LONG-TERM IMPACT OF SUPPLEMENTAL INSTRUCTION IN IMPROVING STUDENT PERFORMANCE IN INTERMEDIATE ACCOUNTING COURSES

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ABSTRACT

This study is the first to explore the role of Supplemental Instruction (SI) in the second and third intermediate accounting course sequence. This study used Heckman's two-stage estimation method to address potential sample selection bias in evaluating the impact of SI on student performance, which was not directly addressed in prior studies. Furthermore, this analysis is the first to investigate the long-term impact of continuous SI attendance in an accounting setting. Using data collected during the period 2015 to 2018 from a public four-year university in the United States, our results show that SI attendees earn 0.309 additional grade point, approximately one letter grade, compared to non-SI attendees, after controlling for the potential sample selection bias. We find students who continuously participate in SI outperform those who stop attending. Our findings have important implications for administrators in managing university resources and promoting student success.

Keywords: Supplemental Instruction, SI, Continuing SI, Intermediate Accounting, Student Academic Performance, Student Success.

INTRODUCTION

Accounting educators are now at the crossroads facing manifold forces of changes in higher education (Pincus et al., 2017). On the one hand, accounting educators face students with

> *"Changing student demographics, high level of student debt, shrinking levels of governmental support, and philanthropic limitations" (Pincus et al., 2017).*

On the other hand, technological forces stimulate the growth of offshoring and automation of accounting jobs. With the automation of routine and repetitive accounting work, the accounting field now requires students to be better equipped with higher-level cognitive skills. Accounting educators faced with these challenges must engage in innovative pedagogy to prepare students to be successful in today's accounting profession.

For the last 30 years, calls for changes in accounting education to meet the needs of the evolving profession are regular and numerous. Among them, the Pathways Commission in July 2012 issued a report recommending several changes in the practice of accounting education, which includes

> *"Defining and developing a signature pedagogy, or suite of pedagogies, that will support the learning approaches of a globally diverse student body" (Pathways Commission, 2012).*

With signature pedagogy being clinical rounds in medicine and case dialogue in law,

the accounting profession is still in the progress of defining its own signature pedagogy, or suite of pedagogies.

Supplemental Instruction in the United States

Supplemental Instruction (SI) is an intervention strategy originating from the University of Missouri-Kansas City (UMKC) in 1973 to improve students' learning. SI is an academic support program that consists of peer-learning sessions normally offered to historically identified high-risk courses. SI has been implemented in over thousands of colleges and universities across the U.S. (UMKC-SI). The benefit of SI has been documented in studies commonly focusing on high-risk courses including science, technology, engineering and mathematics (STEM) subjects (Dawson et al., 2014). However, the evidence of usefulness of SI in accounting has been scarce (Etter et al., 2000; Jones & Fields, 2001; Kilpatrick et al., 2013), particularly at upper-level gatekeeper courses. It is still an open question whether SI is a suitable and effective pedagogy for accounting, echoing the call from the Pathways Commission.

Supplemental Instruction in the International Context

The International Center for SI at UMKC recognizes National SI Centers around the world for their work in disseminating the SI model and supporting the development of SI programs in regions such as Australia, Canada, Europe and Africa (UMKC-SI). In Australia, SI is renamed as Peer Assisted Study Sessions (PASS). Paloyo et al. (2016), in one of the few experimental studies, find that the largest improvement in grades came from students in their first semester at university from participating in the PASS/SI. They suggest that PASS/SI is instrumental for those students who are new to the university system and are faced with making new social connections.

Significance of the Study

Among all accounting courses, intermediate accounting is a fundamental course in any typical accounting curriculum and is usually referred to

"As a weed-out course that determines which students really have what it takes to be accounting majors…" (Shoulders & Hicks, 2008).

Many prospective employers use this course as an indicator of a student's ability to succeed professionally in accounting." (Sanders & Willis, 2009).

The topics covered in intermediate accounting courses are typically complicated and challenging, especially those covered in the second or third intermediate accounting course in a three-course sequence. A stream of prior literature (Lindquist & Olsen, 2007; Shoulders & Hicks, 2008; Sanders & Willis, 2009; Sargent, 2013; Brink 2013; Wynn-Williams et al., 2016; Bay & Pacharn, 2017) focused on exploring different strategies to ensure students' success in intermediate accounting courses.

