Did COVID-19 Impact Student Learning in an Introductory Accounting Course?

Janet A. Meade, University of Houston – Houston, Texas, USA
Kiran Parthasarathy, University of Houston – Houston, Texas, USA

ABSTRACT

This study examines how performance on an introductory managerial accounting course's final exam was affected by the learning behaviors of students impacted by the COVID-19 transition to online instruction. Using a 2x2 design, we classify students into four learning modes based on the accuracy of responses to in-class polling questions and the viewing of instructor-created videos. Polling accuracy serves as a proxy for learner-to-instructor interaction and video viewing proxies for learner-to-content interaction. Results indicate that students who increased both types of interaction after the COVID-19 transition outperformed all others on the final exam. Likewise, those who increased learner-to-content interaction while reducing learner-to-instructor interaction also performed well, but at a lower level. Students who reduced both types of interaction underperformed the other two groups. The findings emphasize the importance of using mixed-mode teaching methods that increase learner interactions and enhance online learning.

Keywords: COVID-19, accounting, learner-to-instructor interaction, learner-to-content interaction, online instruction

INTRODUCTION

The COVID-19 pandemic forced educators around the world to abruptly transition their courses from traditional face-to-face instruction to nontraditional online delivery (e.g., Daniel 2020). The transition disrupted higher education and left many students struggling to modify their learning behaviors. This research examines the impact of changes in student learning behaviors after the COVID-19 disruption on exam performance in an introductory managerial accounting course.

The question we address is important to the future of the accounting profession because of the role accounting education plays in developing the supply of future accountants. Accounting programs must deliver effective learning experiences if they are to continue attracting high-quality individuals into the profession (e.g., Pathways Commission 2012). By extension, accounting educators must understand how the COVID-19 disruption impacted student learning behaviors, as well as the consequence of changes in those behaviors, if they are to adapt their teaching techniques to the new normal. Our paper seeks to shed light on this change and to foster innovation in the teaching of accounting and related business topics.

RELATED RESEARCH

Few studies to-date have examined the impact of the COVID-19 disruption on higher education and student performance. Tartavulea et al. (2020) surveyed 114 professors and 248 students in 13 European countries about the pandemic. Their results showed a move to largely passive delivery with reduced opportunities for interaction. Additionally, both professors and students indicated that they perceived online instruction to be less effective than face-to-face teaching.

Guo (2020) compared student performance in an introductory calculus-based physics class which moved its instruction from a face-to-face format to an online format during the COVID-19 pandemic. Guo found that students who regularly attended the online class outperformed those who did not. He also found that students who did not attend regularly perceived the course as more difficult and felt they spent more time on the class than those who attended regularly. Gou's findings, however, were based on only 21 students and his course provided limited opportunity for multiple types of learner interaction.

Beyond these two studies, most of the literature on the pandemic and higher education is largely descriptive and only a few studies are specific to accounting or business education (e.g., Aguilera-Hermida, 2020; Alqahtani and Rajkhan, 2020; Bao, 2020; Lowenthal et al., 2020; Pohle, 2020; QS, 2020; Maritz, 2020; Niemotko and Tolan,

2020; Sangster et al., 2020). A common theme among most of this literature, however, is a call for studies that examine the effectiveness of online instruction.

Effective online instruction requires student engagement, and engagement is generally best developed through interaction (Anderson, 2003). Before the COVID-19 disruption, most interaction took place in physical classrooms. The pandemic altered the delivery of higher education and, in so doing, impacted the types of interaction available to students. Moore (1993) identified three types of interaction inherent in effective online courses: learner-to-instructor, learner-to-learner, and learner-to-content. DeVries (1996) found that when at least one of these forms of interactions is incorporated into teaching, positive results are associated with student achievement and satisfaction. Lear et al. (2010) found that interactions with peers, instructors, and content help online learners create interactivity and a sense of community and that these correlate with positive learning outcomes.

Learner-to-content interaction is the most fundamental of the three types. The process traditionally identified as "learning" takes place when a student interacts with the subject matter or course content. Content can take the form of text, audio, video, graphic imagery or some combination. Learner-to instructor interaction is the type typically associated with the lecture format (many-to-one), but it can also occur in other forms (one-to-one) and either asynchronously (i.e., emails, discussion boards) or synchronously (i.e., online tutorials, videoconferencing, real time chats). Learner-to-learner interaction involves activity in which learners collaboratively gain mastery of the subject matter or course content (e.g., Bryant et al., 2005; Dutton, 2019).

