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Do Instructor-Created Videos Improve Student Performance in the Introductory Accounting Course?

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Supplementary, educational videos are widely used in higher education; however, there is little evidence documenting their effect on student performance in the introductory financial accounting course. Moreover, there is no evidence regarding the differential effect of videos on the performance of achieving and low-achieving accounting students. In this paper, we address these two questions using a series of short, instructor-created videos embedded into the course management system (CMS) of an introductory financial accounting course. Our results show that supplementary videos do improve student performance and that greater improvement accrues to low-achieving students.

Keywords: Educational Videos, Student Performance, Low-Achieving Students
Disciplines of Interest: Accounting, Business

INTRODUCTION

An introductory financial accounting course is generally required of business and some nonbusiness students as part of their degree plan. The course is intended to equip students with the ability to understand and interpret accounting information in subsequent courses and careers [Warren and Young, 2012]. Yet, despite the fundamental content of the course, many students struggle with the analytical thinking process required of the discipline [Spiceland, Spiceland, and Schaeffer, 2015], and at some universities, as many as 35 to 45 percent either drop the classes or earn grades of C-minus or below [Doran, Bouillon, and Smith, 1991; Kealey, Holland, and Watson, 2005]. For some, this means changing majors and careers. For others, it means delaying graduation. The

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accounting academy, therefore, encourages educators to experiment with mechanisms for improving student performance in introductory courses [Pathways Commission, 2012].

Numerous course tools and technologies exist for enhancing the student experience, and many of these are adaptable to the introductory accounting course. In this paper, we focus on one popular technology—short, supplementary, instructor-created videos—to determine whether they improve student performance and, more specifically, whether they help low-achieving students gain a better understanding of core accounting concepts. We selected this learning supplement because prior research in analytical disciplines such as mathematics [Hegeman, 2015], engineering [Kinnari-Korpela, 2015], and chemistry [He, Swenson, and Lents, 2012] finds that instructor-created videos are effective at improving student performance. Additionally, research by Kolikant and Broza [2011] finds that short videos, when used in combination with other teaching interventions, are effective at helping low-achieving students understand mathematical concepts. We extend this line of inquiry by investigating the effect of short videos on the exam performance of achieving and low-achieving introductory accounting students.

We address our research questions by creating a series of short videos and embedding these in the course management system (CMS) of an introductory financial accounting course. Over the course of the semester, we encourage students to view the videos, but we provide no extrinsic reward or incentive for doing so and the content of the videos is similar to material covered in class.[1] The videos, however, offer several benefits documented in previous research. First, they are convenient in that they may be viewed at any time [Kinnari-Korpela, 2015]. Second, they are concise—no more than 20 minutes—and this allows for multiple, focused views [Duxbury, Gainor, and Trifts, 2016]. Third, they are recorded, which means they may be paused, repeated, or slowed [Chen and Wu, 2015]. Fourth, they are instructor-created and, as such, closely mirror the explanations provided in class [Hegeman, 2015].

Our results indicate that viewing the videos does improve performance, as measured by the change in scores between the first midterm exam and the cumulative final exam. We also find that greater improvement accrues to low-achieving students, defined as those with incoming GPAs in the lowest tercile.[2] Taken together, our results demonstrate that short, instructor-created videos are a valuable supplement to introductory financial accounting courses.

[1] No credit was provided for watching the videos because we wanted to ensure that the motivation for watching was to improve accounting knowledge, not simply earn course credit. Had credit been provided, some students, in an effort to earn credit, might have played the videos without actually watching them. This would have reduced the efficacy of the videos and diluted their effect on exam performance.

[2] Students in the lowest tercile had incoming GPAs of 2.75 or less; those in the middle tercile had incoming GPAs of 2.76 to 3.36; and those in the highest tercile had incoming GPAs of 3.67 or above.

The remainder of this paper is organized as follows. First, we review the literature and develop the hypotheses. Next, we explain the methodology and present the results. Finally, we provide some concluding remarks.