Using data collected from a public four-year university, this study documents the effectiveness of SI in improving students' academic performance in upper-level accounting courses. Accounting students at our institution are required to finish a three-quarter sequential intermediate accounting series before graduation. Our study focuses on students' performance in Intermediate II and III, which includes more complex material than the first intermediate course. The results indicate that students who take advantage of SI session outperform their counterparts by 0.309 additional point, approximately one letter

grade. The findings are robust to controls for potential sample selection bias using Heckman model. More importantly, our results show that the academic performance of students who continuously attend SI sessions is superior to the performance of students who discontinue attending SI or who did not attend SI in any course. These results suggest that SI is an effective pedagogy in accounting instruction. This study contributes to the literature in three aspects. Different from Kilpatrick et al. (2013), which focuses on the effect of SI on students' performance in the first intermediate accounting course, our study emphasizes the effect of SI in the second and third intermediate accounting courses. In addition, we address potential sample selection bias by deploying the Heckman model in the process of estimation. Furthermore, this study is the first to examine the effect of continuous SI attendance in the accounting setting. In contrast to previous studies, which focus on the impact of SI on a single course, our study examines the influence of continuous attendance in SI on improving students' academic performance.

The rest of the paper is organized as follows: Section 2 introduces the Supplemental Instruction model and reviews literature. Section 3 develops hypotheses and states research methodology, including research models used and procedures of sample selection and data collection. Section 4 presents results and analysis. Section 5 concludes.

LITERATURE REVIEW

Supplemental Instruction (SI) Model

One important milestone in developmental education has been the creation of the Supplemental Instruction (SI) model. Supplemental Instruction (SI) was first established at the University of Missouri-Kansas City (UMKC) in 1973 by Deanna Martin to solve the attrition problem in dentistry, pharmacy and medicine disciplines (Arendale, 2002). The focus of SI is to identify "high risk" courses, which are those historically difficult courses with a large number of D, F, and W grades, and to build a program that centers on the course itself.

The SI model has a tri-fold purpose: (1) to increase retention within targeted historically difficult courses; (2) to increase student grades within targeted historically difficult courses; and (3) to increase the graduation rates of students (UMKC-SI). The SI program provides another paradigm in developmental education by helping to achieve program and institutional-level goals while minimizing costs.

SI model has various unique features. It is free to all students within a targeted course. The program is voluntary and all students are encouraged to attend. SI is anonymous; instructors do not attend the session nor do they know the names of individual students who are in attendance until after grades have been submitted. SI employs peer-assisted study sessions held outside of class by a student SI leader, who has previously taken and passed the course with a superior grade. These weekly sessions allow students to work collaboratively on building complete and accurate notes, formulating possible exam questions and sharing ideas for post-test improvements (Congos& Schoeps, 1993; Congos & Schoeps, 1997). In contrast to regular tutoring, SI sessions provide a learning environment

"Where communication, conversation and scaffolding are provided to assist students to construct the knowledge they need to acquire" (Fayowski & MacMillan, 2008).

Empirical Studies on Supplemental Instruction

Since the inception of SI in 1973, extant literature provides ample evidence that SI is effective in improving student performance and retention in short-term studies of its

implementation (Hensen & Shelley II, 2003; Ogden et al., 2003; Moore & LeDee, 2006; Fayowski & MacMillan, 2008; Malm et al., 2012). Other studies examined the intrinsic and auxiliary benefits of SI, including enhanced social and academic skill development (Paloyo et al.,2016; Ning & Downing, 2010; Price et al., 2012; Cantrell et al., 2014). Studies of the SI model applied to introductory financial accounting classes find results consistent with non-accounting studies; SI participants have better course performance and lower attrition rates than non-participants (Etter et al., 2000; Jones & Fields, 2001).

Traditionally, intermediate financial accounting is known to be challenging for both students entering into the major and instructors in covering the breadth and difficulty of the course material (Anderson & Boynton, 1992; Eikner & Montondon, 2001). Students enter intermediate accounting from various abilities, backgrounds, and perceptions; failure rate to complete the course is high (Shoulders & Hicks, 2008; Sanders & Willis, 2009).

Extending the prior research on introductory accounting, Kilpatrick et al. (2013) examined the effectiveness of SI in the first intermediate accounting course for accounting majors. Their results indicate that SI attendance had a significant effect on the first intermediate course grade, with an improvement in course GPA of 0.74 for students who attended five or more SI sessions over those students who did not attend any sessions. Even moderate attendance (three to four SI sessions) showed a marginally significant improvement in course GPA of 0.41 compared with no attendance.

