Proof that a simple positive approach can reduce student cheating

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ABSTRACT

This research utilizes a unique, validated, multiple-choice exam design that allows researchers to observe and measure the degree to which students copy answers from their peers. Using data collected from the exam, this study investigates whether asking students to sign an honor code at the start of the exam reduced instances of cheating relative to a control group. Empirical results demonstrate that the classroom of students who signed the honor code had less overall copying of answers and also fewer individual students who engaged in cheating. This study contributes to the literature by conducting analysis on a sample that measures actual cheating frequency, as opposed to relying on reported cheating in surveys, and by demonstrating that a positive intervention can effectively discourage unethical behavior.

Keywords: academic dishonesty, observed cheating, exams, honor code, higher education

INTRODUCTION

Academic dishonesty, especially on exams which often determine the major portion of a student's grade, is a significant concern for higher education. When, through cheating, an individual earns a grade that represents another student's achievement and not their own, employers and graduate schools who use this data to make major, often expensive, decisions are duped. If the misrepresentation of academic ability is repeatedly detected through inadequate preparation or underperformance, faith in the academic institution's ability to provide accurate information erodes. Consequently, interest in the school's graduates diminishes and the individuals who end up being hurt the most from academic dishonesty are honest students. Therefore, schools must find efficient and effective ways to dissuade cheating on exams to not only preserve their reputation but, perhaps more importantly, to protect honest students from being punished by the actions of the dishonest.

Unfortunately, the education literature indicates that student cheating on exams is much too common. According to the Josephson Institute (2012), nearly 52 percent of the over 23,000 high school students surveyed admitted that they had cheated on one or more exams in the prior year, and more than 76 percent admitted to having copied another student's homework. The International Center for Academic Integrity (2020) lists that of the over 71,000 undergraduate students surveyed between 2002 and 2015, 39 percent admitted to cheating on exams and 62 percent acknowledged that they cheated on written assignments. And, in a study that surveyed over 5,000 nonbusiness and business graduate students at 32 different schools in the U.S. and Canada, McCabe et al. (2006) report that 18% of nonbusiness graduate students and 23% of graduate business students admitted to having engaged in one or more incidents of cheating on exams in their graduate programs.

In many colleges and universities, faculty stand as the main line of defense in the battle against student cheating. That is, teachers are the designated cheating police, and similar to criminal police officers, teachers can take a punitive, preventative, or positive approach to the problem. For the punitive approach, students are warned that if they are caught engaging in an academically dishonest activity, they will be punished. At many schools, cheating on an exam can carry penalties as severe as automatic failure of the class or expulsion from the institution. Though such severe punishments can be effective, the literature suggests that they are seldom used by teachers (Chesney, 2009). One possible explanation for hesitancy to enforce the punitive approach is that the higher education teaching profession is based on encouraging positive outcomes (i.e., learning) as opposed to disciplining negative behaviors. That is, college teachers, by nature, tend to make poor corrections officers.

The preventative approach involves making cheating (i.e., perpetrating a crime) more difficult to commit. Common preventative cheating techniques include diligent proctoring, using multiple versions of a test, and randomly assigning where students must sit in the exam room (Fendler et al., 2018). Although these methods are less severe than direct punishment, they still require teachers to engage in activities that mitigate a negative action instead of teaching a positive behavior. As such, these processes also run counter to the fundamental purpose of teaching (i.e., learning).

The positive approach involves teaching students to refrain from cheating because not cheating is the right thing to do. This approach calls on students to adhere to an ethical standard based on integrity, honesty, and trustworthiness. In most schools, the honor code is this standard. Honor codes clearly explain what practices are allowed and what are not allowed. Often honor

codes address student behavior both inside and outside of the classroom to promote ethical behavior and foster responsible social behavior not only while in school, but also beyond.

Although the honor code approach better aligns with the philosophy of education, there are obvious questions about its efficacy. On the one hand, it seems overly optimistic to assume that merely reminding a student that cheating violates the school's honor code can possibly stop the degrees of cheating discussed above. On the other hand, research indicates that students are less likely to copy or to allow another to copy from them during an exam if they are reminded of the honor code prior to taking the exam (McCabe & Trevino, 1993; Bing et al., 2012; Shu et al., 2011). However, nearly all this research, and in fact most of what academics know about student cheating, comes from student surveys, and there is reason to believe that student surveys about cheating may not be completely dependable. In these surveys, dishonest people (i.e., cheaters) are asked to truthfully admit if they engaged in dishonest behavior or if being reminded of the importance of integrity would prevent them from acting unethically. Obviously, for any discussion of the effectiveness of something as simple as being reminded of the school's honor code to be meaningful, real differences in behavior must be observed.

