sorensen, & Tippets, 2009).

Others advise sidestepping technology, advocating social methods that tap the power of symbolism to manage students' propensity to cheat. Social approaches target antecedents and correlates of cheating. Promoting ethical consciousness with a dash of benevolent big-brother oversight should diminish students' propensity toward academic dishonesty. LoSchiavo and Shatz (2011) and McGee (2013) reported that amplifying "teacher presence" through systematic announcements, frequent feedback, and engaged interactions personalizes the otherwise anonymous, typically superficial teacher-student relationship and foster social deterrents. Similarly, some recommend nurturing academic integrity and promoting ethical awareness through pre-class surveys, scenario profiles, and orientation readings. Bing et al. (2011), for example, found that explicitly presenting an institution's honor code, fortified with ongoing reminders and candid warnings over the semester, lowered cheating in a face-to-face class.

Potent Approaches, but not Panaceas

Technology tools and social methods provide powerful approaches. Still, regulating online tests challenge each approach. Students' physical separation creates tremendous potential for illicit search or collusion; checking these temptations are tough. Technology tools quickly hit hard boundaries (Cluskey, Elhen, & Raiborn, 2011; Kolowich, 2013). For example, requiring students to complete an exam while monitored via remote webcam, besides demanding the proctor recognize each student, imposes extreme time demands. Oft-unreliable photo directories, to say nothing of the scale of observation in large

sections, enact inordinate burdens. Fundamentally, monitoring sections with many students annuls the asynchronous merits of online evaluation. Operationally, asynchronous testing, by opening exams for extended periods, escalates the difficulty and expense of direct oversight. Similarly, technology controls impose additional expenses upon cost-conscious students and institutions. Lastly, engaging increasingly invasive surveillance technologies to monitor student activity provokes thorny philosophical issues (Hope, 2009).

Social methods face limits as well. The quest to inspire ethical consciousness imposes time-intensive obligations. An instructor regularly engages online students, individually and collectively, through impersonal means. This task is challenging, particularly in the face of increasing class sizes. Furthermore, successfully championing a code of ethics calls for personalizing student-teacher relationships in order to develop the requisite context of trust, obligation, duty, and honor (McCabe et al., 2006; Bing et al., 2011). Granted, genuine concern for students' engagement is a noble quest. Gallant intentions often are constrained by many factors: frequent, multiple, large classes; evolving social norms; objections to what some may regard as self-righteous moralizing; even the intrinsic impersonality and benign anonymity that commonly marks online education (Crews & Butterfield, 2014).

The Call for an Integrated Approach

The persistence and prevalence of cheating, confirm the limits that confound the effectiveness of technology tools and social methods (McCabe et al., 2006; Beck, 2014). Arguably, the scale and scope of academic dishonesty call for grudgingly accepting its inevitability. Rather than acceptance, we advocate mapping an integrate approach that reduce the practicality of cheating as well as students' propensity to cheat. This research profiles maps a systematic, technology-based, socially-directed pedagogy to do so.

We begin by assuming that technology is necessary to successfully reduce cheating. However, the persistence and prevalence of cheating indicate that technology tools are ultimately ineffective. Just as hackers incrementally outwit security safeguards in a never-ending drama of cat and mouse, students also devise methods to circumvent the latest, greatest technology tools (Gabriel, 2010). This challenge endorses engaging social methods that confront students' perception of the productivity and practicality of cheating. Blending technology tools and social methods should spur students' realization that it's far more productive to complete a quiz independently than it would be to cheat.

Mapping an Integrated Approach

The study of cheating on online evaluations, while it draws increasing attention, lags in practice. Therefore, this research, while anchored in several literatures, is largely exploratory. Nonetheless, as depicted in Figure 1, various ideas organize our model—notably, (1) our view of the design and delivery of online assessments and (2) the option for multiple quiz attempts in order to tap the testing effect as well as mediate test anxiety. We profile each idea in sequence.

A panorama of design and delivery methods.