Martin and Bolliger (2018) examined student perceptions of the importance of the three types of online learner interaction. They found that students viewed learner-to-instructor interaction as the most important, followed closely by learner-to-content interaction. When asked to rank various strategies for creating engagement in an online environment, students placed high value on synchronous meetings that required student participation (learner-to-instructor) and videos that supported a flexible approach to learning (learner-to-content). We build on these findings and examine how students adapted their learning behaviors in response to the COVID-19 pandemic in an introductory managerial accounting course. The course transitioned its delivery from face-to-face instruction to virtual online meetings through Zoom. The online meetings continued the best practices of the face-to-face class in that it required student interaction via in-class polling questions. Throughout the semester, students were also encouraged to augment their learning by viewing instructor-created videos of the course's content. The course we study, therefore, provided students with the two types of interaction considered necessary for successful online instruction: learner-to instructor and learner-to-content. Using proxy measure for these two types of interaction, we examine how students adapted to the online learning environment created by the pandemic and whether their adaptive learning behaviors contributed to effective learning.

EDUCATIONAL SETTING

In response to the COVID-19 pandemic, 10 sections of an introductory managerial accounting course moved from face-to-face instruction to online synchronous delivery via Zoom in mid-March 2020. The move to online instruction affected 1,019 business students enrolled in the course. All sections of the course were coordinated by the same instructor and initially were held on the campus of a large, public, doctoral degree-granting university having undergraduate enrollment of approximately 38,000 students. The university follows a semester system consisting of two 15-week terms, one in the fall and one in the spring. The spring semester in 2020 began in January and concluded in May. The introductory managerial accounting course we study is the second accounting course in a two-course sequence and its topics include job and process costing, capital budgeting, ABC costing, master budgets, performance evaluation, product costing and pricing, business decision evaluations, and cost-volume-profit analysis. Most of the students enrolled in the course are freshmen or sophomores.

Course materials included a textbook, which came with publisher-created learning aids, and instructor-created lecture notes, available to students on the course management system (CMS). Course grades were determined based on student scores on three exams, in-class polling questions, and out-of-class homework assignments. A small portion of the course grade was also based a student's video viewing, but this accounted for only 1.4 percent of the final grade. As an aid to learning, students also had access both before and after the transition to supplementary instructor-created videos embedded in the CMS. 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. The presentation and content in the videos mirrored the in-class lectures in that they walked through the steps involved in performing various managerial accounting calculations, but they lacked polling or quiz questions

and instructor/student interactions. Collectively the videos covered all the material in the course. Viewing patterns of the videos for each student were tracked by the CMS.

Prior to the move from face-to-face instruction to online synchronous delivery, some students had viewed videos related to material tested on the first exam and some had responded to the related in-class polling questions. All students had completed the first exam and assigned homework. After the transition to online instruction, students completed two additional exams, as well as the remaining homework assignments and in-class polling questions. They were also encouraged to view the remaining videos. Both before and after the online transition, students were incentivized to attend the face-to-face and online Zoom meetings by including polling scores in the calculation of the final grade. Students were also incentivized to view the instructor-created videos, but this component of the course's learning activities accounted for only a small portion of the final grade.

METHODOLOGY

This study examines how performance on the course's final exam was affected by the learning behaviors of students impacted by the COVID-19 transition to online instruction. The managerial accounting course which we study had 1,019 students enrolled, of which 978 received scores on both the first and final exams. Using a 2x2 design (e.g., Mukerjee and Wu 2006), we classify these students into four learning modes based on two learning behaviors observed in the pre- and post-COVID-19 transition period: (1) the accuracy of responses to in-class polling questions and (2) the viewing of instructor-created videos. We treat polling accuracy as a proxy for learner-to-instructor interaction. We allow video viewing to proxy for learner-to-content interaction. Prior research shows that both types of interaction are important dimensions to the learning of complex subjects, such as accounting (e.g., Arbaugh and Benbunan-Fich, 2007; Strauss and Terenzini, 2007). Learning mode 1 is composed of students whose polling accuracy and video viewing decreased in the post-transition period. Learning mode 2 is composed of students whose polling accuracy decreased in the post-transition period, but whose video viewing increased. Learning mode 3 is composed of students whose polling accuracy increased in the post-transition period, but whose video viewing decreased. Learning mode 4 is composed of students who increased both their polling accuracy and video viewing in the post-transition period. Table 1 presents descriptive statistics for these modes of learning.

