The Effect of Learning Modality on Subsequent Courses in the Finance Major: Does Online Learning Impact Student Success?

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This paper investigated the impact of learning modality of the fundamental finance course on student success in subsequent finance courses. We studied students' characteristics, learning modality, and learning outcomes in a sequence of finance courses at the Texas Woman's University from 2013 to 2020. We found students who took the fundamental finance course (FIN1) online performed better in the second finance course (FIN2). This effect was robust after we controlled for year fixed effects and factors considered to influence student performance. To treat the selection issue of choosing to take FIN1 online, we utilized 2SLS and main results still hold.

Keywords: learning modality, online vs face-to-face, finance course sequence, learning outcome, knowledge retention

INTRODUCTION

Over the last twenty-five years the use of online learning platforms for course delivery has continued to grow, outpacing the growth of traditional courses in many disciplines such as education, social sciences, and business. This trend is expected to continue (Atchley, Wingenbach and Akers 2013; Berger & Lyon, 2005; Palloff & Pratt, 2003; Harasim, 2000). Students choose online courses for several reasons: the format allows students to make progress toward their degrees despite full time work, family, and other obligations. Digital natives have greater proficiency and preference for using the technology. Online format usually allows students better access to course materials, especially class recordings. Most recently the Covid19 pandemic necessitated the move to fully online courses, increasing the rate of adoption of this mode of instruction across the educational spectrum. There has been an assumption that distance education is less desirable for delivering content effectively in more complex, quantitative disciplines such as Finance. Even so, business schools nationwide are shifting significant percentages of their offerings to online formats. This creates both challenges and opportunities for faculty. Faculty and administrators planning schedules need to better understand the impact of online instruction for students in quantitative majors such as finance,

where each successive course in the discipline builds on the competencies of a previous course. Although many studies research courses in the social sciences, education, and business, there are far fewer studies examining the effectiveness of online instruction as students' progress through their major.

Our study extends current research in Finance education by examining the effect of learning modalities throughout a student's major. Students completing the Finance major take three successive courses. Business Finance (FIN1) covers the first half of an introductory corporate finance text and prepares students to succeed in Financial Management (FIN2), which covers the second half of the book. The capstone course, Finance Policy and Strategy (FIN3), covers topics in an intermediate level Corporate Finance textbook. Finance majors are required to take all three courses in sequence. Our purpose was to measure whether the choice of delivery mode (traditional/online course) in introductory Finance courses has any effect on successive, more advanced courses in the discipline.

LITERATURE REVIEW

Choice of Modalities

Many studies in the Finance discipline compared online students to those taking a live class (Bertus, 2006; Kruck & Lending, 2003; Terry, 2002;). Most of these studies examined the significant differences between online and traditional students in terms of their success in the course as evidenced by their grades. The evidence in these studies is quite mixed: some studies found that students in traditional sections performed better than their online counterparts (Brau et al., 2017; Farinella, 2007; Brown, 2002). Others found that online students scored higher than students in live courses (Atchley et al., 2013; Bertus. 2006). Still other studies found no significant differences between the two modalities (Arbaugh et al. 2009). Atchley et al (2013) analyzed retention rates and other measures of success such as grades across disciplines. Their meta-analysis of 300 studies between and 2000 and 2008 found that the two modalities were essentially comparable (Wingenbach & Akers, 2013).

Demographic Factors

Other studies identified exogenous or demographic factors that may contribute to student success in online courses. Past research (Yukseltkurk & Top, 2013; Boling et al., 2012; Anderson, 2008; Bertus, 2006; Terry 2002; Kruck & Lending 2003) suggests that prior grades in prerequisite courses, major, gender, and especially cumulative GPA were significant predictors of student performance.

GPA

Several studies argued that GPA tends to be the largest indicator of performance success and accounts for much of the variance between online and face-to-face classes regardless of delivery mode (Davisson & Bonello, 1976, Arbaugh et al., 2009, Wilson & Allen, 2011).

Age

Since older students are more likely to enroll in online courses and tend to be better students, a student's age may also positively impact performance (Anderson, Benjamin, & Fuss, 1994; Wilson & Allen, 2011). However, Kotey (2006) found that age was not related to performance.

Major

Finance majors tend to be more engaged in Finance courses than non-Finance majors, and therefore choice of major tended to be a strong predictor of performance (Bertus, Terry, & Andy, 2002).

Gender

Several studies found that females generally performed worse than males and were less enthusiastic about finance and economic courses (Brau, Cardell, Holmes, & Wright, 2017; Brau, Holmes, & Israelsen, 2019; Brau, Brau, Rowley, Mac, & Swenson, 2017; Chen & Volpe, 2002; Anderson, Benjamin, & Fuss, 1994; Brown & Liedholm, 2002).

