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Examining How Supplemental Instruction Impacts Students' Motivation in Organic Chemistry

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ABSTRACT: This study investigates the effect of Supplemental Instruction (SI) on students' motivation and learning outcomes in an introductory Organic Chemistry course for non-majors. SI, conducted by experienced facilitators, offers a range of academic support for students that may include reviewing challenging concepts, working through practice problems, and answering student questions. To assess the impact of SI in this Organic Chemistry course, we measured several parameters: student engagement during SI sessions, exam scores and final course grades, as well as self-reported motivation levels at both the beginning and end of the semester. We performed a linear regression analysis and observed a positive correlation between SI participation and improved performance on certain exams for SI participants. Further analysis showed that student motivation alone could be driving these improvements. These results suggest that while SI may be beneficial for some students, greater emphasis should be placed on ensuring that students are motivated to learn difficult concepts.

Keywords: Supplemental Instruction, Organic Chemistry, Motivation

INTRODUCTION

Supplemental Instruction (SI) programs are academic support models implemented across many colleges and universities. The concept of SI was first proposed and created at the University of Missouri-Kansas City (UMKC) by Deanna Martin in 1973 with the goal of "reduced attrition and grade improvement in core curriculum courses," [1]. These programs offer a collaborative, near-peer-facilitated learning environment that allows students to enhance their understanding of the course content and learn problem solving strategies. SI programs facilitate regular interactions between an SI leader, who is usually an advanced student peer who has previously taken the course and excelled in it, and students currently taking the course. Since its inception, many institutions have established their own programs, with about 250,000 students participating in an SI program per academic term [1].

Many academic institutions around the world, including four-year universities and two-year community colleges, have conducted research studies on the success of SI programs or similar concepts. Some studies focused on specific STEM courses, while others included a variety of subjects. The majority of studies analyzed a similar format of SI: voluntary sessions led by near-peer facilitators that were conducted regularly outside of the course lectures. Additionally, these leaders generally received some form of training, and their goal was to foster a collaborative learning space where they could teach problem solving and study skills. In general, these studies yielded positive results regarding SI programs. The collaborative nature and small group setting of SI programs provides students with a supportive learning environment which enables them to work with their peers to learn how they best study and master challenging material. Moreover, the near-peer relationship between SI leader and students creates a more comfortable space for students to ask questions.

Multiple studies focused on course grades, GPAs, passing rates, and retention rates as measures of academic outcomes. One study at Curtin University found "SI attendance was significantly and positively associated with students' grades, as well as their odds of passing and retention into the next academic year," [2]. Two studies that analyzed the effects of SI programs in multiple courses both found that the program was especially beneficial for students that previously had low GPAs in high school [3,4]. Another study conducted in a large public research university determined that SI programs in various courses led to improved course grades and retention and had an overall positive impact on student exam scores and retention [5]. More specifically, they also found that SI programs had a higher impact amongst underrepresented minority students in the programs [5]. Finally, a study conducted at an urban community college where researchers analyzed one general psychology course found that students who participated in SI sessions had higher success rates and assignment completion rates [6].

Other studies specifically analyzed SI programs implemented in General and Organic Chemistry courses, given that these courses are particularly challenging for students [7]. At San Francisco State University, researchers found an overall positive impact of SI on pass rates and grades, noting its larger impact on students in General Chemistry 1 and Organic Chemistry 1 compared to students in General Chemistry 2 and Organic Chemistry 2 [8]. Similarly, in another study on SI programs in Organic Chemistry, researchers learned that students participating in SI sessions not only had a higher passing average, but also had improved comprehension and problem-solving skills [9]. The City College of New York conducted two studies on SI: one on General Chemistry, and another on Organic Chemistry. Both studies found that participation in SI sessions resulted in positive academic outcomes, including higher passing averages, improvement of problem-solving skills, and positive student feedback about the sessions [7,10]. Interestingly, one study conducted found that participants were more likely to attend an SI session with an SI leader of the same gender [11].

In addition to the overwhelmingly positive academic outcomes of SI, some studies found that SI also had a positive social impact on students. At the University of Wollongong in Australia, researchers reported that SI sessions expanded the students' social networks and provided an opportunity for them to learn how to collaborate [12]. Researchers at the University of KwaZulu-Natal in South Africa also analyzed the social component of SI by interviewing students about their experience and reported that students felt their SI leaders created a non-judgmental, positive learning environment [13]. Furthermore, researchers at the University of Ottawa found that students in SI sessions felt a greater sense of belonging and overall "enhanced their social integration" [14].