METHODOLOGY

Hypotheses Development

With SI, students develop new learning strategies and receive feedback on understanding the concepts. Through interaction with their peers, students are able to reflect, refine, and reinforce the materials discussed in the lecture in a way that would not be possible if studying alone. Therefore, one would expect SI attendance has a positive impact on academic performance in each of the intermediate accounting courses. However, intermediate accounting sequence isprogressively more difficult as students move along the sequence. The challenge posed by more complex topics included in Intermediate II and III courses may not be easily overcome by SI model.If true, one may observe no or less impact from attending SI on academic performance in Intermediate II and III courses. Thus, we form the following hypothesis:

H1: SI attendance is positively associated with students' academic performance in intermediate accounting courses.

While the vast majority of previous studies investigate the impact of SI on a single-quarter or semester course, few studies examine the long-term impact of SI program in non-accounting disciplines (Grattis, 2000; Gunn et al., 2002; Ogden et al., 2003). It is an open question whether such a long-term impact of SI is transferable to the intermediate accounting sequence. Learning techniques and strategies obtained by attending SI in prior intermediate course may be internalized by the student and endure into the next intermediate course. On the other hand, learning benefits from SI may be scaffolded and therefore buildable. Therefore, we form the following hypothesis to address the long-term effect of SI.

H2: Continuous SI attendance is associated with improved students' academic performance in Intermediate III.

Institutional Background

Our study is carried out in a four-year public university in the western region of the United States. Most students begin their accounting studies by taking accounting principles at a community college. Accounting students enroll in a three-course sequence of intermediate accounting normally during their junior year. To proceed to the next course in the intermediate series, students must have earned at least a grade of C- in the previous intermediate course. Student failure rate, i.e., the percentage of students who receive D, F, or W, in intermediate accounting courses is typically very high, averaging 30% to 40%. The consequence of failing intermediate accounting could be dramatic. Not only does it prolong the students' progress towards graduation, but it also entails substantial department resources. Thus, it is important for administrators to understand whether the SI strategies are helpful in achieving student academic success.

Research Models

To test the effectiveness of SI program in intermediate accounting courses, the following model is deployed:

$$Y = \beta X + \delta C + \epsilon \quad (1)$$

Where Y measures students' academic performance in intermediate accounting courses; X is a matrix of covariates that impact students' academic performance in intermediate accounting; C is a dummy variable indicating whether or not the students attend SI session; and ε is a vector of random disturbance.

However, the ordinary least squares (OLS) estimator of δ would be inconsistent in measuring the value of attending SI session due to self-selection bias (Greene, 2000). Traditionally, a student's inclusion in SI session is determined by the student, not by the instructor. In prior studies it was suspected that students who choose to attend SI may have relatively high academic performance regardless whether they attended SI or not (Guarcello et al., 2017). In other words, we would expect highly motivated or capable students to have good academic outcomes. The same students may also have a higher probability of participating in SI due to their motivation for success. To control for potential selection bias, we include a covariate, prior GPA, in estimating equation (1), following Jones & Fields (2001). To ensure additional controls for self-selection, we also use Heckman's two-stage estimation method (Heckman, 1979; Greene, 1981; Greene, 2000) by adding a selection equation, i.e.,

$$C^* = \alpha W + u \quad (2)$$

Where C = 1 (from equation (1)) if $C^*>0$, and C = 0 if $C^* \leq 0$; W is a matrix of explanatory variables that affect students' willingness in attending SI session; and u is a vector of disturbances.

The concern of potential selection bias implies that ε and u could be correlated. To account for this potential selection bias, Heckman's two-stage estimation procedure is deployed as follows: Estimate equation (2) using the probit model by maximum likelihood. The estimators of W are used to compute λ, which is the ratio of the standard normal density function to the cumulative distribution function. Equation (1) is then estimated by OLS, including the estimates of λ, along with other regressors. However, the inclusion of λ causes the heteroscedasticity in ε. To mitigate the concern of heteroscedasticity of ε, White heteroscedasticity consistent estimators are reported. Using Heckman's estimation method, potential identification problem may arise when considering the set of explanatory variables

to be included in the selection equation and adjusted OLS equation (e.g., Olsen, 1980; Loviscek & Cloutier, 1997). Due to the difficulty in finding suitable regressors for simultaneous exclusion from adjusted OLS equation and inclusion in selection equation, prior studies have chosen the same set of regressors to be used in both steps. However, this gives rise to a concern of inflated standard errors and unreliable estimates of coefficients in the adjusted OLS equation (Vella, 1998).