Prerequisite Course Performance

Guidry's (2015) study found that students who took the online format of a prerequisite finance course performed half a grade higher in a subsequent higher level finance course than did students who took the prerequisite face to face. However, she did not control for a variety of other exogenous factors shown to influence success in Finance courses. In other studies, student performance is measured within the same course, such as how well the student performs on a final exam (Brau et al 2017 and Farinella 2007).

METHODOLOGY

Research Setting

In contrast to other business courses such as introductory courses in Management and Marketing that have significant qualitative content, there is evidence that students taking finance courses online underperform students taking the same course face-to-face. For example, Farinella (2007) found that students taking an online version of an introductory finance course significantly underperformed students taking the course in the traditional classroom. In this study, we measure how the delivery modality (online or in the classroom) of the introductory Finance course affects the performance of students in the second required course in the Finance major. The first course, FIN1, is a prerequisite for FIN2, which is in turn a prerequisite for FIN3. Business Finance (FIN1) is the first finance course Business students take and covers the usual first chapters of an introductory Corporate Finance textbook. Financial Management (FIN2) covers the second half of the introductory Corporate Finance textbook. Finance Policy and Strategy (FIN3) covers topics in an intermediate level Corporate Finance textbook. Finance majors are required to take all three courses. Management and Business Administration majors are required to take FIN1 and FIN2. All Business majors are required to take FIN1. We want to know whether taking FIN1 online or in the classroom has any impact on their performance in FIN2 and in FIN3, and if the format of FIN2 has any impact on student performance in FIN3.

FIN1 covers what is usually the first several chapters in a typical introductory level corporate finance textbook, while FIN2 covers the remaining chapters. Much of the material that students learn in FIN1, such as time value of money, financial statement analysis, risk and return, valuation, capital budgeting, and cost of capital, are essential for understanding the topics covered in FIN2, which includes capital structure, dividend policy, working capital management, financial forecasting, and planning, mergers, and acquisitions, and more. If students do well in FIN1, they are better prepared to learn the topics in FIN2. FIN3 revisits many of the topics covered in the previous two courses, but at a more advanced level. The Capstone course, FIN3, emphasizes the intuition behind financial theories and concepts, provides a deeper understanding of these topics and requires more complex critical thinking. Based on the different fociof FIN2 and FIN3, we tested the impact of learning modality on FIN2 and FIN3 separately and have two sets of hypotheses.

Hypotheses

Based on existing literature with mixed findings, we proposed null hypotheses. Our first hypothesis is: The online introductory Finance course (FIN1) equally prepares students for the second Finance course (FIN2) containing introductory material as the face-to-face course does.

H10: *Students who take FIN1 online perform equally well in FIN2 as students who take FIN1 face to face.*

H11: *Students who take FIN1 online do not perform equally well in FIN2 as students who take FIN1 face to face.*

Our second hypothesis is: The online first and second Finance courses (FIN1 and FIN2) equally prepare students for the third Finance course (FIN3) containing intermediate material as the face-to-face course does.

H20: Students who take FIN1/FIN2 online perform equally well in FIN3 as students who take FIN1 face to face.

H21: Students who take FIN1/FIN2 online do not perform equally well in FIN3 as students who take FIN1 face to face.

Arias (2018) pointed out that an experiment that isolates the effect of an online relative to face-to-face class should randomly assign students to course format. Otherwise, students would gravitate to the course format (online or face-to-face) in which they believe they would most likely excel. This confounding effect would render the experiment a convenience sample, and not a truly random study. This is also true of our study since we used historical data. Students chose the online format based on their preference and course availability. Arias (2018) also pointed out that instructors may gravitate toward the format they prefer given the opportunity. Not randomly assigning students to either course format, however, is somewhat mitigated by the fact that students often did not have a choice of course format when they enrolled in FIN1 and FIN2. In some semesters, FIN1 and FIN2 were only offered in the classroom or online. In addition, we utilized 2SLS to treat the selection of taking FIN1 online to find whether there is any effect of learning modality after we consider the selection issue.

Sample Descriptions

Texas Woman's University has been offering FIN1 in online format since 2013. We collected class performance data for each FIN1, FIN2, and FIN3 courses offered since 2013, keeping student ID, scores, class format (online or face-to-face), semester, year, and instructor information. We collected student information data from Registrar's office to get cumulative GPA, total credit hours the student has taken when they took FIN1, age, gender, and other major variables. Our sample consisted of 307 observations for students who took both FIN1 and FIN 2 after 2013 and 109 observations for students who took all three courses since 2013. Table 1 shows the distribution of student learning modality of taking FIN1, FIN2, and FIN3.