LITERATURE AND HYPOTHESES

For the past three decades, both the profession and joint practitioner-academic commissions have recommended changes in accounting education to reduce attrition and improve performance (e.g., AAA Committee on the Future Structure, Content, and Scope of Accounting Education, 1986; Arthur Andersen et al., 1989; Accounting Education Change Commission, 1990; Siegel and Sorensen, 1994; Carlozzi, 1998; AICPA, 1999, 2000, 2010; Albrecht and Sack, 2000; Bolt-Lee and Foster, 2003; Pathways Commission, 2012; Lawson et al., 2014). Most of these recommendations have called for greater focus on skills and technical competencies, as well as more integrative and active learning models.

In response to these calls, many accounting programs have redesigned their introductory accounting courses with the aim of improving retention and performance. Many have introduced event videos, adaptive learning software, in-class polling, interactive PowerPoint presentations, and/or interactive Excel spreadsheets [e.g. Holtzblatt and Tschakert, 2011; Phillips, 2015; Spiceland, Spiceland, and Schaeffer, 2015]. Yet, little empirical evidence exists regarding the impact of such learning technologies on student performance. In this paper, we investigate the effect of one of these learning technologies—short, supplementary, instructor-created videos—with the aim of providing empirical support for their use in introductory financial accounting courses.

The use of online video as a learning aid was first popularized in 2004, when Sal Khan recorded a video to help tutor his young cousin in math [Noer, 2012]. Today, Khan Academy delivers almost 7,000 video lectures to over 4.9 million YouTube subscribers [YouTube, 2018]. Khan's success has also inspired a rush of other online video education, including the CrashCourse channel, with over 9.6 million subscribers, and Vsauce, with over 14.6 million subscribers [YouTube, 2018].

The enormous popularity of educational videos has not gone unnoticed by university faculty. According to a survey by Pearson Learning Solutions and Babson College Survey Research Group, approximately 80 percent of faculty surveyed use some form of online videos in their classes [Moran, Seaman, and Tinti-Kane, 2011]. Most of these videos are clips prepared by publishers, the news media, and professional organizations. However, using simple tools such as PowerPoint, a touch-screen laptop, microphone, and stylus pen, any instructor can create their own educational videos.

Videos can be recorded in a number of different ways. One variation is lecture capture, which is a recording of the entire classroom session. Lecture

capture, however, suffers from two main weaknesses: it is generally too long and it lacks clearly identified learning goals [Settle, Dettori, and Davidson, 2011]. Far more popular than lecture capture are short, focused videos [Fish, Mun, and A'Jontue, 2016]. Typically, these videos supplement traditional face-to-face delivery, either by providing summaries of material covered previously or by adding additional material to broaden or deepen the student's understanding. But, like all educational aids, the goal of supplemental videos is to gain students' attention and move information into their working memory for later recall. As such, the power of supplementary videos resides primarily in their ability to reinforce ideas [e.g. Kozma, 1991].

Most studies of the use of supplementary videos report heightened satisfaction among students. For example, McElroy and Blount [2006] surveyed second-year accounting students and found that 75 percent agreed that videos enhanced their learning. But perceptions of enhanced learning are not necessarily indicative of improved academic performance. In a study of the usefulness of videos in flipped classrooms, Duxbury et al. [2016] found that, while a majority of their introductory accounting students felt that the video approach made learning easier, the approach did not significantly improve performance as measured by grades. Their results contrast sharply with those reported by researchers studying the effect of videos on learning by chemistry, engineering, and mathematics students [e.g. He, Swenson and Lents, 2012; Kinnari-Korpela, 2015; Hegeman, 2015]. In discussing their findings, Duxbury et al. [2016] noted that some of their videos were too long and that others were not clearly tied to key learning objectives. Based on student and instructor feedback, they consequently recommended the use of focused videos running between 15 and 20 minutes in length.

In sum, while prior research has studied the efficacy of videos, there has been no systematic study examining the effect of short, supplementary, instructor-created videos on accounting student performance. This is particularly surprising, given that many students must master introductory accounting concepts in order to succeed in college. Our aim in this paper, therefore, is to address this omission in the accounting education literature and provide empirical support for the use of supplementary videos. We posit that such videos will improve grade performance based on prior research showing the power of repetition for student learning [e.g. Clark, Lansford, and Dallenbach, 1960] and the ability of digital media to hold students' attention and interest [e.g. Schmidt and Vandewater, 2008]. We also draw on the work of Kolikant and Broza [2011] regarding the efficacy of videos for low-achieving students and speculate that the benefits of videos will accrue more to low-achieving students than to other students. Our two research hypotheses are stated below.