The purpose of this study is to determine, through observation (not surveys), whether students who are asked to sign the school's honor code prior to taking an exam are less likely to cheat than students who take the same exam but are not asked to sign the honor code. Specifically, over 200 students who took an introductory corporate finance class taught by the same instructor took the same final exam in two different, proctored classrooms. Approximately the same number of students took the exam in each room. In one of the classrooms, students were asked to sign the school's honor code on the first page of the exam. In the second classroom, this page was omitted. Then, using the cheating observation technique described in Fendler and Godbey (2016), the amount of actual, observed cheating was examined in both rooms. To the degree that a difference is observed in these two groups, the results reported in this paper have important implications for teachers, as well as administrators, who are interested in finding an efficient, positive way to stem the tide of student cheating on exams to preserve the integrity of the university as well as protect honest students.

LITERATURE REVIEW

The history of academic dishonesty, especially cheating on exams, is longstanding. There are many different, indeed some highly creative, ways that students cheat on exams, and technology has generally contributed to the cheating pandemic. Academic duplicity begins at an early age and seems to peak in high school, but it continues through college, graduate school and even beyond. Teachers use a variety of different techniques to limit cheating, but the literature is unclear on the actual impact of these efforts. Nonetheless, the cheating epidemic must be addressed and efficient and effective ways to mitigate this behavior must be properly verified.

Longstanding History of Cheating

Cheating on exams is not new. Suen and Yu (2006) highlight what is believed to be one of the earliest examples of extensive exam cheating. In China, nearly 1,400 years ago, candidates began taking civil service examinations, or Keju, to earn administrative positions in the government. Higher scores resulted in more prestigious appointments which garnered greater power and wealth. Additionally, those who successfully passed the three-day Keju exams were

exempted from military service and from taxes. Over time, available government jobs, especially top positions, became scarce and the exams got progressively more difficult. And as the exams became more challenging, cheating increased (Elman, 2000).

Miyazaki (1981) claims that Keju candidates copied notes in their underwear written with invisible ink. Others bought model composition essays written by professionals (Elman, 2000). These were memorized and transcribed on the exams, even though the government strictly outlawed this practice. Suen and Yu (2006) claim that bribery of officials monitoring the exams was common, some candidates hired substitutes to take the exams in their place, and others devised elaborate hand signaling systems where outside companions provided test takers with answers. Sneaking notes into the exam room was also common. Wealthy families bought cheat sheets made of silk or gold-leaf shavings that could be inserted into the shaft of a pen. A tiny booklet, printed on silk, that was allegedly used as a cheating implement by a Keju test taker was recently shown at a collector's conference in Hunan Province in China. The item is about the size of a matchbox, yet the 160 pages contain the entire Confucius texts Four Books and Five Classics (Moore, 2009), which were major subjects covered on the Imperial civil service examinations.

According to Brickman (1961), government officials were so concerned about cheating that they separated exam takers into private cubicles and all candidates were body searched before entering the room. Suen and Yu (2006) claim that those caught cheating were caned or placed in stocks for a month. There are even recorded cases of executions for cheating. During the Song dynasty (960–1279), the exams were held in prisonlike complexes where over 22,000 examinees completed their tests in individual cells. These facilities were surrounded with thorn bushes and had armed guards who monitored the compound from watchtowers.

Ways that Students Cheat

The cheating described on the Keju exams is particularly interesting because many of these same techniques are still used by students (Lang, 2013). Today, however, instead of writing on underwear, students inscribe notes in water bottles, on their fingernails, thighs and knees, inside the ridge of a ball cap, and on the bottom of their shoes (Shon, 2006). They print on tissue paper and pretend to have allergy symptoms so they can look at their cheat sheets during the exam. Or they ask to go to the bathroom where they view notes hidden in their pockets. Some even place a tiny sheet of paper filled with notes in the eraser cavity of mechanical pencils (Montgomery, 2020).

Contract cheating, where a student pays a friend or someone found on a social media site to write a paper for them or to take an exam in their place, is rapidly becoming a major issue (Walker & Townley, 2012). Extracting data from 65 studies dating from 1978 to 2017, Newton (2018) concludes that 3.52 percent of students admit to engaging in exam contract cheating. However, this value has increased to over 15 percent for samples evaluated since 2014. Though this form of cheating has been reported across all disciplines and programs of study, Lancaster (2020) reports that of the 19 discipline groups evaluated, contract cheating is most prevalent among students studying architecture, computer science, and law.