We can alleviate this concern by including additional variables in equation (2), which we do not include in estimating equation (1). Specifically, the following specifications were used:

$$SIAtt\_2 = \alpha_0 + \alpha_1 PriorGPA + \alpha_2 Gender + \alpha_3 Age + \alpha_4 Distance + \alpha_5 Load + \alpha_6 Conflict + \alpha_7 Location + \alpha_8 TimeSIOffr \quad (3)$$

$$Grade = \beta_0 + \beta_1 SIAtt\_2 + \beta_2 PriorGPA + \beta_3 Gender + \beta_4 Age + \beta_5 Load \quad (4)$$

In which,

SIAtt_2 = 1 if attending SI session at least two times in a quarter and 0 otherwise (0, 1)
Grade = Grade received from current intermediate accounting course (A=4, A- = 3.7, =3.3, B = 3, B- = 2.7, C+ = 2.3, C = 2, C- = 1.7, D+ = 1.3, D= 1, W or F = 0)
PriorGPA= Cumulative grade point average the quarter prior to taking any intermediate accounting courses (0 to 4)
Gender = 1 if male and 0 otherwise (0,1)
Age = Age of the students when taking the course (19 to 60 years old)
Distance = Distance between a student's mailing address and campus address (0 to 75 miles)
Load = Number of course units taken during the quarter SI is offered (4 to 24 units)
Conflict = 1 if a student has time conflict with another class and 0 otherwise (0, 1)
Location = 1 if SI session is held in the same building as the target class and 0 otherwise (0, 1)
TimeSIOffr = 1 if SI session is held within two hours of class time and 0 otherwise (0, 1)

Following prior literature (Hicks & Richardson, 1984; Turner et al., 1997, Eikner & Montondon, 2001; Burnett et al., 2010; Kilpatrick et al., 2013; Rabitoy et al., 2015), we include *PriorGPA*, *Gender*, *Age*, and *Load* to control for other covariates that may influence students' academic performance in the intermediate accounting courses. We incorporate *Distance* and *Conflict* in predicting SI participation to capture students' difficulty in attending SI. *Location* and *TimeSIOffr* are included since untabulated results indicate that the participation rate is higher for a SI session held within the same building as the target class or within 2 hours of class time.

To investigate the long-term effect of SI in hypothesis 2, we compare the academic performance of students who continuously attend SI session in both Intermediate II and III (treatment group) with those who attend SI session in only Intermediate II (control group). We adopt the difference-in-difference approach and test the long-term effect of SI using the t-test and the following OLS regression model:

$$Grade = \gamma_0 + \gamma_1 Course + \gamma_2 Continue + \gamma_3 Course * Continue + \gamma_4 PriorGPA + \gamma_5 Gender + \beta_6 Age + \gamma_7 Load \quad (5)$$

In which

Course = 1 if current course is Intermediate III; 0 if current course is Intermediate II (0, 1)

Continue = 1 if a student continues attending SI in Intermediate III after II; 0 if a student only attends SI in Intermediate II but not in Intermediate III. A student is viewed as a SI attendee if he or she attends SI for at least one time during quarter (0, 1). γ_3 is the coefficient of the difference-in-difference interaction term. If students benefit from continuous attendance in SI sessions, we expect γ_3 to be positive.

We also employ the following model to compare the marginal effect on the efficacy of attending SI with not attending SI. Specifically, we compared the academic performance of the students who never attend any SI session in either Intermediate II or III courses with students whoattend SI sessions in Intermediate II only, Intermediate III only, or both.

$$Grade = \theta_0 + \theta_1 SI_{23} + \theta_2 SI_2 + \theta_3 SI_3 + \theta_4 PriorGPA + \theta_5 Gender + \theta_6 Age + \theta_7 Load \quad (6)$$

In which

SI_23 = 1 if a student attends SI in both Intermediate II and III and 0 otherwise. A studentis viewed as a SI attendee if he or she attends SI for at least one time (0, 1)

SI_2 = 1 if a student attends SI in Intermediate II only and 0 otherwise (0, 1)

SI_3 = 1 if a student attends SI in Intermediate III only and 0 otherwise (0, 1)

Sample Selection and Data Collection

The accounting department at our institution started implementing SI model in Fall 2015. We use data from Fall 2015 to Spring 2018 prior to the institution change from a quarter system to a semester system in Fall 2018. We first apply the SI model in three-course sequential intermediate accounting series due to their historically difficult nature.