TABLE 1A
CROSSTABULATION OF STUDENTS IN THE FIRST AND THE SECOND FINANCE COURSE BY DELIVERY MODE

307 total students	FIN2 Face-to-Face (208 students, 68%)	FIN2 Online (99 students, 32%)
FIN1 Face-to-Face (120 students, 39%)	110 (35.8%)	10 (3.3%)
FIN1 Online (187 students, 61%)	98 (31.9%)	89 (29.0%)

TABLE 1B
PERCENTAGES OF ONLINE AND FACE TO FACE STUDENTS TAKING THE MOST ADVANCED FINANCE COURSE

109 Total Students	Number of Students (Percentage of 109 total students)
FIN1 Classroom and FIN2 Classroom	51 (46.8%)
FIN1 Classroom and FIN2 Online	5 (4.6%)
FIN1 Online and FIN2 Classroom	35 (32.1%)
FIN1 Online and FIN2 Online	18 (16.5%)

Of the 307 students that took both FIN1 and FIN2, 35.8 percent took both courses face-to-face, 29 percent took both courses online, 31.9 percent took FIN1 online but took FIN2 in the classroom, and 3.3 percent took FIN1 in the classroom and FIN2 online. The distribution represented in Table 1 would have been determined by both student choice and the availability of online and face-to-face sections. We can see that students have their own preference when they chose whether to take FIN1 online or face-to-face, because who chose FIN1 face-to-face were very likely to take FIN2 face-to-face. That does not hold for students who chose FIN1 online because there were very limited FIN2 sections offered online.

Of the 109 students that took all FIN1, FIN2, and FIN3, 51 (46.8%) of them took FIN1 and FIN1 both face-to-face; 5 (4.6%) of them took FIN1 face-to-face and FIN2 online; 35 (32.1%) of them took FIN1 online and FIN2 face-to-face; 18 (16.5%) of them took FIN1 online and FIN2 face-to-face. FIN3 has been instructed 100% face-to-face before the COVID-19 Pandemic.

Table 2a shows summary statistics of major variables used in our analyses. The full list of variable descriptions can be found in Appendix. We can see that 60.9% of students in our sample took FIN1 online and the rest 39.1% took FIN1 face-to-face, while only 32.2% of students took FIN2 online. Fewer students chose to take FIN2 online because there are fewer FIN2 sections offered online. This fact implies that choice of taking FIN1 or FIN2 online is not random. We needed to treat the selection of learning format in our analyses. The AGE, Female, and Total Credit Hours of our student samples matched the typical student profile at TWU where Median AGE is 22, and the 75th percentile is 27. Our student body consists of non-traditional students who have work experience and did not start to attend TWU right after graduating from high school. About 90% of our sample was composed of female students, matching well with the TWU student body. The median Total Credit Hours was 89, indicating that students took FIN1 during or after their junior year.

TABLE 2A
SUMMARY STATISTICS

Variable	N	Mean	Std Dev	1st Pctl	5th Pctl	Lower Quartile	Median	Upper Quartile	95th Pctl	99th Pctl
FIN2Score	307	77.546	12.192	40.38	54.30	70.92	79.63	86.99	93.18	95.45
FIN3Score	109	74.066	16.243	21.83	47.31	65.94	75.09	85.88	96.31	97.30
FIN1Online	307	0.609	0.489	0	0	0	1	1	1	1
FIN1Score	307	82.289	10.996	54.40	62.87	75.13	84.53	91.18	96.09	99.39
FIN2Online	307	0.322	0.468	0	0	0	0	1	1	1
Major	307	1.893	0.827	1	1	1	2	2	4	4
Female	307	0.899	0.302	0	0	1	1	1	1	1
Instructor	307	0.420	0.494	0	0	0	0	1	1	1
Age	307	24.883	6.289	19	20	21	22	27	41	46
Summer	307	0.189	0.392	0	0	0	0	0	1	1
Total Cr. Hours	307	89.541	20.612	52	61	75	89	100	125	148

This table reports the number of observations, mean, standard deviation, 1st percentile, 5th percentile, 25th percentile, median, 75th percentile, 95th percentile, and 99th percentile of major variables used in the paper. FIN1Score, FIN2Score and FIN3Score are the numeric scores of the first, second, and third finance courses, Business Finance, Financial Management, and Finance Policy and Strategy. FIN1Online and FIN2Online are the dummy variables of whether the first or second finance course is of online format (dummy=1) or face-to- face format (dummy=0). Major is a discrete variable defined as 1 if the student's declared major was Finance, 2 if the student's declared major was Management, 3 if the student's declared major was Accounting, and 4 otherwise. Female is the dummy variable of student gender with 1 as female and 0 as others. Instructor is the dummy variable of two instructors who taught the first finance course, FIN1. Age is the student age when they took FIN1. Summer is the dummy variable whether the student took FIN1 in summer (dummy=1) or not (dummy=0). Total Credit Hour is the discrete numeric variable of

total number of credit hours the student has taken when FIN was taken. All variable descriptions can be found at Appendix.