An instructor may engage one to a few methods to fine-tune test design and regulate how, when, where a student engages an online assessment. Popular choices include open notes/book flexibility, question/response sequence, password management, timestamp analysis, time regulation, question format, and time sequencing. We segment these tools (Figure 1) in terms of the role they play in designing or delivering an online quiz. Regarding the former, an instructor's choice on matters of scope, scale, frequency, or format of the quiz, for example, can ease or complicate cheating. Likewise, regarding delivery, an instructor can tap a repertoire of tools, such as randomizing questions, regulating the duration of a test. The instructor also can customize exams for groups, if not individuals, to diminish the ease of cheating.

Figure 1: Research Model
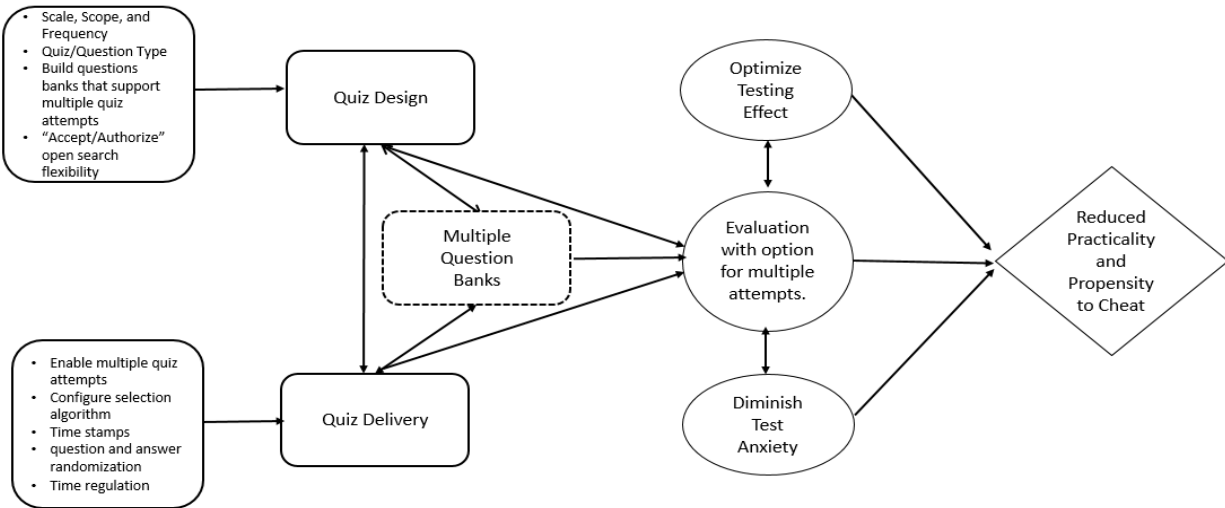
Based on student interviews, conversations with host University's Center for Teaching and Assessment of Learning, and various literature, we reasoned that leveraging technology to reduce the productivity and practicality of cheating on online objective evaluations has a clear mandate: radically decrease the probability that classmates taking an online quiz serially or sequentially have the same test with the same questions, in the same sequence, and at the same time. Extending this solution beyond a single course calls for reducing the usefulness of copying, sharing, or archiving questions. Effectively, one must make the search for a question, whether in hard copy format or in online archive, an inordinately difficult and inevitably unproductive task. Table 1 profiles the methods used in this study to do so.

Tapping the testing effect to mediate test anxiety.

While technology-centric, we do not endorse technological determinism. Reports of cheating's pervasiveness made us skeptical of relying solely on technology-centric tools. We looked to complementary social methods to mediate catalysts of cheating. Notably, asynchronous online assessments administered via an LMS can tap various methods, such as quiz retakes, that engage the testing effect.