During the nine quarters from Fall 2015 to Spring 2018, we offered 37 sections of intermediate accounting courses with SI sessions with a potential of 1,520 students as SI attendees. Out of 37 sections, six were for Intermediate I, 15 for Intermediate II, and 16 for Intermediate III. More SI sessions were offered for Intermediate II and III due to the complexity of topics covered. We first limit the sample to include only those sections that have at least two or more SI attendees, defined as those students who have attended SI sessions at least two or more times. This resulted in an initial sample of 27 sections of intermediate accounting classes with 1,127 students. The 27 sections consisted of two sections of Intermediate I, 11 sections of Intermediate II, and 14 sections from Intermediate III. We further reduce the sample by deleting repeated attempts by the same student. We also exclude those students with non-local mailing address, missing information on prior quarter cumulative GPA or pre-intermediate accounting cumulative GPA, or temporary academic status. The final sample size has 909 subjects (584 individual students): 66 in Intermediate I; 397 in Intermediate II; and 446 in Intermediate III.

We obtained the data on SI session attendance from the SI Coordinator, who is responsible for maintaining student attendance and grade records for SI sessions. SI Coordinator also provided us with the information on location and time of each SI session. We received the information about students' academic performance, i.e., course letter grade, from each instructor teaching intermediate accounting courses. We also confirmed this information using students' available records. The data on other covariates, including *PriorGPA, Gender, Age, Load, Distance* and *Conflict*, was manually retrieved from students' records.

RESULTS

Descriptive Statistics

Table 1 Panel A presents descriptive statistics on the final sample 909 subjects, consisting of 584 individual students. For the dependent variable *Grade*, the average grade received in intermediate accounting courses is 2.271, equivalent to a C+. About 20% of subjects received a D, F or W course grade (Panel C), which is lower than the 30-40% failing rate before SI was implemented inintermediate accounting courses. For SI attendance, around 30% of the subjects attended SI sessionat least one time; 22% of them attended at least two times (Panel B). The highest number of SI attendance is 19 times, i.e. he/she attended every single SI session, including exam review. The average number of SI attendance is approximately two times (untabulated).

Table 1
DESCRIPTIVE STATISTICS

Panel A: Descriptive Statistics of All Variables

Variable	# of Observations	Mean	Median	Standard Deviation	Minimum	Maximum
Grade	909	2.271	2.300	1.180	0.000	4.000
SIAtt_2	909	0.220	0.000	0.414	0.000	1.000
PriorGPA	584	3.161	3.177	0.454	1.878	4.000
Gender	584	0.447	0.000	0.498	0.000	1.000
Age	909	27.628	26.000	6.514	19.000	60.000
Distance	584	15.264	12.995	11.382	0.000	74.146
Load	909	13.990	16.000	3.271	4.000	24.000
Conflict	909	0.271	0.000	0.445	0.000	1.000

All variables are defined in Section 4.

Panel B: Subjects by SI Attendance

Number of Attendance in SI session	Number of Subjects	Percentage
0 times	639	70.30%
1 times	70	7.70%
2 times	28	3.08%
3-5 times	39	4.29%
6-10 times	53	5.83%
11-15 times	64	7.04%
16-20 times	16	1.76%
Total	909	100.00%

Panel C: Subjects by Course Grade (*Grade*)

	Total		SI Attendees		Non-SI Attendees	
CourseGrade	Number of Subjects	Percentage	Number of Subjects	Percentage	Number of Subjects	Percentage
A	178	19.58%	53	26.50%	125	17.63%
B	230	25.30%	58	29.00%	172	24.25%
C	316	34.76%	69	34.50%	247	34.83%
D, F and W	185	20.35%	20	10.00%	165	23.28%
Total	909	100.00%	200	100.00%	709	100.00%

Prior to enrolling into the three-course intermediate series, sample students have an average cumulative GPA of 3.161, indicating higher GPA students enrolled in the intermediate accounting courses. More than half of sample students are female. The average age of subjects is 27.6 years old and the age of the entire sample is from 19 to 60. In addition,

half of the students live more than 15 miles from campus. The average subject had class load of 14 units; more than 50% of subjects carried a total course load of 16 units while taking the intermediate accounting course. 27% of the subjects had another class during the time SI session was offered.

Pearson correlation coefficients among variables included in the model are shown in Table 2. We find that students' participation in SI session is significantly and positively correlated with their prior cumulative GPA and current course grade (significant at <0.0001).