Even more concerning, technology is making it easier to cheat and harder to detect. Technological advances that not too many years ago enabled students to store formulas and equations in graphing calculators or PDAs, now allow students to store lecture materials, entire textbooks, solution keys, and tutorials on their cellphones (Walker, 2017). They can use their

phones to access the Internet during an exam, text friends in the exam room for answers, or take pictures of exam pages and send these to friends in a dorm room who look up or derive answers that are returned via texts (Yee & MacKown, 2009). As technology continues to evolve, so too will the sophistication of students' efforts to gain an unfair advantage. In the not-too-distant future, or perhaps it is even happening now, students may wear contact lenses that transmit exam questions to colleagues in a remote location who send back correct answers via an undetectable audio receiver embedded in the test taker's ear.

Cheating is Pervasive

Studies noting significant student test cheating in high school, college, and graduate school were highlighted in the introduction. Wehman (2009) provides a chart (see Table 1, pages 9-11) that summarizes 22 additional cheating studies published between 1992 and 2008. These studies, involving over 36,000 undergraduate and graduate students, report admitted academic dishonesty of between 62 percent and 89.5 percent for cheating in general, and between 34 percent and 61.2 percent for cheating on exams.

Although much of the cheating literature focuses on teens and young adults, it appears that no age group is exempt from academic dishonesty. Lewis et al. (1989) performed an experiment with 3-year-olds where the children were told not to look at a toy that was placed on a table behind them and then the adult left the room. Over 87 percent of the children looked at the toy. Those children who looked were then asked if they obeyed the adult's instruction, and 62 percent either said no or did not answer the question. Polak and Harris (1999) devised a similar study with 3- and 5-year-olds. These authors used a control group to verify that the children understood that peaking when being told not to do so was wrong. Still, 75 percent of the children in their study disobeyed the instruction, and of this group, 80 percent denied doing so. Interestingly, the authors reported that dishonesty was more prevalent among the 5-year-olds than the 3-year-olds. Talwar and Lee (2002) conducted a similar study comparing 3-, 4-, 5-, 6- and 7-year-olds. They found that 82 percent of the children looked at the toy. The authors found no significant difference between either the different age groups or gender. However, when asked if they peeked, those who did so but denied their behavior (what the authors define as "lie-tellers") differed significantly between age groups. Specifically, 36.4 percent of 3-year-olds were classified as lie-tellers, and 90.9 percent of the 7-year-olds were lie-tellers, with consistent increases across the middle age groups. Thus, dishonesty and trying to cover up dishonest actions seems to begin early in life and increase with age.

In a survey that asked students when they first cheated, Schab (1980) reports that 24 percent of females and 20 percent of males claimed that they initially did so in first grade. Brandes (1986) presents the results of a California State Department of Education study of academic honesty among California students. In this study, more than 1,000 elementary school students were surveyed about possible cheating behaviors. Over 38 percent of those surveyed admitted to copying one or more times from another student during a test and more than 41 percent admitted to overt plagiarism on papers they submitted. Evans and Craig (1990a) queried middle school students about cheating in their school. Nearly 64 percent of these students described cheating as a "serious problem." In an extension survey study of middle schoolers conducted at another school, these same authors (Evans & Craig, 1990b) reported that, instead of believing their behavior was incorrect, the majority of students blamed their teacher or outside circumstances. In particular, students indicated that they believed that it was okay to cheat if an

exam was too difficult, the teacher did not actively proctor, or if they felt pressure from parents or the school to achieve high grades.

Academic dishonesty is not an isolated American problem. In fact, numerous studies show that students cheat throughout the entire world. Bernardi et al. (2008) document significant amounts of student-reported cheating on exams in Australia, China, and Ireland. Using a sample of students in the United States as their comparison/control group, the authors found that 28.4 percent of students in China and 26.1 percent of students in Australia admitted to cheating on major exams, versus 17.8 percent for U.S. students. Over 73 percent of Australian students, and over 50 percent of students in China and the U.S., admitted to cheating on minor exams. They found that Irish students claimed to cheat the least (6 percent on major exams and 25 percent on minor exams). Despite these significant amounts of self-reported cheating, students in all four countries stated that they clearly understood that cheating is "wrong, dishonest, or unethical" (87.0 percent in Australia, 87.5 percent in China, 91.9 percent in Ireland, and 83.9 percent in the United States). Other studies show similar amounts of student reported cheating in South Korea (Park et al, 2013), Hungary (Farkas & Orosz, 2012), Western Europe, Africa, and Oceania (Teixeira & Rocha, 2010).

Unfortunately, cheating does not necessarily stop upon graduation. In 2015, eleven former administrators and teachers in Atlanta were convicted of participating in a widespread scandal of changing student answers on statewide standardized exams. Erasure analysis suggested that several of the charged teachers changed certain student-entered answers from being incorrect to correct so that their schools would qualify for No Child Left Behind performance-dependent federal and state funding aid (Blinder, 2015). In a subsequent state investigation of the Atlanta cheating scandal, Sass et al. (2015) provide evidence that although only 11 individuals were convicted, as many as 200 teachers most likely engaged in falsifying student scores.