Saranson (1959, p. 26) long ago observed that "we live in a test conscious, giving culture in which the lives of people are part determined by test performance." Since then, the causes and consequences of test anxiety have risen in tandem with the escalating impact of high-stakes testing (Zeidner, 1998; Brown et al., 2014). Research on the motivators of academic dishonesty emphasizes the stress that a student experiences before and during an evaluation. Students suffering anxiety tend to become distracted during testing, typically struggling to recall relevant information. Poor performance often follows, not because of cognitive limits or under-preparation, but because of the tension of evaluation. Coping with test anxiety, reinforced with memories of earlier consequences, encourages academic dishonesty (Stowell & Bennett, 2010; Fask et al., 2014). Deterring students' propensity to cheat ultimately calls for engaging evaluation methods that reduce a key catalyst of cheating, namely test anxiety.

Table 1
Methods Used within the LMS to Manage Students' Perception of and Potential for Cheating

Method	Application
Question/Answer Randomization	The LMS algorithm shuffled all questions and all answers.
Continuous Question Development	The LMS test generation algorithm selected questions from multiple test banks that contain anywhere between 30 to 50 questions; a full set of test banks for particular chapter would include 300 to 500 questions. Questions are continually added to the test banks.
Exam Versions	Generate multiple versions of an exam; in theory, the LMS algorithm has potential to generate unique exam for each student for each iteration.
Multiple Quiz Attempts	Students have the option to take a quiz multiple times. Each quiz has different questions on the assigned material. The LMS system records the highest score, irrespective of its position in the sequence.
Open Notes/ Book Flexibility	Students have unqualified access to all materials; the use of an e-text directly enables powerful search capabilities.
Question Format	Use a variety of questions, including true/false, multiple-choice, multiple answers, fill in the blanks, fill in multiple blanks, matching, and multiple drop-down.
Question Sequence	Present individual question items in a full set; students could navigate through quiz as they prefer. No two students receive the same set of questions in the same sequence.
Question Types	Questions reflect Blooms typology; questions contained in the critical concept checks tested remembering, understanding, and applying. Questions on the critical thinking scenarios tested the dimensions of analyzing, evaluating, and creating.
Quiz Frequency	Offer shorter quizzes more frequently. Completion of a chapter corresponds to the assignment of two exams; first exam tests their mastery of the critical concepts and content; the second exam contains critical thinking scenarios to test their ability to apply the material to a novel situation.
Time Stamps	Cross-check start and submission time of exams as well as source IP address among students. The LMS records the time the student began and completed the examination. Rank-ordering timestamps identifies students who tended to take the examination concurrently or consecutively.

Preempting test anxiety strains the bounds of popular policing methods; indeed, some methods such as surveillance and biometric technologies likely aggravate it. We reasoned that mediating the behavioral catalysts and correlates of test anxiety calls for social methods that moderate students' perceptions of the necessity of cheating (Williams, Nathanson, & Paulhus, 2010; Bratton & Strittmatter, 2013; Sapp, 2013). Admittedly, the ease, accessibility, and flexibility of online learning through increasingly robust technology platforms calls for, as well as encourages, a rethinking of online evaluation models. While creating opportunities, these online learning features also open unprecedented paths to cheating (Simha, 2014; Gabriel, 2010). For this reason, we manipulated several technology tools to engage social dynamics that diminish test anxiety and, thereby, diminish the propensity for cheating.

Our manipulations followed reports in the "testing effect" literature regarding the design and delivery of a quiz (Roediger, Putnam, & Smith, 2011; Brown, Roedinger, & McDaniel, 2014). The testing effect maintains that students acquire and retain knowledge more effectively by being tested on material versus additional drills or repeating lessons. Moreover, the testing effect shows that taking and retaking a test enables a student to better estimate his level of mastery as well as identify deficiencies. Engaging the testing effect often spurs reduces the performance anxiety that often spur cheating. (Roediger et al., 2011; McDaniel, Anderson, Derbish, & Morissette, 2007).