Table 2
PEARSON CORRELATION TABLE

	SIAtt_2	Grade	PriorGPA	Gender	Age	Distance	Load	Conflict	Location
Grade	0.149***								
PriorGPA	0.099***	0.447***							
Gender	0.051	-0.052*	-0.241***						
Age	0.066**	0.069**	-0.008	-0.118***					
Distance	-0.023	-0.098***	-0.037	0.001	0.092				
Load	-0.037	0.066*	0.116***	0.019	-0.201***	-0.005			
Conflict	-0.264***	-0.001	-0.007	-0.017	-0.030	0.051	0.153***		
Location	0.150***	-0.008	0.030	0.029	0.014	0.031	0.045	-0.190***	
TimeSIOffr	0.122***	0.004	-0.023	-0.004	0.078**	0.068**	-0.044	0.157***	-0.171***

All variables are defined in Section 4; t-statistics in parentheses and ***p < 0.01; ** p < 0.05; * p < 0.10

We also compare prior grade point average between SI attendees and non-SI attendees. SI attendees have a higher (3.266) average cumulative grade point before starting intermediate accounting course than their counterparts (3.160) and the difference is significant (untabulated). This implies a potential self-selection bias, i.e., students with higher performance may be more motivated to attend SI session to ensure they continue to have good grades.

Hypothesis 1 Results: SI Attendance and Academic Performance

Tables 3 and 4 show the results across different specifications of equations (3) and (4). Table 3 reports the probit estimates of the selection equation examining the relationship between SI attendance and variables suspected to affect SI attendance. Table 4 displays the OLS results from evaluating the relationship between SI attendance and academic performance with estimates adjusted for potential selection bias. Prior study (Loviscek and Cloutier, 1997) has suggested a concern about Heckman's two-stage estimation method in terms of its sensitivity of results across alternative specifications. We therefore provide the results for three different specifications of equations (3) and (4), i.e., specification (a), (b) and (c). Each probit model specification in Table 3 corresponds to the OLS estimate of the specification in Table 4. We also include an OLS estimate unadjusted for selection bias in specification (d) of Table 4 as a benchmark.

In Table 3, the pseudo R^2 for each specification indicates the model fit relative to the baseline specification, i.e., probit regression with a constant and no predictors. The pseudo R^2 is calculated as $1 - L/L_0$, where L is the log likelihood for a given specification of the equation (3), and L_0 is the log likelihood for the baseline specification. Based on this criterion, specification (c)achieves the best model fit (pseudo R^2 =0.1468). The corresponding OLS estimate of specification (c) in Table 4 also displays highly significant explanatory power, as indicated in the adjusted R^2 and F-statistic (adjusted R^2 = 0.2150; F-statistic = 42.46).

Table 3
PROBIT ESTIMATES OF SI ATTENDANCE SELECTION EQUATION

$SIAtt\_2 = \alpha_0 + \alpha_1 PriorGPA + \alpha_2 Gender + \alpha_3 Age + \alpha_4 Distance + \alpha_5 Load + \alpha_6 Conflict + \alpha_7 Location + \alpha_8 TimeSIOffr$

	(a)	(b)	(c)
Intercept	-2.625*** (0.433)	-1.641*** (0.357)	-2.954*** (0.525)
PriorGPA	0.401*** (0.111)		0.418*** (0.120)
Gender	0.258*** (0.099)	0.165 (0.101)	0.261** (0.106)
Age	0.016** (0.007)	0.012 (0.008)	0.013* (0.008)
Distance		-0.004 (0.005)	-0.003 (0.005)
Load		0.010 (0.016)	0.004 (0.016)
Conflict		-1.243*** (0.162)	-1.247*** (0.163)
Location		0.426*** (0.103)	0.416*** (0.103)
TimeSIOffr		0.590*** (0.108)	0.595*** (0.109)
# of Observations	909	909	909
Log Likelihood	-468.93	-414.85	-408.67
Pseudo R^2	0.0209	0.1339	0.1468

All variables are defined in Section 4; t-statistics in parentheses and ***p < 0.01; ** p < 0.05; * p < 0.10

The probit estimates of the selection equation in Table 3 suggest several results. First,assuming prior GPA reflects the current state of each student's motivation and ability, a student with higher motivation and ability is more incentivized to participate in SI sessions, other thingsbeing equal. Second, male and older students are more likely to attend SI, ceteris paribus. A SIsession held within the same building of the target class or within two hours of class time, both indicating a convenient location or time for students, increases the likelihood of attendance. Lastly,a SI session held at the same time as students' other classes decreases the likelihood of attendance.