Table 1. Descriptive Statistics

	Learning Mode			
Learning behavior	1	2	3	4
Polling accuracy	Decrease	Decrease	Increase	Increase
Video viewing	Decrease	Increase	Decrease	Increase
Performance (mean / median)				
First midterm exam score	70 / 70	73 / 77	69 / 70	70 / 74
Cumulative final exam score	63 / 68	70 / 72	65 / 68	71 / 72
Change in exam score	-7 / -2	-3 / -5	-4 / -2	1 / -2
Sample n	302	294	150	232

Although the mean and median scores on the cumulative final exam were generally lower than those on the first midterm exam, the decline is within the historical range of scores for students enrolled in prior semesters. Similar to most accounting courses, the material becomes more challenging as the course progresses. Additionally, the cumulative nature of the final exam requires that students not only perform basic managerial calculations, but that they also exhibit an ability to integrate concepts across managerial topics.

The dependent variable in our analysis is *ExamDiff*, which measures the difference between a student's score 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 (Plosser et al., 1982). However, it does not control for ceiling effects or regression toward the mean. We address these concerns using the indicator variable *Achieve*, which

controls for differences in the four group's scores on the first midterm exam. *Achieve* is equal to 1 when a student's score on the first midterm exam is above the median, and 0 otherwise.

RESULTS

Table 2 reports the results of an ANOVA with *ExamDiff* as the dependent variable and *Learning_Mode* and *Achieve* as independent variables. *Learning_Mode* is a categorical variable having four levels corresponding to the changes in learning behaviors reported in table 1. Because the four learning modes have an unequal number of observations, the appropriate sums of squares test is Type II, which assesses differences between the least square means when *Achieve* enters the model before *Learning_Mode.* As shown, both variables are significant at the 1 percent level. The adjusted R-squared statistic for the model is 0.213, which indicates that the two independent variables are able to explain about one-fifth of the variation in *ExamDiff*. Supplemental analysis indicates that the interaction between the two independent variables is not significant and, as such, it is not included in the model. Significance levels are based on two-tailed tests.

Table 2. Effect of Learning Modes on Change in Exam Scores

	Dependent variable = *ExamDiff*					
Variable	**Df**	**Type II SS**	**Mean Square**	**F value**	**Pr > F**	**Adjusted R^2**
Learning_Mode	3	4584.73	1528.24	5.13	0.0016	0.213
Achieve	1	72016.34	72016.34	241.74	<.0001	
n=978						

*df= degrees of freedom; SS=sums of squares.

Table 3 reports the least square means of *ExamDiff* for the four learning modes, as well as pairwise comparisons between the modes. Least square means are more appropriate for pairwise comparison than arithmetic means because the number of observations in each learning mode is unequal. Directionally the least square means are similar to the arithmetic means (reported in table 1) for learning modes 1, 2, and 3, all of which display a decline in scores between the first and final exams. The least square mean of *ExamDiff* for learning mode 4, however, is also negative and differs directionally from the arithmetic mean, which is positive. This difference arises because the least square means are calculated after controlling for individual student performance in the pre-transition period. Among the pairwise comparisons, learning mode 4 is associated with a significantly smaller decline in *ExamDiff* than the other three learning modes. Conversely, learning mode 1 is associated with a significantly larger decline in *ExamDiff* than learning mode 2. Not significantly different are the declines in *ExamDiff* for learning modes 1 and 3, and 2 and 3.