In this study, we operationalized the testing effect via an expanded test-retake option. Students had the option to take a quiz multiple times. Once was sufficient, but students could retake a quiz up to five times in an effort to maximize their performance. Importantly, each quiz iteration presented the student with a set of different questions. Operationally, we configured the LMS selection algorithm to tap questions from various question banks and generate a different set for each quiz attempt. Lastly, we applied a final tweak to further diminish test anxiety, and the LMS recorded the highest quiz grade, irrespective of its slot in the sequence.

Research Questions

This study anchors its analytics and explanation in terms of evidence-based procedures administered to MBA students enrolled in online-only classes. This design allows us to assess students' views of the practicality of cheating in the face of an online assessment procedure intended to diminish it. Similarly, we assessed the moderating influence of technology and social methods that aim to mediate test anxiety and leverage the testing effect. We expected them to reduce the propensity to cheat as well as promote an effective learning experience.

Methods

Sample

The study assessed the outlooks of 178 MBA students. Data was collected from eight sections of a graduate level course in international business at a public university in the northeast United States. Sections ran between June 2014 and April 2014. All activities, assignments and assessments were delivered exclusively online.

Performance Data

Each student completed two types of quizzes per assigned chapter. One type, "Core Concepts Check," tested their mastery of content reported in the corresponding text, readings, or activities. The other type, "Critical Thinking Scenarios," tested their ability to apply their understanding of these materials to interpret hypothetical scenarios. In terms of Bloom's Taxonomy, the questions comprising a Core Concepts Check (CCC) quiz assessed a student in terms of "remembering, understanding, and analyzing", whereas a Critical Thinking Scenario (CTS) quiz assessed a student in terms of "applying, evaluating, and creating" (Bloom, Engelhart, Furst, Hill, & Krathwohl, 1956). All CCC quizzes were objective evaluations that used content-based, topically-themed, multiple-choice questions; occasionally, students saw a matching question. All CTS quizzes were objective evaluations that used content-linked, topically-themed, multiple-choice questions based on scenario specified in the question. All questions on the CCC and CTS included an item-specific narrative explanation. The LMS delivered all questions on a quiz in a full set; students could navigate between questions. A quiz determined 5% of the final grade.

Student Perceptions.

At the start and end of a course, students completed a series of online surveys regarding their initial expectations of and then experiences with the design and delivery of the class, quiz procedures, and test anxiety; completion contributed to 1% of the final grade. We developed questions based on relevant

literatures as well as advice offered by the staff of the host University's Center for Teaching and Assessment of Learning; questions used a 5-point Likert-scale bounded by Strongly Agree and Strongly Disagree. We conducted follow-up interviews and discussion with students, both formally and informally, throughout the study.

Quiz Bank Design and Delivery

We operationalized the testing effect via the instrumentality of the test-retake option. Students had the option to take a quiz multiple times; once was sufficient, but they could choose to retake up to five times. We configured Canvas's quiz algorithm to tap questions from various questions banks to generate a different set for each quiz attempt—hence, and quite critically, each quiz iteration presented a different set of questions to a student. This requirement spurred developing several thousand questions. These items were organized into a series of question banks that corresponded to the course flow. For example, items testing the core concepts of Chapter 1 were organized into eight separate banks. We included narrative feedback in each questions. Over time, we developed additional questions, response sets, and item explanations.

We configured the Canvas LMS to (1) regulate the scale, scope, duration, and window of a quiz, (2) auto-generate a unique quiz per student based on questions selected randomly from a bank of relevant questions, (3) shuffle responses per question, (4) administer the take-retake procedure, (5) report immediate feedback to the student that identified and explained correct answers, and (6) record a student's highest quiz grade as the final score irrespective of its slot in the quiz sequence. Applying the selection algorithm to the scale and scope of the question banks generated a seemingly infinite variety of online assessments.