The adjusted OLS estimates in Table 4 reveal several noteworthy findings. First, in relation to H1, the results in Table 4 confirm that student attendance in SI (*SIAtt_2*) is significantly related to course GPA (*Grade*), across all model specifications. While controlling for prior motivation and ability (*PriorGPA*) and other grade-determinant factors, students who attend SI at least two times experienced an increase in the final course grade of 0.309 (specification (c)), almost a one letter grade improvement. The result is similar in OLS regression analysis unadjusted for sample selection bias. Second, the coefficient on λ is not significant, suggesting any selection bias in the data is not statistically significant. Finally, consistent with previous literature, male or older students perform significantly better than their counterparts.

Table 4
THE RELATIONSHIP BETWEEN SI ATTENDANCE AND ACADEMIC PERFORMANCE: OLSRESULTS ADJUSTED AND UNADJUSTED FOR SELF-SELECTION BIAS

$Grade = \beta_0 + \beta_1 SIAtt\_2 + \beta_2 PriorGPA + \beta_3 Gender + \beta_4 Age + \beta_5 Load$

	(a)	(b)	(c)	(d)
Intercept	23.015 (25.694)	1.289*** (0.300)	-2.416*** (0.391)	-2.192*** (0.347)

SIAtt_2	0.273*** (0.080)	0.463*** (0.093)	0.309*** (0.084)	0.277*** (0.085)
PriorGPA	-1.607 (2.882)		1.213*** (0.084)	1.187*** (0.082)
Gender	-1.660 (1.856)	-0.115 (0.079)	0.158** (0.078)	0.141* (0.073)
Age	-0.098 (0.114)	0.014** (0.006)	0.015*** (0.006)	0.014*** (0.005)
Load		0.030** (0.012)	0.010 (0.011)	0.012 (0.011)
λ	-9.012 (9.240)	0.088 (0.079)	0.081 (0.070)	
# of Observations	909	909	909	909
F-statistics	50.67	6.93	42.46	50.68
Adjusted R^2	0.2148	0.0316	0.2150	0.2148
All variables are defined in Section 4; t-statistics in parentheses and ***p < 0.01; ** p < 0.05; * p < 0.10				

Hypothesis 2 Results: Long-term Effect of SI Attendance

Following Gattis (2000) study on long-term knowledge gains due to SI in a two-course sequence chemistry courses, we investigate the effect of continuous SI attendance for a three-course sequence of intermediate accounting courses. We focus on a subsample of 116 subjects who attended SI sessions in Intermediate II. Out of these 116 subjects, 84 enrolled in Intermediate III in the quarters when SI was offered. Among these 84 subjects, 45 continued attending SI in intermediate III (treatment group); 39 stopped attending SI (control group).

The comparison between two groups is shown in Panel A of Table 5. We compare these two groups in terms of their prior GPA and course grade in Intermediate II and III. While initially the treatment group shows a 0.20 higher average prior GPA than the control group, both groups do not perform significantly different in Intermediate II, when both participated in and benefitted from SI. Both groups also experienced a lower average course grade for Intermediate III compared to Intermediate II. However, when students continue their SI attendance in Intermediate III, the treatment group's course grade was significantly higher (0.452 points) than the control group. In relation to H2, our results are consistent with the findings that continuous SI attendance in Intermediate III has a significant and positive impact on student performance.

Panel B of Table 5 presents the OLS results of equation (5). The coefficient estimator on the interaction variable *Course*Continue*, which captures the difference-in-difference effect, is positive but not significant. The positive findings are consistent with H2; however, due to the small sample size, the regression results should be interpreted with caution.

Table 5
LONG-TERM EFFECT OF SI ATTENDANCE ON ACADEMIC PERFORMANCE

Panel A: Two-Sample t-test Comparing between SI-II&III Group and SI-II Group

	SI-II Group (Control) (n=39)	SI-II&III Group(Treatment) (n=45)	t value
PriorGPA	3.147 (0.425)	3.347 (0.316)	2.41**
Grade (Intermediate II)	2.426 (0.958)	2.653 (0.893)	1.13
Grade (Intermediate III)	2.172 (1.199)	2.624 (1.039)	1.85*

All variables are defined in Section 4; standard errors in parentheses and ***p < 0.01; ** p < 0.05; * p < 0.10. SI-II&III group consists of those who attended SI session in both Intermediate II and Intermediate III. SI-II groupconsists of those who attended SI session only in Intermediate II.