While the Atlanta cheating case attracted much attention, it is not isolated. Jacob and Levitt (2003) created an algorithm to detect teacher cheating and, using data from the Chicago public schools, concluded that severe cheating occurs on at least 4 to 5 percent of elementary school student standardized tests each year. Dee et al. (2019) provide evidence suggesting that from 2004 to 2010, over 40 percent of student scores near the proficiency cutoff level (about 6 percent of all scores) on New York high school exit exams were manipulated. Specifically, the scores of those students who fell just below the cutoff level were adjusted upward to increase passing rates. Similar teaching cheating scandals have occurred in Houston (Radcliffe, 2014), Philadelphia (Chen, 2019), Washington D.C. (Toppo, 2013) and Sweden (Wong, 2016).

The Battle to Reduce Cheating on Exams

Though the techniques employed today are, thankfully, less extreme than caning and execution, the threat of punishment is still used to dissuade students from cheating. Modern day punishments typically include being assigned a grade of 0 on the assignment, automatic failure of the class, suspension, or expulsion from the school. Unfortunately, these potentially effective measures are seldom used by educators. Diekhoff et al. (1996) find that less than 3 percent of students who cheat report that they have ever been caught. Graham (1994) reports that only 9% of faculty penalize students who they catch cheating. In surveys of faculty, Keith-Spiegel et al. (1998) find that 71 percent of teachers claimed that policing student cheating behavior was the worst aspect of their job. Fendler et al. (2018) note that teachers find it difficult to comprehend why a student would cheat instead of learning the material, fear possible repercussions of

accusing a student of cheating, and view the cheating accusation process to be excessively time intensive.

Teachers also engage in many activities to make cheating more difficult. Today, however, instead of testing in prison-like facilities, using armed guards or body searching exam takers, instructors use multiple exam versions, randomly assign seats to prevent friends from sharing answers, employ teaching assistants to actively proctor throughout the exam room, erase programmable calculators, and limit cell phone use during a test (Lang, 2013). Despite these measures, cheating is getting worse (Hobbs, 2021). It seems that students are always one step ahead of teachers in the cheating prevention war (Norris, 2019).

Since punitive anti-cheating measures lack faculty support and preventative measures lack effectiveness, another approach that better aligns with the profession of teaching should be considered. The positive approach to preventing academic dishonesty involves teaching students that cheating is wrong. It entails helping students develop an ethical code to use not only in school but throughout their entire lives. This approach challenges students to adopt the notion that the purpose of learning is much greater than just getting good grades – it is instead about empowerment. Education enables students to gain skills that will allow them to be effective in their careers and to make a difference, and honesty and integrity are key components of achieving such goals.

Although it may seem overly optimistic to believe that positivity alone can reduce the amounts of cheating outlined above, research indicates that a student's thoughts, feeling and perceptions about cheating are important determinants of behavior. Jordan (2001) finds that knowledge of institutional policy and attitudes about cheating are the major determinants of who chooses to cheat and who does not. This author concludes that having an honor code that is clearly communicated to students and consistently highlighted by instructors is essential to teaching students to choose to not cheat. Ljubin-Golub et al. (2020) find that students having a favorable attitude towards cheating explained 24 percent of academic cheating behavior. Specifically, students who believe that cheating is neither acceptable nor justifiable are less likely to engage in academically dishonest behavior. An academic honor code that calls on students to act appropriately and to report other students for violations can influence a student's attitudes about cheating by stressing the importance of being responsible and accountable to themselves and to those around them.

Indeed, several academic studies report that honor codes can be effective in reducing academic dishonesty. McCabe and Trevino (1993) surveyed over 6,000 undergraduate students at 31 different schools. Some of these schools had honor codes and some did not. The survey asked students about their potential cheating in twelve different areas. Overall, nearly 75 percent of the students in the study admitted to engaging in at least one form of cheating. However, for schools with an honor code, the amount of admitted cheating was lessened by more than 50 percent. Bing et al. (2012) divided a sample of undergraduate business students into four groups to examine the impact of an honor code reminder and/or a specific warning about academic integrity on student cheating behaviors. Group 1 was the control group that received neither a reminder nor a warning. Group 2 received a reminder; Group 3 received a warning; and Group 4 received both a reminder and a warning. Homework assignments were then carefully examined for any evidence of cheating. Whereas cheating was found in nearly 50 percent of the assignments submitted by Group 1 students, the amount of cheating for Groups 2 and 3 was only about 25 percent, and the cheating for Group 4 was about 12 percent. In a study carefully designed to determine the impact of an honor code on cheating, Shu et al. (2011) found that

asking students to read an honor code significantly lessened the amount of cheating, while asking students to sign an honor code statement effectively eliminated cheating. Other studies, however, found no difference in reported cheating behaviors between honor code or no honor code groups (see Konheim-Kalkstein et al., 2008; Arnold et al., 2007).