Results

Response rates to the online survey averaged 98% across all sections (high of 100%, low of 95%). On average, each class provided 12 to 18% of the survey data. Table 2 reports the full results with regard to the students' view of cheating. Nearly 91% of the respondents agreed that the option to retake a quiz reduced the utility of collusion while 83% found the option to retake a quiz persuaded them that it was "easier to do my best on my own rather than making the effort to cheat on a quiz." Regarding practicality, 84% of the respondents concluded that it would be difficult to share quiz questions with classmates. Some 57% of the students disagreed with the statement that "it would've been easy to find a way to cheat on the quizzes administered through Canvas;" 22% were neutral, and 21% agreed. Regarding the usefulness of searching online archives, 94% of respondents reported it would be difficult to locate quiz questions that way. Finally, only 3% of the sample believed that people worked together on the online quizzes.

Table 3 reports the students' view on the implications of the quiz design and delivery to aspects of test anxiety, testing effect, and learning engagement. Students consistently attribute benefits to the test-retest option, endorsing fundamental aspects of the testing effect (Brown, et al., 2014). Explanatory feedback, improved understanding, knowledge gap identification and better familiarity via practice, each an element of the testing effect, found extensive agreement among the sample. Likewise, students suggest the option to retake a quiz helped minimize a common cause of cheating:94% of respondents reported that the test-retest option reduced test anxiety and, correspondingly, 95% found online quizzes less stressful than those in a classroom.

Table 2

Implication of the Integrated Design to the Practicality, Productivity, And Propensity of Cheating, (N = 178)

	Percent Per Category					Mean, SD
	Strongly Disagree	**Disagree**	**Neutral**	**Agree**	**Strongly Agree**	
Given the fact that I could retake a quiz, it seems to me that it would not be worth bothering to work with a classmate to cheat in completing a quiz.	0	2.3	6.6	32	58.7	4.50, .73
The fact that I could retake a quiz to earn a higher score made it easier for me to do my best on my own rather than making the effort to cheat on a quiz.	2.3	6.6	8.1	29.3	53.7	4.25, 1.05
Given my experience in taking the online quizzes, I think it would be difficult to share the quiz questions with my classmates	1.9	5.8	8.5	45.2	38.6	4.09, .95
If I had wanted, it would've been easy to find a way to cheat on the quizzes that I took on Canvas.	15.4	40.9	22	13.5	8.1	2.50, 1.16
If I had wanted, it would have been pretty easy for me to find copies of questions that were on the online quizzes.	52.9	41.3	3.9	1.9	0	1.83, .71
Based on what I heard from classmates, I believe that people worked together on the online quizzes.	53.7	39	4.6	2.7	0	1.65, .75

Some 96% of the respondents believed that an integrated approach made the class a more effective learning experience. In addition, 81% indicated that the additional time spent studying between quiz attempts improved their understanding of the material. Finally, 73% indicated they worked harder than they otherwise would have.

Table 3

Implication of Quiz Design to Testing Effecting, Test Anxiety and Learning Engagement, (N= 178)

		Percent Per Category					Mean; SD
		Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree	
Testing Effect	Retaking quizzes led me to develop a stronger understanding of class materials.	0	0	5.4	36.7	57.5	4.51, .60
	The feedback included in a test question, by explaining why an answer was correct or incorrect, improved my understanding of the material.	0	1.9	9.3	32.8	56	4.48, .75
	My improved understanding of the material, given feedback on my previous attempt, helped me get a higher score on my next attempt.	0	0	7.3	47.1	45.2	4.41, .66
	Taking a quiz helped me identify gaps in my understanding of the material.	0	0	6.7	46.4	46.9	4.39, 1.83
	I did better when I retook a quiz due to the benefits of more practice with the quiz materials.	0	0	10.4	38.3	51.4	4.36, .73
	I did better when I retook a quiz because the additional time I spent studying improved my understanding of the material.	1.2	6.3	20.8	40.5	31.3	4.09, .91
Test Anxiety	The option to retake a quiz reduced my test anxiety.	0	1.9	4.2	25.9	68	4.51, .74
	I found that taking a quiz online, when and where I want, was less stressful than taking a quiz in a classroom.	0.8	0.4	4.2	31.3	63.3	4.49, 1.13
	I did better when I retook a quiz due to better familiarity with the way the quiz was set-up.	0	0	5.4	41.1	53.5	4.36, .66
	My improving familiarity with the quiz, after my first attempt, made me worry less about taking it again.	0	0	0.8	39.1	52.2	3.93, .79
Continued next page.							