H1: Viewing short, supplementary, instructor-created videos improves the exam scores of introductory financial accounting students.

H2: Viewing short, supplementary, instructor-created videos improves the exam scores of low-achieving students more than those of other students.

METHODOLOGY

Participants in our study were 826 students enrolled in three sections of an introductory financial accounting course.[3] The financial accounting course is the first of a two-course sequence designed for freshman and sophomore students. The course is required of all business majors, as well as of many nonbusiness majors. All sections of the course were coordinated by the same instructor and were held on the campus of a large, public, doctoral degree-granting university having undergraduate enrollment of approximately 38,000 students and a diversity index of 0.74 (*U.S. News & World Report*, 2018).[4] Students were provided with the textbook, publisher-created learning aids, and instructor-created lecture notes via the course CMS. They were also provided with supplementary instructor-created videos that were embedded into the CMS as material was covered in class. Although students were encouraged to view the videos, no reward or other inducement was given.

Over the duration of the semester, 10 videos were created to explain the following basic concepts: (1) the accounting equation and its expanded form; (2) debits, credits, journal entries, the general ledger, and the components of financial statements; (3) adjusting entries, closing entries, and the trial balance; (4) bank statement reconciliations; (5) accounts receivable and bad debts; (6) inventory; (7) fixed assets and depreciation; (8) short-term liabilities; (9) long-term liabilities, time value of money, and amortization of bond discount and premium; and (10) equities.

All videos were uploaded to the CMS shortly after the concepts were discussed in class. The length of each video ran between 15 and 20 minutes and included narration and handwriting in a style similar to that of an instructor giving a lecture while writing on a whiteboard. Although the recordings were prepared with a free PowerPoint add-on from Microsoft called Office Mix,[5] similar results could have been obtained by using the slide show recording feature available in PowerPoint 2013 and higher. Alternatively, PowerPoint plug-ins such as Camtasia could have been used. Hardware requirements were minimal, as only a touch-screen laptop with a stylus pen and headset microphone were used. Average

[3] Total enrollment at the beginning of the semester was 836 students. During the semester, 10 students withdrew from the course, 5 for academic reasons and 5 for medical reasons. Attrition, therefore, was less than 2 percent.

[4] The diversity index of *U.S. News & World Report* ranges from 0 to 1, with 1 representing more diversity. For the 2016–2017 school year, the most diverse national university in the ranking had a diversity index of 0.75.

[5] Shortly after we created our videos, Microsoft announced that it was making Office Mix part of PowerPoint, rather than a separate add-on.

creation time per video was generally less than two hours, including uploading to YouTube and linking to the CMS.[6]

The content of the videos was similar to material presented during class. Each video included a discussion of the learning objectives and step-by-step instructions on how to record certain financial transactions or perform various accounting calculations. Although no new material was introduced in the videos, each presentation was clearly narrated and legibly transcribed, without any of the distractions typically encountered in a large classroom or lecture hall. We chose instructor-created videos over those available from the publisher based on research showing that the former were preferred by freshman-level undergraduate students studying college mathematics [Hegeman, 2015].

The organization of each class meeting was similar. Typically, the instructor opened the class with a 10-minute recap of previous material. This was followed by the introduction of new material, examples, and workout exercises. To test student knowledge, several polling questions about the new and previously discussed material were asked.[7] After class, students were expected to complete the assigned textbook reading and homework. The textbook for the course was McGraw-Hill's *Financial Accounting*, 4th ed. [Spiceland, Thomas, and Hermann, 2016]. Exam questions were drawn from the test banks provided by the publisher.

Because our research questions ask whether supplementary videos improve overall exam scores, as well as the scores of low-achieving students, our statistical analysis uses a two-way analysis of variance (ANOVA) with an interaction. The dependent variable is Δ*Exam_Score*, which measures the difference between a student's scores on the cumulative final exam and the first midterm exam. The advantage of using a "change" measure as the dependent variable is that it allows each student to serve as his/her own control and, as such, it mitigates the role of unobservable factors that affect exam performance.