Table 3. Pairwise Comparisons of the Effect of Learning Modes on Change in Exam Scores

	ExamDiff	**Pairwise Comparisons**		
	Least Squares	**Dependent variable = *ExamDiff***		
Learning Mode	**Means**	2	3	4
1	-6.58	0.0445	0.2215	0.0001
2	-3.73		0.6709	0.0454
3	-4.47			0.0372
4	-0.69			

Overall, students who elected to increase both learner-to-instructor and learner-to-content interactions (learning mode 4) continued to perform well in the course, with little difference between scores on their first and final exams. Interestingly, these students were not the highest scoring group on the first exam. But they responded positively to the COVID-19 disruption and adapted to the new learning environment by increasing their in-class participation and out-of-class study. In contrast, students who disengaged from the synchronous online instruction and reduced their out-of-class study (learning mode 1) were unable to maintain the scores they received on the first exam before the disruption. Consequently, their final exam scores dropped markedly from those on the first midterm exam. Our results suggest that had these students increased their out-of-class study, such as was done by students in learning

mode 2, they could have averted much of the decline in their exam scores even if they did not increase participation in the synchronous online instruction.

Our results also suggest that merely increasing participation in the synchronous online class was not enough to prevent a decline in scores between the first and final exams. Like students in learning mode 4, those in learning mode 3 participated more in the online class than in the face-to-face class. However, the mean *ExamDiff* for students in learning mode 3 is not significantly different from those in learning modes 1 and 2. One possible explanation for this is the tendency for learners to multitask during online instruction, possibly because instructors and peers are not physically present (e.g., Lepp, et al., 2019). Depending on situational factors, such as home life and broadband reliability, online instruction may also create feelings of frustration and fatigue, as well as burnout from "Zoom hangovers" (e.g., Lowenthal, et al., 2020). Our results suggest that asynchronous study, when used as a supplement to synchronous online instruction, counterbalances some of the negative attributes associated with online delivery and encourages, rather than discourages, engagement during the synchronous online instruction.

One concern highlighted by our study is the sizeable number of students who opted to disengage from the synchronous online class after the COVID-19 disruption. Students in learning modes 1 and 2, both of whom reduced their in-class participation after the move to the online format, comprised over 60 percent of the students enrolled in the course. While it is possible that the large number of students who chose to disengage from the online class did so because of changes in their personal situation (elevated demands at work, disruption in child care services, need to home school children, etc.) it is also possible that some found themselves suffering from Zoom fatigue after all their courses moved to an online format. Additional research on this question is warranted.

CONCLUSION

This study examines how changes in student learning behaviors affected performance on an introductory managerial accounting course's final exam following the COVID-19 transition to online instruction. Using a 2x2 design, we classify students into four learning modes based on the accuracy of response to in-class polling questions and the viewing of instructor-created videos. We consider polling accuracy as a proxy for learner-to-instructor interaction and video viewing as a proxy for learner-to-content interaction. We find that students who increased both types of interaction after the COVID-19 transition continued to perform well in the course, with little difference between scores on their first and final exams. Similarly, students who increased learner-to-content interaction, but who decreased learner-to-instructor interaction, also performed well, but at a lower level. In contrast, students who reduced both learner-to-instructor and learner-to-content interactions underperformed the other two groups. Our findings provide further evidence of the multidimensional nature of learning and reinforce the need for faculty to create engaging online content that allows for both synchronous and asynchronous study.

One limitation of this study is that it examines the performance of students in only one course during a semester marked by an unanticipated disruption. Another limitation is that we do not measure the extent to which a student increased or decreased learning behaviors. We are therefore unable to determine whether a threshold level of effort is required before a specific form of learner interaction impacts learning outcomes. We leave it to future research to re-examine this question across multiple courses and semesters, where both students and faculty are better prepared for the new virtual classroom. We fully expect rapid innovation in online instruction and a plenitude of research related to learner interactions. Our study is intended as a small step toward a better understanding of how the online learning behaviors of students affect learning outcomes. We encourage future research that builds upon our work, as well as studies that examine related topics such as the efficacy of online exams, virtual tutoring labs, and elearner-to-elearner interaction.

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Janet A. Meade, PhD, CPA, CGMA, is an associate professor at the C. T. Bauer College of Business, University of Houston. Her research interests include taxation, investment planning, tax lobbying and accounting education.

Kiran Parthasarathy, PhD, MBA, MIB, is an instructional assistant professor at the C.T. Bauer College of Business, University of Houston. She is the Faculty Director of the Principles Accounting Courses. Her research interests include accounting education, financial markets, debt markets, accounting conservatism, corporate governance and financial risk management.