Learning Engagement	The option to retake quizzes made this class a more effective learning experience for me.	0	0	3.9	35.7	60.5	4.57, .58
	Counting the time before and between attempts, the option to retake a quiz to earn a higher score led me to spend more time studying.	0	5	13.1	42.5	39.4	4.12, .87
	The option to retake quizzes motivated me to work harder than I would otherwise have done if I had been allowed to take a quiz only once.	0	10.8	16.2	32.4	40.2	4.03, 1.01

Follow-up interviews and focus group discussions corroborated these findings. Furthermore, student comments independently posted to the instructor's corresponding www.ratemyprofessor.com page speak to several effects. For example, one student noted that "*This is the type of class that every person should be taking in college. I think that I learned more in this class than any other class I've taken (I'm a senior). I get a lot of anxiety taking tests so this class is PERFECT when it comes to tests. You get many chances to retake them and you actually really learn from it.*" Similarly, regarding the role of item feedback, students regularly, highlighted its usefulness; one noted "*built in feedback for online quizzes was terrific.*" Lastly, students routinely explained that that the challenge of cheating exceeded its benefits given the complications posed by the quiz design and delivery standards. Some added that that improving self-confidence, following improving quiz performance, diminished the "need" to cheat.

Discussion

Our findings indicated that implementing the model represented in Figure 1 encouraged the perception that cheating was impractical, promoted an effective evaluation process, and implemented an administratively efficient pedagogy. In sequence, we address each point.

Making Cheating Impractical

Asynchronous, online testing creates immense potential for cheating to occur. Our findings confirm that technology tools, such as randomizing questions, shuffling response sets, and monitoring timestamps reduce expectations that cheating pays-off. Our findings also identified means to fortify the effectiveness of these tools. Surveys, interviews, and class experience suggested that decreasing the practicality of cheating requires reducing the odds that classmates, taking the quiz serially or sequentially, have the same test with the same questions in the same sequence at the same time. Furthermore, one must also disrupt disrupting the efficiency of copying or sharing questions by making the search process difficult and, ideally, futile. The delivery of a seemingly infinite variety of quizzes from wide, deep question banks, made cheating impractical.

Promoting an Effective Learning Experience

Our findings indicated that opportunities for multiple quiz attempts promoted an effective evaluation process. Students' views, as evidenced by their quiz behavior, endorsed the thesis of the "testing effect," whereby repeated testing benefits the test-taker by improving the acquisition, classification, and retention of course content (Roediger & Butler, 2011; Carey, 2014; Dirkx, Kester, & Kirschner, 2014; Brown et al., 2014). This literature suggests that some types of tests, particularly multiple-choice formats, help students who answer incorrectly by priming their brains for subsequent assessments. Specifically, each quiz attempt modifies how one interprets, classifies, and store the

information contained in the questions; 92% of the students agreed that retaking quizzes developed a stronger understanding. Student views coupled with quiz behaviors highlighted a key benefit of the testing effect: test-retest opportunities, supported by "test-potentiated learning" (Brown et al., 2014), mediated tensions between performance pressures and the perceived necessity to cheat. Or, put more eloquently, "each attempt drives home the information in a way that studying as usual does not. We fail, but we fail forward" (Carey, 2014, p. 1).

Within the context of failing forward, the opportunity for quiz retakes gives a student the responsibility for her own learning and succeeding. Self-regulated learning, besides reducing cheating, improves personal esteem, academic performance, self-efficacy, and career potential (Bjork, Dunlosky, & Kornell, 2013; Brown et al., 2014). Furthermore, socializing ethical consciousness through academic experience may ultimately transfer to one's profession (McCabe et al., 2006; Bing et al., 2011). This is a salient concern in business education given that 87% of undergraduate business students from one study alone admitted to cheating on exams (Williams et al., 2010).