The explanatory variables in our analysis are *Video_Viewer* and *Low_Achiever*, as well as their interaction. Blackboard, the CMS at our university, records video viewing patterns when statistics tracking is enabled. Using this data, we created *Video_Viewer* as an indicator variable and coded it as 1 for a student who, after receiving feedback about performance on the first midterm exam, viewed two or more of the videos in the remaining weeks of the course.[8] We chose to use an indicator variable over alternative measures of viewing habits because it is more representative of the relationship we are expecting to find—specifically, that improvements in exam performance accrue to students who supplement their learning by watching instructor-created videos. Using a continuous variable based on the number of videos viewed or the duration of each view

[6] Alternatives to instructor-created videos are available from textbook publishers, on YouTube (e.g., Susan Crosson's Financial Accounting), and at educational websites (e.g., Larry Walther's www.principlesofaccounting.com and Daniel Dickson's www.freeaccountingschool.com).

[7] Polling questions were conducted using TurningPoint Technologies' clickers.

[8] Among the students viewing videos, none watched only one video. All viewers watched at least two videos.

Table 1. Descriptive Statistics[a]

Statistic	Low-Achieving Students (Lowest GPA Tercile)	Mid-Achieving Students (Middle GPA Tercile)	High-Achieving Students (Highest GPA Tercile)
Mean incoming GPA	2.11	3.09	3.70
Range of incoming GPAs	2.00–2.75	2.76–3.36	3.37–4.00
Percentage viewing videos	40.29	47.39	52.67
First midterm exam score	20.07	21.90	24.53
Cumulative final exam score	28.46	30.67	36.01
Change in exam score for nonviewers	7.24	8.66	11.47
Change in exam score for video viewers	10.10	8.91	11.49
N (sample size)	278	268	281

[a]This table summarizes the incoming GPA and change in exam scores from the first midterm exam to the cumulative final exam for students in three sections of an introductory financial accounting course, classified into terciles based on incoming GPA.

would have been problematic for two reasons. First, it would have suggested a monotonic relation between viewing habits and improvements in exam performance—a relation that seems unlikely.[9] Second, Blackboard does not track a student's attention to a video. For example, some students viewed a particular video more than 15 times, and we are unable to ascertain whether these students experienced technical difficulties, interruptions, or other sources of attention interference. The use of an indicator variable alleviates these concerns.

Our second explanatory variable, *Low_Achiever*, is an indicator variable coded as 1 when a student's incoming GPA falls in the lowest tercile of the total student GPA distribution (2.75 or lower). Grade point averages were calculated using a 5-point scale with A = 4 and F = 0). We chose to partition students on the basis of incoming GPA scores because we wanted a standardized metric of academic achievement that was unbiased by prior exposure to accounting concepts. We opted to classify students in the lowest third of the GPA distribution as low-achievers because prior work suggests that students in the tail of the normal grade distribution are the ones most in need of help [e.g. Doran et al., 1991]. Research also indicates that these students are more likely to drop out or take longer in completing their degrees [e.g. Duarte, Ramos-Pires, Goncalves, 2014]. The appendix provides a recap of the variable descriptions.

RESULTS

Table 1 presents the descriptive statistics of the students in our sample. Students with incoming GPAs in the lowest tercile (*Low_Achiever* = 1) had an average GPA of 2.11, which is almost a full letter grade below the average

[9] For example, it seems unlikely that a student who views a video 10 times will exhibit a 10-fold improvement in exam performance relative to that of a student who views a video once.