Panel B: OLS Results between SI-II&III Group and SI-II Group			
$Grade = \gamma_0 + \gamma_1 Course + \gamma_2 Continue + \gamma_3 Course * Continue + \gamma_4 PriorGPA + \gamma_5 Gender + \beta_6 Age + \gamma_7 Load$			
	(a)	(b)	(c)
Intercept	2.426*** (0.151)	-0.050 (0.667)	-0.242 (0.840)
Course	-0.254 (0.242)	-0.254 (0.235)	-0.254 (0.233)
Continue	0.228 (0.201)	0.071 (0.203)	0.104 (.0.211)
*Course*Continue*	0.225 (0.316)	0.225 (0.303)	0.224 (0.302)
PriorGPA		0.787*** (0.210)	0.766*** (0.217)
Gender			-0.061 (0.152)
Age			0.001 (0.009)
Load			0.016 (0.029)
# of Observations	168	168	168
F-statistics	1.94	5.16	2.97
Adjusted R^2	0.0166	0.0906	0.0764
All variables are defined in Section 4; standard errors in parentheses and ***p < 0.01; ** p < 0.05; * p < 0.10			

We also explore the marginal effect of continuous SI attendance. We focus on those who took Intermediate III in the quarters SI was offered (n=447). We delete those who did not take Intermediate II with SI session offered and retain 307 subjects. The results of equation (6) are included in Table 6. Students who attended SI sessions in Intermediate III experienced a final grade 0.403 points higher than those students who never attended SI (specification (c)). The increase in grade due to SI attendance is significant. Students who attended SI in both Intermediate II and III received 0.070 grade points higher than those students who never attended SI, although the difference was not significant.

Table 6
MARGINAL EFFECT OF CONTINUOUS SI ATTENDANCE ON ACADEMIC PERFORMANCE

$Grade = \theta_0 + \theta_1 SI23 + \theta_2 SI2 + \theta_3 SI3 + \theta_4 PriorGPA + \theta_5 Gender + \theta_6 Age + \theta_7 Load$

	(a)	(b)	(c)
Intercept	2.385*** (0.088)	-0.770* (0.423)	-0.734 (0.621)
SI23	0.192 (0.180)	0.070 (0.174)	0.070 (0.175)
SI2	-0.167 (0.209)	-0.120 (0.194)	-0.131 (0.193)
SI3	0.494*** (0.174)	0.395** (0.158)	0.403** (0.164)
PriorGPA		0.982*** (0.133)	0.960*** (0.152)
Gender			-0.064 (0.138)
Age			0.001 (0.010)
Load			0.002 (0.019)
# of Observations	306	306	306
F-statistics	3.20	14.41	8.20

Adjusted R^2	0.0212	0.1495	0.1418
All variables are defined in Section 4; standard errors in parentheses and ***p < 0.01; ** p < 0.05; * p < 0.10			

Overall, we find that students who continuously participate in SI sessions in both Intermediate II and III have better academic performance than students who discontinue participating in SI in Intermediate III. Students who attended SI for both Intermediate II and III and those who only attended SI for Intermediate III outperform students who never attended SI.

DISCUSION, CONCLUSION AND FUTURE RESEARCH ORIENTATION

Accounting educators are faced with a manifold force of change in higher education. Employers are seeking highly skilled critically-thinking workforce; yet education budgets are tightening and demands to serve a more diverse student body are increasing. Accounting educators need to identify effective pedagogies that promote student success within the confines of limited resources to accomplish this task. Our results provide evidence to support that SI model improves student performance in the more complex intermediate accounting courses.

This study finds that students who utilize SI session perform better academically, after controlling for their prior ability and motivation, age, gender, and school course load. This result holds even after considering potential selection bias, i.e., students with higher prior ability and motivation tend to choose to attend SI session. We also find that students who continuously attend SI session perform better in Intermediate III than the ones who discontinue SI attendance. These students also outperform the ones who never attended SI sessions.

The results suggest that accounting students learn better through interacting with their peers. While traditional classroom instruction is oriented towards passive learning, SI improves the learning experience by promoting active learning. Instructors with feedback from a SI leader can teach more effectively by focusing on topics that need more attention. Therefore, students will become more engaged in the classroom and better able to absorb the materials.

Our findings indicate that SI is a valuable investment for an educational institution, considering its benefits. This will help the institution to bridge the achievement gap for underperforming students. In turn it will lead to a higher passing rate for bottleneck courses and improve the time to graduation.

Constraints for implementing the SI model are lack of financial resources, difficulty in finding qualified SI leaders due to extensive training and work involved, instructors' willingness to adopt SI model, availability of classrooms for conducting SI sessions, and students' unfamiliarity with SI and their unwillingness to attend. These constraints will apply to accounting courses in the Unites States as well as around the world.

Since the pandemic educational institutions are moving classes online, SI has been conducted virtually. More research is needed to study the effective approach to conduct SI in a hybrid or an on-line course setting.

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