The quiz questions tested topically related materials. This design has a potential limitation. Laboratory and field studies reported weak support of the test effect when quizzes, based on authentic text materials, emphasized topically related information. Effectively, these sorts of evaluations become "kill and drill" tasks that produce "inert knowledge" of limited transferability (Roediger et al., 2011). Topically related question that include narrative feedback, however, support the testing effect (Mayer et al., 2009; Brown et al., 2014; McDaniel et al., 2007; Wooldridge, Bugg, McDaniel, & Liu, 2014). As such, the questions used in this research included feedback drawn from the text or related materials. Operationally, when a student completed a quiz, Canvas provided immediate results and provided at least an explanations for correct responses. In many cases, it also reported critical evaluation of the incorrect responses.

An Administratively Efficient Pedagogy

For instructors, the usefulness of a pedagogy—independent of the scale or scope of a class—hinges on its capacity to streamline class administration and improve the effectiveness of the learning experience without sacrificing the quality of the assessment. The data indicated that students saw a course organized by the approach reported in this paper as a productive activity. Some , 96% of the respondents saw the option to retake quizzes making the class a more effective learning experience. This view, amplified in student interviews, indicated the integrated model was administratively efficient without sacrificing academic effectiveness.

Configuring a blend of technology tools and social methods through the Canvas LMS had several benefits. It enabled an administratively-efficient, scale-insensitive solution to design and deliver quizzes; the increasing sophistication of LMSs bodes well. Granted, implementing the test-retest option requires a steep initial developmental effort. But, as question banks expand, the requisite development effort slows. Meanwhile, the Canvas LMS grows increasing robust, streamlining existing procedures as well as expanding features, notably item analysis, quiz delivery, and student tracking.

Conclusion

This study contributes to the growing literature on the causes, correlates, and moderators of cheating on asynchronous, objective, online assessments. Our integrated design endorses an integrated pedagogy that efficiently blends technology tools and social methods commonly found in LMSs. The technology tools used in this study, particularly the scale and scope of quiz questions, imposed inordinate logistical difficulties to cheating. Manipulating social dynamics within the context of the LMS—namely,

engaging the testing effect via the test-retest option--mediated test anxiety, thereby diminishing students' propensity to cheat. Extensive student interviews and surveys confirmed this tendency.

Our results suggested that mobility barriers imposed by technology tools along with the incentives generated via social methods, all administered through the Canvas LMS, persuaded students that it was "easier" to complete a quiz independently than it was to cheat. More importantly, our findings suggested that, the test-retest option, by discouraging cheating, promoted a deeper understanding of the material that improved the student's learning experience. Brown et al. (2014) pointed to this as a key instrumentality of the testing effect, noting that it reduces test anxiety, promotes active learning, and encourages conscientiousness. Our findings suggested these outcomes motivated students to complete work honestly.

Ongoing study of cheating in class or online sadly elaborates the scale and scope of academic dishonesty. Lamenting moral failure, assessing yet another potential antecedent, or debating the propensity to cheat given latent orientations distract us from the fact that academic dishonesty is an enduring concern (McCabe et al., 2001; Brown & McInerney 2008; Fask et al., 2014). The persistence, prevalence, and propensity of academic dishonesty, if unchecked, challenges the integrity of online education. Our results profile an administratively efficient, scale-insensitive, inexpensive pedagogy that deterred academic dishonesty as well as boosted student engagement and learning effectiveness.

Lastly, we acknowledge that students' reluctance to confess to cheating suggests self-reports often underestimate academic dishonesty (Peer, Acquisti, & Shalvi, 2014; Simha, 2014). These likely influenced student responses to our survey questions. We maintain that related controls downplay this threat. The fact that students, on average, used 4 of their 5 quiz attempts supports a fit between self-reports and actual behavior.

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