Purpose and Research Questions

The purpose of this study is to examine whether simply asking students to sign the school's honor code statement prior to taking an exam can reduce observed cheating. Two groups of students who took the same class taught by the same instructor took the same proctored final exam in different rooms. In room one, the first page of the exam asked students to sign the university's honor code. In room two, this first page was omitted (thus, this second group did not sign the honor code).

This study is unique for two reasons. First, it is possible that the reduction in cheating due to an honor code that is reported in the literature merely reflect student beliefs that if a teacher often stresses the honor code, that teacher is more likely to use punitive measures or to engage in active preventative activities which students fear. In this study, the honor code was never mentioned or discussed during the semester, and the honor code is not a major focus of the university. That is, this study examines whether an honor code introduced to the class at the most basic level can impact student behavior. If so, then a more concentrated focus on the honor code could result in even more significant reductions in cheating.

Second, using the technique described in Fendler and Godbey (2016), a final exam was designed to allow for actual observation of the amount of cheating that occurred in the exam room. Thus, the results reported in this study are based on actual cheating, not student surveys about cheating. Note that in the context of the study, to "observe cheating" does not indicate that the offender was identified in the act by an eye witness or camera. Rather, the techniques described in the Results and Discussion section below allow a researcher to use students' exam responses to determine, with a given level of statistical certainty, that one student copied from another. This method of identifying cheaters is analogous in many regards to the way that DNA evidence can be used ex-post to show with a certain statistical certainty that a perpetrator was present at the scene of a crime. The Fendler-Godbey method enables researchers to determine both who cheated and how much they cheated. So, not only is it possible to determine if the classroom where students were asked to sign the code had less overall copying of answers, but also if the severity of cheating on an individual-student basis differed across classrooms.

The specific research questions examined in this study are:

1. Was cheating observed on the exam in one or both sections?
2. Did asking students to sign the school's honor code before taking the exam have any significant impact on the classroom-wide number of copied answers in the honor code signature section relative to the non-honor code signature section?
3. Did asking students to sign the school's honor code before taking the exam have any significant impact on the number of individual students in each classroom who engaged in cheating?

METHODOLOGY

Fendler and Godbey (2016) describe an exam design procedure that allows instructors to determine whether students cheated on an exam. The Fendler/Godbey (F/G) technique works best for multiple choice, open-ended problem, and/or short answer question exams taken by many students in a proctored classroom setting. It is simple to execute, student behavior is not altered by the process because students do not know they are being "observed," and, perhaps best of all, the F/G process punishes cheaters who copy their classmates' answers.

The F/G technique involves creating two (or more) versions of an exam and ensuring that all adjacent students in the room have different versions. All of the questions on the versions look identical at first glance, but each has a subtle difference that makes the correct answer for one version the incorrect answer for the other version. Consider two students who are sitting next to each other in an exam room. Assume the same numbered question on each student's exam, located on the same page in the exact same area, as displayed in Table 1 (Appendix).

Although these questions appear identical, in fact there is a key difference. For the question on Version 1, Aaliyah works for eighteen hours as a tutor and for the question on Version 2, she works for sixteen hours. Thus, the correct answer to the question on Version 1 is $228 (choice "b") and the correct answer to the question on Version 2 is $261 (choice "d"). Note that the other three answers are completely random; there is no way to derive any of these answers with the information given in the question.

During a proctored exam, where students are seldom able to do more than quickly glance at a neighbor's test, this subtle difference will not be recognized. Students will believe their exams are the same as the exam of the individual sitting next to them, providing no observable disincentive for students to stray from their preferred ethical behavior. That is, honest students will choose not to cheat because it is the right choice and dishonest students will choose to cheat because they do not fear that doing so will hurt their grade.

For an entire exam structured in this manner, the degree of similarity between the exam answers of two students who sit next to one another, over and above the similarity predicted by random chance, indicates the likelihood that cheating occurred. Assume that two students, Minnie and Mickey, receive versions 1 and 2, respectively, of the exam illustrated in Table 1. If Minnie selects the correct answer (e.g., choice "b" for Version 1) or any of the common incorrect answers (e.g., choice "a", "c", or "e" in Table 1), and if Mickey records the same answer for that question, then a potential instance of cheating has been "observed." Of course, there is the possibility that adjacent student answers may match simply by chance, but the frequency with which students' responses are expected to match by chance is known in the F/G setting, so the degree to which matching occurs beyond this expected frequency measures the probability that cheating has occurred.