TABLE 2B
PAIRWISE COMPARISON

Variables	FIN1 F-t-F	FIN1 Online	Diff (Ftf-Online)	
FIN2Score	75.955	78.567	**-2.612**	*
FIN3Score	74.470	73.639	0.832	
FIN1Score	83.059	81.795	1.264	
Major	1.842	1.925	-0.083	
Female	0.875	0.914	-0.039	
Instructor	0.458	0.396	0.062	
Age	23.2	25.963	**-2.763**	***
Summer	0.133	0.225	**-0.092**	**
Total Cr. Hours	82.071	94.335	**-12.264**	***
GPA	3.157	3.097	0.06	

Table 2b shows the differences in various characteristics between students who took FIN1 online and those who took it face-to-face. First, students who took FIN1 online had significantly higher scores in FIN2 than their peers who took FIN1 face-to-face. The two groups of students did not exhibit a significant difference in scores in the other two finance courses, FIN1 and FIN3. Secondly, students who took FIN1 online were older, had more total credit hours and were more likely to have taken FIN1 in summer. The average age of students who took FIN1 online was 25.963, 2.763 years older than students who took FIN1 face-to-face. Intuitively, older students are more likely to be part-time students and/or have children, making them prefer taking classes online. Students who have more credit hours also tend to be more disciplined in handling their schoolwork (i.e., taking classes online). In summer, the majority of FIN1 sections were offered online, and students didn't have a choice. So, summer course selection was not random. Students could be reluctant to choose FIN1 online because they could not register for the face-to-face format.

Pearson correlations between variables are presented in Table 3. Not surprisingly, all course scores are significantly correlated with each other, depending on students' natural capability of course work and discipline. The choices of taking FIN1 online and FIN2 online are also significantly correlated, indicating that the selection of learning format is not random. This is consistent with the results of Table 2b, where *Age, Summer*, and *Total Credit Hours* are significantly correlated with the choice of taking FIN1 online.

TABLE 3
PEARSON CORRELATIONS

	FIN2 Score	FIN3 Score	FIN 1 Online	FIN1 Score	FIN2 Online	Major	Female	Instructor	Age	Summer	Total Cr. Hours
FIN2Score	1.000										
FIN3Score	0.581***	1.000									
FIN1Online	0.105*	-0.026	1.000								
FIN1Score	0.544***	0.372***	-0.056	1.000							
FIN2Online	0.078	0.075	0.410***	-0.029	1.000						
Major	-0.060	-0.028	0.049	-0.008	-0.011	1.000					
Female	0.029	0.031	0.064	0.092	0.046	0.048	1.000				
Instructor	-0.162***	-0.176*	-0.062	0.216***	-0.263***	0.071	0.022	1.000			
Age	0.028	0.109	0.215***	0.073	0.247	-0.117**	-0.013	0.111*	1.000		
Summer	0.029	0.056	0.114**	0.083	0.130**	-0.038	0.051	0.162***	-0.014	1.000	
Total Cr. Hours	0.028	0.055	0.291***	-0.069	0.182	0.029	-0.035	0.055	0.178***	0.104*	1.000

This table shows Pearson correlations of pairs of variables. All variable descriptions can be found at Appendix. ***, **, and * indicates the significance levels of 1%, 5%, and 10% respectively.

Overall, our univariate results imply that taking FIN1 online has a positive correlation with FIN2 scores, and the choice of taking FIN1 online is highly correlated with students' age, students' total credit hours, and whether they took FIN1 in summer.

Research Methodology and Empirical Results

Building upon previous work in finance education (Farinella 2007, Brau et al 2017), we regressed scores of FIN2 on whether FIN1 was taken online to investigate the impact of taking the first finance course online on the performance of the next level finance course. Given previous work (Farinella 2007, Brau et al 2017) and our univariate results, we included exogenous variables (GAP, gender, and major) as controls that were found to have significant effects on a student's success. The data was analyzed with Ordinary Least Squares (OLS) regression using the students' scores in Financial Management (FIN2) as the dependent variable. The analysis included 307 students enrolled in these courses over five years. About 61% took the first course Business Finance (FIN1) online, and 32% took the subsequent course, Financial Management (FIN2) online. Again, data was analyzed using OLS regression where the students' scores in Finance Policy and Strategy (FIN3) as the dependent variable. This analysis included 109 finance majors that took all three courses. Our methodology replicated previous work on learning modalities.