Table 2. Effect of Video Viewing on Change in Exam Scores

Panel	Dependent Variable = Δ*Exam_Score*[b]						
	df	Type III SS	Mean Square	*F* value	Significance	Error	Adjusted R^2
Full panel (A)						821	0.075
Low_Achiever	2	1392.46	696.23	21.75	<0.0001		
Video_Viewer	1	220.76	220.76	6.90	0.0088		
Low_Achiever × *Video_Viewer*	2	335.78	167.89	5.24	0.0055		
Reduced panel (B)						542	0.030
Low_Achiever	1	1.71	1.71	0.05	0.8233		
Video_Viewer	1	321.86	321.86	9.42	0.0023		
Low_Achiever × *Video_Viewer*	1	227.92	227.92	6.67	0.0101		

[a]This table reports the results of 2×2 ANOVAs with main effects for *Low_Achiever* (students in the lowest tercile of incoming GPAs) and *Video_Viewer* (students viewing one or more supplementary, instructor-created videos after receiving feedback about performance on the first midterm exam) variables and their interaction. Panel A tests for the effect of video-viewing on Δ*Exam_Score* (change in exam scores) using the full sample (students in the lowest, middle, and highest terciles of incoming GPA). Panel B addresses concerns about a possible ceiling effect for students in the highest-GPA tercile by using a reduced sample that removes students in the highest GPA tercile and compares students in the lowest GPA tercile with those in the middle GPA tercile. Significance is based on two-sided tests. See the appendix for definition of the variables.
[b]df, degrees of freedom; SS, sum(s) of squares.

incoming GPA of students in the middle tercile (GPA of 3.09) and more than a full letter grade below the average incoming GPA of students in the highest tercile (GPA of 3.70). The change in exam scores from the first midterm exam to the cumulative final exam is, as expected, positively related to incoming GPA, with students in the highest GPA tercile exhibiting the greatest average increase. This result holds irrespective of whether these students viewed the supplementary videos (average increase in score of 11.49 points among those who viewed the videos and 11.47 points among those who did not). Likewise, the average increase in exam scores among students in the middle tercile was similar for both those who viewed the videos and those who did not (8.91 and 8.66 points, respectively). Among low-achieving students, however, the increase in exam scores is markedly different between those who viewed the videos and those who did not. Low-achieving students who viewed the videos exhibited an average increase in their final exam score of 10.10 points, while those who did not view the videos increased their final exam score, on average, by only 7.24 points.

Table 2 reports the results of two-way ANOVAs with *Low_Achiever* and *Video_Viewer* as the main effects, together with their interaction. The *F* statistic for *Low_Achiever* tests for the effect of incoming GPA on the change in exam scores after controlling for the effect of video viewing. The *F* statistic for *Video_Viewer* tests for the effect of viewing the supplementary videos on the

change in exam scores after controlling for the effect of incoming GPA. The *F* statistic for the interaction of *Low_Achiever and Video_Viewer* tests for the combined effect and indicates whether video viewing had a differential effect on the change in exam scores for low-achieving students as compared to other students.

As shown for panel A, Table 2, the main effects of *Low_Achiever* and *Video_Viewer* are significant, suggesting that both incoming GPA and video viewing impacted exam performance. The former result is not surprising, given that GPA is a standard measure of academic achievement. The latter result, however, suggests that when changes in exam scores are averaged over all students, those who viewed the supplementary videos exhibited larger increases in their exam scores relative to those who did not. This result supports H1. Also significant is the interaction of *Low_Achiever* and *Video_Viewer*, indicating that low-achieving students who watched the supplementary videos obtained a significantly larger increase in their exam scores than those who did not. This result supports H2.

One concern with the test reported for panel A of Table 2 is that students in the highest GPA tercile might have experienced a ceiling effect. Such an effect could arise because those who scored the maximum of 30 points on the first midterm exam could only increase their score by 20 points before reaching the maximum of 50 points on the cumulative final exam. Although few students achieved perfect 50-point scores on the cumulative final exam, we tested the robustness of our earlier finding by running a second ANOVA with a reduced sample that removed students in the highest GPA tercile. The ANOVA with this reduced sample tests for the effect of video viewing on the change in exam scores for students in the lowest and middle GPA terciles, none of whom obtained perfect scores on either of the two exams. We report the results of this test in panel B of Table 2.

As shown in panel B, the main effect of *Low_Achiever* is no longer significant. The lack of significance of this variable suggests that students in the lowest- and middle-GPA terciles exhibited similar changes in their exam scores between the first and final exams. The variable *Video_Viewer* and its interaction with *Low_Achiever*, however, remain significant. These findings again support H1 and H2 and indicate that supplementary videos are both an effective learning aid in introductory financial accounting courses and a valuable tool for helping low-achieving students realize their potential.