Moreover, the most likely cheater can often be identified. For example, if Minnie selects the correct answer (e.g., choice "b" for Version 1) and if Mickey records the same answer, then Mickey has been identified as the potential cheater. Again, it is possible that Mickey recorded the matching answer by chance, but the more frequently this happens over what is expected (i.e., more than 20% of the time for a 5-answer multiple choice question), the greater the probability that Mickey copied from Minnie. Moreover, the more questions that the student from whom the cheater copies gets correct, the more questions the cheater will necessarily miss. Thus, with the F/G technique, cheaters are properly penalized for their unethical behavior, and to the extent that

cheaters are likely to choose high-performing students from whom to copy, this penalty will be increasingly severe.

Fendler et al. (2018) use the F/G technique to show that randomly assigning students to sit at a specific desk in the classroom, thus separating friends from sitting next to one another, significantly reduced the amount of cheating on an exam. In this paper, the same F/G process is employed to examine whether asking students to sign the honor code prior to taking an exam generates a similar response. The honor code literature suggests that it will, but much of that research relies on survey data. This study is unique because it reports what students actually do in a real testing situation as opposed to what they say they may do hypothetically.

DATA

The data for this study is derived from two sections of the core introductory finance course taught in a large urban university by the same professor. The common final exam for the class was taken by all students in a particular section at the same time. The final exam used for this research project was a 40-question multiple choice exam. All questions had five answer choices structured as described in the previous section. All exams, and all exam answer sheets, were numbered and placed face down at desks in a large classroom prior to students entering the room. When students were granted access to the room, they were allowed to sit wherever they wanted. After all students were seated, they were instructed to turn over the exam and begin. The strict time limit for the exam was 150 minutes. Although students had to return both their actual exam and the exam answer sheet, only the answer sheet was graded.

The exam versions given to students in both sections were identical except that in one of the classrooms the answer sheet included an honor code statement that students were asked to sign. Though not required to do so, all students who took the exam in this classroom signed the statement. In the second classroom, the answer sheet did not include an honor code statement. As indicated previously, the honor code was not emphasized in any way during the semester and no previous class assignments required an honor code signature. Thus, this was the only time that any of the students were directly exposed to the university's honor code in either section.

Due to the heavy math content of finance, this course is considered by most students to be one of the most challenging required courses in the business school. Cheating is a major concern in the course for at least three reasons. First, the final exam counts for 35 percent of a student's grade, so a poor score on the final exam can easily move a student from a passing to a failing position. Second, the large number of students per class (over 100 students per section) and the exam room (a large theater-style classroom) makes proctoring difficult. Third, since over 80 percent of the students who take this class will not major in finance, the vast majority just want to pass, sometimes by any means necessary, so they can continue making progress towards their degree.

Prior IRB approval for this project was obtained through the university. Exam data (i.e., recorded answers for each question) was extracted from student answer sheets. The university provided student demographic data, including GPA, gender, age, and major. This data was matched with individual exams and then, to strictly protect student anonymity, all student-specific identifiers were deleted.

Table 2 (Appendix) provides summary statistics for the two sections. The class that was asked to sign the honor code is designated as the Honor Code section and the other class is

designated as the Non-Honor Code section. At the 95% confidence level, there are no statistically significant differences between the two groups.

RESULTS AND DISCUSSION

Fendler et al. (2018) demonstrate that the total amount of cheating that likely occurred in a classroom can be estimated using the relationship between the Average Match Percentage (AMP) and the Expected Match Percentage (EMP). They define AMP as the total percent of incorrect responses that match with a neighbor's response relative to all incorrect responses for every possible pairing of neighboring students in the room. EMP is defined as what this value would be in a room where there was no cheating. For example, in Table 1, if Minnie incorrectly chooses answer "c", what is the probability that Mickey also chooses answer "c"? For multiple choice questions like those in Table 1, an honest student who incorrectly answers a question has a one-in-five chance of matching the student sitting in an adjacent seat. Thus, the EMP for both sections is 20%.

Table 3 (Appendix) presents the Actual Match Percentage and the Expected Match Percentage for the Honor Code and the Non-Honor Code sections. The AMP for the Honor Code section is 28.84% and the AMP for the Non-Honor Code section is 31.11%. The difference between the AMP and the EMP is highly significant for both rooms. Thus, with regards to research question 1, cheating most certainly occurred in both sections.