In our first model, we measured whether taking FIN1 online had any effect on student performance in FIN2. FIN1 was a prerequisite for FIN2. Following the literature, we estimated the coefficients in the following equation:

$$FIN2Score = \beta_0 + \beta_1 \, Fin1Online + \beta_2 \, FIN1Score + \beta_i \, Control \; Variable_i + u \qquad (1)$$

FIN2Score is the student's final percentage score in FIN2, the second course of the two-course sequence in the finance major. GPA is the student's cumulative GPA at the university after the semester that FIN1 was taken and could represent a control variable for human capital, i.e., the ability of academic excellence. It is a continuous variable with 4.0 as the highest possible value. *FIN1Online* is the variable of interest in this study and is defined as 1 if the student took FIN1 online, and 0 if face-to-face. *Age* is the age of the student when they took FIN1. *FIN1Score* is the student's final score, in percent from FIN1, and represents the student's preparation for taking FIN2. *Major* is a discrete variable defined as 1 if the student's declared major was Finance, 2 if the student's declared major was Management, 3 if the student's declared major was Accounting, and 4 otherwise. *Female* is defined as 1 if the student's gender is female, and 0 if male. Two instructors taught FIN1 during the period studied. Therefore, to account for an instructor effect the model includes a dummy variable for one of the instructors. *Instructor* is defined as 1 when one instructor taught FIN1 and 0 if the other instructor taught FIN1. An ordinary least squares regression was performed to measure this equation.

TABLE 4A
LEAST SQUARED REGRESSION RESULTS

Independent Variables	Model(1) Coeff.	Z-stat	Model(2) Coeff.	Z-stat	Model(3 Coeff.)	Z-stat
FIN1Online	3.126***	2.78	3.391***	3.16	3.349***	2.84
FIN1Score	0.682***	13.32	0.466***	7.48	0.466***	7.39
Female	-1.094	-0.60	-1.152	-0.66	-1.156	-0.66
Major	-0.584	-0.88	-0.762	-1.20	-0.761	-1.20
Instructor	-7.002***	-6.16	-6.160***	-5.63	-6.131***	-5.36
GPA			7.723***	5.56	7.742***	5.50
FIN2 Online					0.112	0.09

Constant	24.577***	5.37	18.077***	4.00	18.059***	3.99
Number of Observations	307		307		307	
Adj. R-squared	0.3853		0.4408		0.439	

This table reports least squared regression results of models with *FIN2Scores* as dependent variable and slightly different independent variables (Model 2 with *GPA* added, and Model 3 with *FIN2Online* added). All variable descriptions can be found at Appendix. ***, **, and * indicates the significance levels of 1%, 5%, and 10% respectively.

TABLE 4B
LEAST SQUARE REGRESSION RESULTS CONSIDERING SUMMER

Independent Variables	Model(1) Coeff.	Z-stat	Model(2) Coeff.	Z-stat	Model(3) Coeff.	Z-stat	Model(4) Coeff.	Z-stat
FIN1Online	3.983***	3.18	3.910***	2.97	3.923****	3.23	3.812***	3.02
Summer					2.433	0.95	2.552	0.99
FIN1Online * Summer					-3.255	-1.02	-3.532	-1.06
FIN1Score	0.519***	7.33	0.517***	7.21	0.470***	7.51	0.468***	7.41
Female	-2.084	-1.08	-2.104	-1.09	-1.251	-0.72	-1.272	-0.73
Major	-0.709	-1.00	-0.710	-1.00	-0.693	-1.08	-0.687	-1.07
Instructor	-5.875***	-4.56	-5.772***	-4.11	-5.751***	-4.82	-5.593***	-4.35
GPA	6.388***	3.88	6.455***	3.82	7.624***	5.46	7.691***	5.45
FIN2 Online			0.293	0.19			0.443	0.33
Constant	18.132	3.51	18.018	3.46	17.522***	3.84	17.398***	3.80
No. of Obs	249		249		307		307	
Adj. R-squared	0.4330		0.4307		0.4391		0.4374	
Ex. Summer	Yes		Yes		No		No	

This table reports least squared regression results of models with *FIN2Scores* as dependent variable and slightly different independent variables. Model 2 and Model 4 include *FIN2Online* as a control variable. Model 1 and Model 2 exclude the observations that FIN1 was taken in summer. Model 3 and Model 4 include the *Summer* dummy variable and the interaction between *Summer* and *FIN1Online*. All variable descriptions can be found at Appendix. ***, **, and * indicates the significance levels of 1%, 5%, and 10% respectively.