Another concern arises because three of the 11 videos were available to students before the first midterm exam, possibly affecting subsequent viewing habits and the change in scores between the first midterm exam and the final exam. Among low-achieving students, 16.19 percent watched one or more of the original three videos, and this percentage increased to 40.29 percent for videos after the first midterm exam. Similar increased viewing occurred among the other terciles: 18.28 percent of those in the moderately achieving tercile watched videos

prior to the first midterm exam, increasing to 47.39 percent after; 21.00 percent of those in the high-achieving tercile watched videos prior to the first midterm exam, increasing to 52.67 percent after. As expected, a chi-square test shows that there is an association between incoming GPA tercile and the proportion watching videos—the higher the incoming GPA tercile the greater the probability of watching videos. However, when we re-run our analyses and define *Video_Viewer* as 1 for a student who watched one or more of the original three videos (rather than using viewing that occurred after the first midterm exam) and zero otherwise, we find no significant relationship between watching versus not watching any of the initial three videos and the change in scores between the first and final exams. As such, it does not appear that our results are being driven by differences in the percentage watching the videos before and after the first midterm exam.

CONCLUSION

This paper addresses two questions. First, it asks whether short, supplementary, instructor-created videos improve overall accounting student performance. Second, it asks whether the benefit of such videos accrues more to low-achieving students than other students. We examine these questions within the context of an introductory financial accounting course—a class with broad enrollment and a variety of important accounting and business concepts.

We find that students who view supplementary videos show a significant and positive improvement in grade performance. We also find that this positive improvement is more pronounced among low-achieving students—a result that is robust even after controlling for a ceiling effect among high-achieving students.

The findings of this paper should be of interest to business school administrators and instructors who are faced with the task of improving graduation rates. Introductory accounting courses are often required of many students across a diverse range of majors. Yet, many of these students are poorly prepared for the analytical thinking required of the discipline [e.g. Kealey, Holland, and Watson, 2005]. Traditional methods of improving performance, such as tutoring, labs, and study sessions, are time consuming and expensive. This paper examines a low-cost alternative to these traditional methods and finds that short, supplementary instructor-created videos can improve exam performance in introductory financial accounting courses.

Because this study is exploratory in nature, it does not address why videos improve exam scores more for low-achieving students than others. The literature on this issue is sparse. In one of the few studies of the effect of videos on low-achieving students' academic performance, Kolikant and Broza [2011] found that math videos were effective only when they were context relevant and able to provide personal meaning to the struggling student. Related explanations, however, are also conceivable. Possibly, a greater number of these students are visual learners. Alternatively, some of these students may substitute videos for other

forms of study, such as participating in classroom exercises, reading the textbook, and working problems. For now, we leave the answer to this important question to future research.

Another limitation of our study is its failure to address whether videos increase the efficiency of students' study. During the semester, many high- and moderately achieving students commented on the usefulness of the videos in targeting their study and quickening the pace of their learning. Our study, however, does not measure this effect, focusing only on the change in exam scores. The study also does not examine effects related to students' video viewing habits or accounting background. For example, we do not address whether the frequency or duration of video viewing affects learning or exam performance. We also do not examine the effectiveness of supplementary videos in advanced accounting courses, where both the student audience and subject matter are more sophisticated. Our exploratory work in both of these areas suggests a more nuanced relationship than that examined in this paper, and we encourage future pedagogical research that investigates these and other related questions.

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APPENDIX: VARIABLE DESCRIPTIONS

Low_Achiever is an indicator variable equal to 1 if a student's incoming GPA (grade point average before any accounting courses, calculated using a 5-point scale where 4.0 = A) falls in the lowest tercile of the GPA distribution, and 0 otherwise.

Video_Viewer is an idicator variable equal to 1 if a student views one or more supplementary, instructor-created videos after receiving feedback about performance on the first midterm exam and before the cumulative final exam, and 0 otherwise.

Δ*Exam_Score* is the difference between a student's scores on the cumulative final exam (50 points possible) and the first midterm exam (30 points possible).