While SI programs follow the same core principles, their implementations are not identical. At Truckee Meadows Community College, researchers studied an embedded tutoring program where near-peer leaders were present in the classroom to assist students, as well as outside of class for voluntary study sessions [15]. Like in the SI studies, the researchers found that students who participated in the tutoring program achieved "consistently higher term and course GPAs for science and mathematics courses" [15]. Another university studied a peer-led team learning (PLTL) approach that was implemented in Organic Chemistry courses [16]. Instead of being voluntary sessions, the PLTL workshops were integrated into the course and the course instructor developed materials to be used during the allotted time [16]. Despite the differences in their approach, the researchers found that PLTL resulted in students earning higher course grades and had better retention rates, and they determined that this was in large part due to the peer-to-peer relationship established in the workshops [16].

Based on the literature, it is well established that SI programs are associated with positive outcomes, both academic and social. Our study aims to explore how SI affects students' learning outcomes and motivation in Organic Chemistry 1. Similar to other studies, we analyzed course grades and compared SI and non-SI students. This study is unique in that we investigated the impact of student engagement during SI sessions, as well as certain demographic factors such as first-generation college status and employment status. Additionally, we focused on how students' motivation changed throughout the semester, and whether participation in an SI session had an impact on their motivation. Assessing student motivation in Organic Chemistry courses is important because, for many students, these are challenging courses that lay the foundation for other rigorous, upper-level science courses. These courses can also be necessary for admission into professional or graduate programs, or even critical in their future careers.

RESEARCH METHODS

SI Group Implementation

During the first week of class in the Fall 2022 semester, the SI program and this study were introduced and offered to each student in the participating instructor's sections of Organic Chemistry 1 (CHM2210) offered at the University of Florida. Study consent forms were collected during the first week of class to allow students ample time to decide whether they wanted to participate. Toward the start of the second week, students were able to select an SI group that fit their schedule. There was at least one offering per day. SI sessions commenced at the start of the third week.

Each SI group met once a week for approximately fifty minutes, which is equivalent to one class period, and was led by an Undergraduate Teaching Assistant (UGTA), also referred to as an SI leader. The SI leaders are undergraduate students who have previously taken the course and excelled in it, and showed interest in leading an SI group. At the start of the semester, all the SI leaders met with the instructor and discussed strategies to enhance the learning environment for the students. This included problem-based learning strategies as well as working in groups to answer complex open-ended questions. While there was some guidance on how SI sessions should be conducted, including class resources, SI leaders ultimately decided how each session was structured and what content was covered. SI leaders regularly met and communicated with each other and the professor throughout the semester to discuss any challenges or concerns.

Population and Sample

Out of the entire class, ninety-four students consented to participate in the study and completed both pre- and post-surveys. Most students declared Biology as their major and were between 18 and 21 years of age. Sixty-seven participants identified as women, 24 as men, and 3 as non-binary. As for the racial demographics of the sample, 57 participants identified as White or Caucasian, 18 indicated they were Asian, 6 identified as Mixed Race or Multi-race, 5 as Latino or Hispanic, 3 identified as African American or Black, 3 as Middle Eastern, 1 as Native American or Alaskan Native, and 1 participant preferred not to disclose this information. Seventeen participants shared being a first-generation college student. The majority of students (n = 65) reported being unemployed at the time, while 29 students worked part-time.

Data Collection

All procedures and surveys were approved by the University of Florida's Institutional Review Board before the commencement of this study. At the beginning and end of the course, participants were sent a brief survey adapted from the Science Motivation Questionnaire II © 2011 Shawn M. Glynn with demographic and Likert-type questions to assess their motivation and attitudes regarding Organic Chemistry. We assessed several motivation factors adapted from this questionnaire: intrinsic motivation, which is defined as one's interest in completing an activity due to their own personal satisfaction or interest in it; career motivation, which is one's interest in gaining skills and knowledge that will help them in their future career; self-determination, which is one's belief in how much control they have over their own learning process; self-efficacy, which is one's belief that they can learn the material effectively and perform well; grade motivation, which is one's belief in the importance of getting a good grade in the course and their subsequent drive to aim for high academic achievement [17,18].

Participation in this study was voluntary and study participants had the option to decline involvement in the study at any time without penalty. This survey was estimated to take approximately 10 minutes to complete. The questions of the survey can be found in Table 1. Attendance was recorded for each SI session, and students were allotted three unexcused absences before being removed from their group. Additionally, students were able to drop out of the SI program, as well as the study, without fear of repercussions. Each session, the SI leader would assign a participation score ranging from 1-3: 1 (not paying attention), 2 (somewhat attentive, not participating much), 3 (attentive, asking questions, not distracted) to each student. SI leaders were counseled on behaviors corresponding to each score before the semester started. Exam scores were collected for all participants of this study.