TABLE 4C
LEAST SQUARED REGRESSION RESULTS WITH YEAR FIXED EFFECTS

Independent Variables	Model(1) Coeff.	Z-stat	Model(2) Coeff.	Z-stat	Model(3) Coeff.	Z-stat
FIN1Online	2.072*	1.76	2.835**	2.15	2.757**	2.21
Summer					0.763	0.27
FIN1Online * Summer					-5.092	-1.49
FIN1Score	0.494***	7.81	0.543***	7.58	0.492***	7.80
Female	-1.216	-0.72	-2.370	-1.27	-1.353	-0.80

Major	-1.015		-1.61	-1.105	-1.56	-0.982	-1.56
Instructor	-2.242		-1.34	1.063	0.37	0.584	0.27
GPA	6.914***		4.97	5.673***	3.40	7.015***	5.06
FIN2 Online	-0.397		-0.30	0.485	0.31	-0.004	0.00
Constant	18.107***		4.03	17.269***	3.32	16.912***	3.75
No. of Obs	307		249		307	
Ex. Summer R-sq: Within	No		Yes		No	
	0.4469		0.4418		0.4557	
Between	0.306		0.1816		0.1585	
Overall	0.4185		0.3694		0.3841	
Prob>F (Xb)	0		0		0	
Prob>F (all u-i)	0.0002		0.0009		0	

This table reports the regression results after controlling for year fixed effects. All variable descriptions can be found at Appendix. ***, **, and * indicates the significance levels of 1%, 5%, and 10% respectively.

The *FIN1Online* variable was significant at the 1% level and has a coefficient of higher than 3 in all the models presented. This evidence indicated that the average student who took FIN1 online earned a score in FIN2 more than 3 points, or three tenths of one grade, higher than the average student who took FIN1 face- to-face. This result is consistent with Guidry (2015) who found that students who took a prerequisite course online outperformed the face-to-face students in a subsequent finance course. The *FIN1Score* variable was significant at the 1% level. The coefficient 0.466 (for models 2 and 3) indicates that, on average, a 1-point increase in a student's FIN1 score resulted in about a 0.466-point higher score in FIN2. The *GPA* variable was significant at less than the 1% level. The coefficient indicated that a 1-point increase in a student's GPA resulted in about a 7.7-point higher score in FIN2. The t-statistics of betas on *FIN1 Score* and *GPA* are high, indicating they are the major factors influencing a student's score in FIN2. The coefficients on both the score in the prerequisite course and *GPA* are consistent with previous research. In many studies GPA was a significant determinant of success in a finance course. In our study, *Age* was not statistically significant and not reported. In other studies, the impact of age on the success of a student in an online or fact-to-face class is mixed. *Female* was insignificant, unlike other studies, indicating that gender does not have a significant influence on course performance after other control variables have been considered. Given the significant coefficient on *Instructor*, there might have been an instructor effect. The coefficient may also reflect the grading curve of one of the instructors, indicating that we should include the *Instructor* dummy variable in all regressions. To test whether taking FIN2 online was a factor in the results, we repeated the regression with an additional dummy variable for taking FIN2 online. The coefficient was insignificant, and the inclusion of the extra independent variable did not significantly affect the overall results. In addition, a variance inflation factor (VIF) test was less than 2, indicating multicollinearity was not a problem.

To check the robustness of the results, we repeated the similar regression by considering the situation that students took FIN1 in summer, when very limited sections of face-to-face sections were available. Regardless of whether we dropped the observations of taking FIN1 in summer or included the dummy variable *Summer* and controlled for the interaction of *FIN1Online* and *Summer*, our main results remained the same (Table4b). We also repeated the same regression twice, once for just finance majors and once for non-finance majors. The results were basically the same and therefore not reported. Table 4c presents the OLS regression results considering Year Fixed Effects. Our main results still stayed the same. These robustness checks indicated that the positive effect of taking FIN1 online on FIN2 performance is robust and significant.

TABLE 5
TWO-STAGE LEAST SQUARED REGRESSION RESULTS

Indep. Variables	Model(1)		Model(2)		Model(3)		Model(4)	
	Coeff.	Z-stat	Coeff.	Z-stat	Coeff.	Z-stat	Coeff.	Z-stat
FIN1Online	8.624*	1.77	8.658*	1.76	7.797*	1.75	8.535*	1.79
FIN1Score	0.484***	7.30	0.484***	7.29	0.481***	7.36	0.483***	7.31
Female	-1.550	-0.86	-1.546	-0.85	-1.488	-0.83	-1.543	-0.85
Major	-0.906	-1.37	-0.910	-1.37	-0.883	-1.35	-0.903	-1.37
Instructor	-6.451***	-5.37	-6.428***	-5.31	-6.401***	-5.41	-6.445***	-5.38
GPA	7.599***	5.27	7.603***	5.27	7.621***	5.34	7.601***	5.28
FIN2 Online	-2.228	-0.90	-2.220	-0.91	-1.861	-0.81	-2.189	-0.90
Summer			-0.149	-0.10				
Constant	15.317***	2.93	15.289***	2.91	15.747***	3.09	15.364***	2.95
No. of Obs	307		307		307		307	
Adj. R-squared	0.4151		0.4146		0.4257		0.4263	
Exogenous Instruments:								
AGE		Age2	Age2		Age1		Age2	
Total Cr. Hours		Yes	Yes		Yes		Yes	
Summer		No	No		Yes		Yes	
Wald Ch2		232.49	232.39		236.68		233.05	