Table 4 (appendix) compares the difference between AMP in the Non-Honor Code section and the Honor Code section. The Non-Honor Code section AMP is larger than the Honor-Code section AMP by 2.27 percentage points, a difference which is statistically significant at the 98.11% confidence level. Thus, with regards to research question 2, the section in which students were merely asked to sign the school's honor code prior to taking the exam had fewer overall instances of observed cheating.

Fendler et al. (2018) also demonstrate that the probability that a student in the room copied from a particular neighbor's exam (either to the right or to the left) can be estimated by the following equation:

$$\mathrm{P(copied)} = 1 - \left(1 - \sum_{\mathrm{m=0}}^{\mathrm{M-1}} \mathrm{P(x = m)}\right) = \sum_{\mathrm{m=0}}^{\mathrm{M-1}} \frac{\mathrm{n!}}{\mathrm{m!\,(n-m)!}} 0.2^{\mathrm{m}}(1-0.2)^{(\mathrm{n-m})} \qquad (1)$$

where ***n*** is the total number of questions the student missed, ***M*** is the number of missed questions that match with the particular neighbor's exam, and 0.2 reflects the fact that for multiple choice questions with 5 answer choices, the probability of matching answers due to guessing is 20% (i.e., 0.2).

Table 5 (Appendix) shows the results from applying Equation (1) to every set of neighboring students in the sample for each section. For students sitting at the end of a row, there is only one student pairing possible; for students sitting in any other seat in the row, there are two possible pairings (a student to the right and a student to the left). Table 5 lists the count and percentage of students in each section that engaged in probable copying from a specific neighbor at varying levels of statistical certainty. For example, it is 95 percent certain that 18 (17.65%) of the students in the Honor Code section cheated on the exam and that 24 (23.76%) of the students who did not sign the honor code cheated on the exam. For a student to be identified as a probable cheater at higher confidence levels, the student must appear to have copied more frequently (i.e.,

a higher percentage of responses on missed questions match with a specific neighbor's responses).

Note that more than twice as many students (22 versus 10 in sections of about the same number of total students) in the Non-Honor Code section cheated frequently enough to meet the highest certainty threshold in the table. It is particularly noteworthy that for any of the given confidence levels, there is a higher percentage of cheaters in the Non-Honor Code section, suggesting that signing the honor code prior to taking the exam significantly altered student behavior. With regards to research question 3, these results strongly suggest that not only was there less copying overall in the Honor Code classroom, but that, regardless of how stringently the threshold for identifying individual students as having cheated is defined, fewer individual students in the Honor Code section engaged in this unethical behavior. These results support the hypothesis that when students are asked to sign the honor code prior to taking an exam, they are less likely to cheat.

LIMITATIONS AND FUTURE RESEARCH

As with all empirical research, there are limitations to this study. First, the sample size is relatively small. In this sample of 203 students, more than twice as many individuals in the Non-Honor Code section can be identified as probable cheaters at the strictest certainly level. While the sample is large enough to identify statistically significant differences in the two sections, a larger sample size would provide greater confidence in the robustness of this result.

Second, this study examines the response of business school students taking a multiple-choice exam in a required class in corporate finance. It is possible that students taking an elective course in their chosen major may have responded differently. This study should be extended to students in multiple classes as well as to different exam formats (i.e., open-ended problems or short answer questions).

Third, the students evaluated in this study attend a single school. It is possible that students at other schools may have a greater or lesser response to being asked to sign the university's honor code prior to taking an exam. Broadening the study to multiple schools, perhaps even in different countries, would further the understanding of the general applicability of the findings reported in this study.

Finally, although the lack of attention paid to the honor code throughout the class is a possible strength of this study, it is possible that it may instead be a weakness. Similar to how an instructor's persistent focus on the honor code may cause students to cheat less because they fear that their instructor will be more diligent in proctoring and/or harsh in punishing, it is possible that the sudden appearance of a request to sign the honor code on the final exam may have produced a similar fear factor for the students in this sample. It would be interesting to see if students in a course where the honor code was discussed throughout the entire class respond any differently than students who are exposed to the honor code only one time in the class (just before taking the final exam).

In addition to expanding the study in these directions, it would also be interesting to examine whether combining the positive honor code approach with other simple preventative measures aimed to disrupt even the most devoted cheaters, such as random seating, would further reduce instances of observed cheating. It is reasonable to expect that particularly determined cheaters may plan their dishonesty by sitting next to a student with whom they have premeditatively colluded or by purposely sitting next to a top student in the class. It is possible

that signing the honor code could mitigate instances of casual, spur-of-the-moment cheating, while random seating could dissuade these more dedicated cheaters.