This table reports different 2SLS regression results with *FIN2Score* as the dependent variables and different dependent and instrumental variables. Model 1 and 2 have *AGE1* and *Total Credit Hours* as the instrumental variables for the first stage. Model 3 uses *AGE1, Total Credit Hours*, and *Summer* as the instrumental variables for the first stage. Model 4 uses *AGE2, Total Credit Hours*, and *Summer* as the instrumental variables for the first stage. *AGE1* is the dummy variable with value equals to 1 when Age is greater than the median age of taking FIN1, 22. *AGE2* is the dummy variable with value equals to 1 when Age is greater than the 75th percentile age of taking FIN1, 27. All variable descriptions can be found at Appendix. ***, **, and * indicates the significance levels of 1%, 5%, and 10% respectively.

Our analyses of Pearson Correlations and pairwise differences between students taking FIN1 online and face-to-face suggest the choice of taking FIN1 online is not random. We should consider the selection issue by instrument the choice of taking FIN1 online using exogenous variables. Table 4 presents the two-stage least squared regression (2SLS) results. Results of main OLS regressions suggest that *Age*, *Total Credit Hours*, and *Summer* do not have significant influence on the dependent variable, *FIN2Score*, while they are highly correlated with the selection variable, *FIN1Online*. Therefore, they are good candidates for the instrumental variables. We constructed *Age1* and *Age2* as dummy variables to determine whether the age when taking FIN1 was higher than the median (23 years old) and the 75th percentile (27 years old). The two-stage least squared results are robust across different models with different instrumental variables. *FIN1Online* is still significant, but only at the10% significance level, implying that the selection does contribute to some of the positive impact of taking FIN1 online on the FIN2 performance.

We next examined whether taking FIN1 and FIN2 online had any effect on a student's score in FIN3. From 2013 through 2020, 109 Finance majors completed all three courses. We estimated the coefficients in the following model:

FIN3Score=β0 + β1FIN1Online+ β2 FIN1Score + β3 FIN2Online + β4 FIN2core
+ βi Control Variablei + u (2)

FIN3Score is the student's final percentage score in FIN3, the third course of the three-course sequence in the finance major. *FIN1Online* and *FIN2Online* are the two variables of interest. FIN1 is defined as 1 if the student took *FIN1Online*, and 0 if face-to-face. *FIN2Online* is defined as 1 if the student took FIN2 online, and 0 if face-to-face. *FIN1Score* and *FIN2Score* are the student's final score from the first and second finance courses. Both score variables represents the student's preparation for taking FIN3. To account for instructor effects, we again include an instructor Dummy variable for FIN1, *Instructor*. All other variables were defined as before (Appendix).

TABLE 6
THE IMPACT OF TAKING THE FIRST FINANCE COURSE ONLINE ON THE MOST ADVANCED FINANCE COURSE PERFORMANCE

Independent Variables	Model(1) Coeff.	Z-stat	Model(2) Coeff.	Z-stat	Model(3) Coeff.	Z-stat
FIN1Online	-4.989*	-1.79	-6.508**	-2.07	-5.590*	-1.82
Summer					0.023	0.00
FIN1Online * Summer					7.626	0.70
FIN1Score	0.127	0.63	-0.072	-0.31	0.110	0.54
FIN2Online	4.852	1.37	5.106	1.19	4.441	1.19
FIN2Score	0.883***	4.77	0.932***	4.46	0.918***	4.80
Female	0.272	0.07	-1.508	-0.36	0.663	0.17
Major	-1.122	-0.78	-1.601	-0.98	-1.138	-0.77
Instructor	-4.444	-0.97	-11.438	-1.52	-9.630	-1.34
GPA	2.712	0.75	4.596	1.10	2.375	0.65
Constant	-12.522	-0.93	-0.112	-0.01	-11.285	-0.83
Number of Obs.	109		91		109	
Ex. Summer R-sq:	No		Yes		No	
Within	0.3950		0.4001		0.4008	
Between	0.2681		0.1303		0.2480	
Overall	0.3730		0.3344		0.3604	
Prob>F (Xb)	0.0000		0.0000		0.0000	
Prob>F (all u-i)	0.0783		0.0468		0.0678	

This table reports the regression results about the impact of taking FIN1 Online on FIN3 performance. The dependent variable is *FIN3Score*. Model 2 excludes the observations if FIN1 was taken in summer. Model 3 includes the *Summer* dummy variable and the interaction between *Summer* and *FIN1Online*. All regression models control for the year fixed effects. All variable descriptions can be found at Appendix.

***, **, and * indicates the significance levels of 1%, 5%, and 10% respectively.

Our earlier results suggest that students who took FIN1 online scored more than three points better in FIN2 than face-to-face students. Table 6 presents the regression results of *FIN1Online* and *FIN1Online*'s impact on FIN3 performance, controlling for Year Fixed Effect. FIN3 was taught at a higher level than the first two courses and followed an intermediate finance textbook. The coefficients on *FIN1Online* and *FIN2Score* are both significant. According to the first model in Table 6, students who took FIN1 online

scored about 5 points lower than peers who took FIN1 face-to-face. The result is significant at 10% level for the first model, and is more significant after we exclude observations that FIN1 was taken in summer or we control for taking FIN1 in summer. The coefficient of *FIN2Online* is not significant, indicating that whether taking the second finance course online or face-to-face does not have significant impact on student success at FIN3

This would suggest that the average student who took FIN1 face-to-face would, after accounting for the other factors, scored about 4.6 points higher in FIN3 than the average student who took FIN1 online. This is inconsistent with Krisandra (2015) who found that online students outperformed face-to-face students in a subsequent more advanced finance course. Although only marginally significant at the 10 percent level, the sign on the coefficient supports the "notion" that online courses can prepare students for learning the more introductory material taught in FIN2 but does not prepare students as well as face-to-face learning format for the more complicated material taught in FIN3.

The results for *FIN1Online* and *FIN2Online* may be consistent with earlier research. Brown 2002 found that classroom students performed only equally as well as online students on learning basic concepts (such as knowing definitions and recognizing important concepts) in a Principles of Microeconomics course, but they performed significantly better than online students on learning the more complex material. At the university in our study, the first two courses follow an introductory corporate finance textbook. The first course covers roughly the first half of the chapters, and the second course covers the remaining chapters. The third course follows an intermediate managerial finance textbook and revisits much of the material from the first course, but at a more advanced level, trying to generate a deeper understanding. The negative sign on *FIN1Online* indicates that online learning does not preparing students as well as the face-to-face format for the more complex material in FIN3. The positive effect of taking FIN1 online on FIN2 might be driven by the facts that FIN2 uses the same textbook as FIN1 and materials for online FIN1 are more accessible than face-to-face FIN1.

CONCLUSION

Being aware of the increasing demand and practice of online learning and the importance of learning modality of quantitative courses, we conducted this extensive study of the three-finance course sequence for finance and other business major students in the Texas Woman's University from 2013 to 2020. Our results suggest that taking the first fundamental finance course online helped students perform better in the next level finance class using the same textbook than taking the first course in person. On the contrary, taking the first fundamental finance course in person prepares students better for the more advanced finance course.

As to our best knowledge, this study is the first one to investigate learning modality's impact on subsequent major required courses. Our results are seemingly mixed in terms of suggesting that the online format of taking the first fundamental finance course prepares students better than the face-to-face format for the next level course using the same textbook, while the face-to-face format prepares students better than online format for the more advanced finance course. Future studies building on this one may investigate deeper in whether this seemingly mixed effect exists in other teaching areas, such as accounting and operation research, and which factors contribute to these seemingly mixed effects.

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APPENDIX: VARIABLE DESCRIPTION

Variable	Definition
FIN1/FIN2/FIN3Score	Students' raw score out of 100 range for the fundamental finance course (Business Finance, FIN1), the second finance course (Financial Management, FIN2), and the third finance course (Finance Strategy and Policy, FIN3)
FIN1/FIN2/FIN3Online	Dummy variable that equals to 1 if the course was taken online, and 0 face-to face for FIN1, FIN2, and FIN3
Female	Dummy variable that equals to 1 if the student's gender was female and 0 otherwise
Instructor	Dummy variable that equals to 1 if FIN1 was taught by one of the two instructors and 0 by the other instructor.
Age	Students' age when they took FIN1
Age1	Dummy variable that equals to 1 if Age is higher than median (23) and 0 otherwise
Age2	Dummy variable that equals to 1 if Age is higher than the 75 percentile (27) and 0 otherwise
Summer	Dummy variable that equals to 1 if FIN1 was taken in summer and 0 otherwise

Total Credit Hours	Total credit hours that students had taken before they took FIN1
GPA	Cumulative GPA that students had before they took FIN1
Major	Students' major (1: Finance, 2: Management, 3: Accounting, 4: others)