CONCLUSION

Student cheating, especially on exams which heavily influence a student's grade in a class, is a major concern for higher education. Much of the literature indicates that student cheating, which occurs at all levels of education, is rampant. Because cheating causes the learning and abilities of a school's graduates to be exaggerated, when businesses that hire and graduate schools that accept these individuals realize they are being duped, the school's reputation is tarnished and demand for the school's graduates declines. Consequently, schools must find a way to reduce student cheating, if for no other reason than to protect honest students from being punished for the actions of their dishonest colleagues.

Teachers, who have been designated as the "cheating police" can take a punitive, preventative, or positive approach to the cheating problem. The punitive approach involves severely disciplining students who are caught cheating. The preventative approach requires heightened suspicion and diligent patrolling. Unfortunately, neither of these approaches is consistent the personality of most teachers or with the purpose for why most teachers choose academia as a profession.

The positive approach, which involves training students to choose honesty because that is the right action regardless of the outcome (e.g., getting a low grade in the class), best matches the main objective of education. However, there are questions concerning whether a positive approach to preventing cheating can actually work. In this study, empirical evidence demonstrates that asking students to sign the school's honor code prior to taking the final exam significantly reduced the amount of cheating in the class. This study is unique because these findings are based on observed cheating. That is, instead of relying on anonymous student answers to survey questions about what they might do in a hypothetical situation, as most other studies do, this study measures how students actually behaved in a real-world, high-pressure event (i.e., a final exam that determined 35 percent of their course grade). As such, this study demonstrates that requiring students to sign the university's honor code before taking an exam may be an effective positive approach to stem the tide of the cheating pandemic that is infecting higher education and, more importantly, may protect honest students from the selfish actions of cheaters.

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Table 1: F/G Technique Example

Exam Version 1	Exam Version 2
7. For the past month, Aaliyah has been working part-time jobs to try to accumulate enough money to make a required $1500 down payment on a new car. She babysat for her neighbor three times, each for 5 hours at $12 per hour. She worked as an online tutor for eighteen hours. Aaliyah earns $16.50 per hour tutoring. And she worked as an Uber Eats driver for forty-five hours at $11 per hour. If Aaliyah started with $300 in her savings account, how much does she still need to make the required $1500 down payment on her car? a. $207 b. $228 c. $243 d. $261 e. $301	7. For the past month, Aaliyah has been working part-time jobs to try to accumulate enough money to make a required $1500 down payment on a new car. She babysat for her neighbor three times, each for 5 hours at $12 per hour. She worked as an online tutor for sixteen hours. Aaliyah earns $16.50 per hour tutoring. And she worked as an Uber Eats driver for forty-five hours at $11 per hour. If Aaliyah started with $300 in her savings account, how much does she still need to make the required $1500 down payment on her car? a. $207 b. $228 c. $243 d. $261 e. $301

Table 2: Group Summary Statistics

	Honor Code Section *(N = 102)*		Non-Honor Code Section *(N = 101)*		Difference Significant?
Variable	Mean	St. Dev.	Mean	St. Dev.	
Final Exam Score	69.7%	9.9	68.1%	10.2	No
GPA	3.10	0.41	3.09	0.42	No
Gender (Female = 1)	60.7%	n.a.[1]	59.9%	n.a.[1]	No
Age (years)	26.3	6.2	26.6	6.5	No
Finance Major (Yes = 1)	17.6%	n.a.[1]	17.3%	n.a.[1]	No
[1] Standard deviation is not applicable (n.a.) for binary variables.					

Table 3: Estimate of Cheating in Each Section

	Honor Code Section	Non-Honor Code Section
Actual Match Percent (AMP)	28.84%	31.11%
Expected Match Percent (EMP)	20.00%	20.00%
Difference (AMP – EMP)	8.84%	11.11%
Z-stat for Difference	8.65	15.51
Significance level	> 99.99%	> 99.99%

Table 4: Estimate of Cheating in Non-Honor Code Section vs. Honor Code Section

	Difference
AMP in Non-Honor Code Section – AMP in Honor Code Section	2.27%
Z-statistic	2.08
Significance level of difference in means	98.11%

Table 5: Estimate of Individual Cheating in Honor Code vs. Non-Honor Code Sections

Confidence Level	Honor Code Section *(N = 102)*		Non-Honor Code Section *(N = 101)*	
	Number of Students	Percent of Section	Number of Students	Percent of Section
99%	10	9.80%	22	21.78%
95%	18	17.65%	24	23.76%
90%	23	22.55%	29	28.71%
80%	29	28.43%	37	36.63%
70%	46	45.10%	49	48.51%
60%	55	53.92%	59	58.42%
50%	63	61.76%	72	71.29%