Data Privacy

All identifying information from data was removed prior to data analysis. All of the data was stored and de-identified by an independent co-investigator. SI leaders did not have access to any identifying information while data was being collected.

RESULT AND DISCUSSION

Of the 94 study participants, 85 indicated in the pre-survey that they were planning to participate in SI sessions. SI participation and engagement data at the end of the semester revealed that 36 participants in the study sample did not end up taking part in SI or were absent from most SI sessions, 5 engaged with SI with minimal effort, 31 students regularly attended SI sessions and overall paid attention during the sessions, and 22 students actively participated in SI session asking meaningful questions etc. (Figure 1).

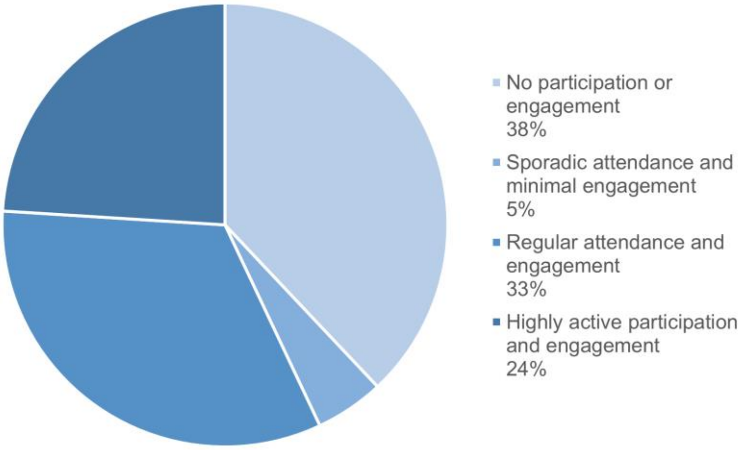

FIGURE 1. Breakdown of student engagement in SI Sessions

TABLE 1. Likert-type questions assessing student motivation on a scale from 0 to 5 (0 = never, 5 = always) with average scores from the beginning and end of the semester

Questions	Pre-Course Avg.	Post-Course Avg.
1. The organic chemistry I learn is relevant to my life	2.12	1.92
2. I like to do better than other students on organic chemistry tests	3.38	3.40
3. Learning organic chemistry is interesting	2.49	2.60
4. Getting a good organic chemistry grade is important to me	3.87	3.80
5. I put enough effort into learning organic chemistry	3.12	3.35
6. I use strategies to learn organic chemistry well	2.90	3.26
7. Learning organic chemistry will help me get a good job	2.98	2.78
8. It is important that I get an “A” in organic chemistry	3.62	3.18
9. I am confident I will do well on organic chemistry tests	2.29	2.40
10. Knowing organic chemistry will give me a career advantage	2.75	2.47
11. I spend a lot of time learning organic chemistry	2.90	3.33
12. Learning organic chemistry makes my life more meaningful	1.80	1.68
13. Understanding organic chemistry will benefit me in my career	2.90	2.55
14. I am confident that I will do well on organic chemistry labs and projects	2.37	2.49
15. I believe I can master organic chemistry knowledge and skills	2.63	2.73
16. I prepare well for organic chemistry tests	2.84	3.22
17. I am curious about discoveries in organic chemistry	2.25	2.17
18. I believe I can earn a grade of “A” in organic chemistry	2.60	2.27
19. I enjoy learning organic chemistry	2.52	2.51
20. I think about the grade I will get in organic chemistry	3.52	3.71
21. I think about the grade I will get in organic chemistry	2.74	2.87
22. I study hard to learn organic chemistry	3.22	3.48
23. My career will involve organic chemistry	2.56	2.22
24. Scoring high on organic chemistry tests matters to me	3.73	3.60
25. I will use organic chemistry problem-solving skills in my career.	2.67	2.38

Effects of SI on Non-majors' Motivation to Engage with Organic Chemistry

Examination of the pre- and post-survey results demonstrated that overall students who elected to pursue SI were more motivated to study organic chemistry (M = 73.53, SD = 13.28) than their counterparts who did not participate in SI (M = 65.14, SD = 13.51). This difference was statistically significant (t_{92} = 2.96, p = .004, d = 0.63). Table 2 provides a summary of the descriptive statistics for the SI and non-SI groups relative to their overall motivation to engage with organic chemistry as well as motivation factors "intrinsic motivation", "career motivation", "self-determination", "self-efficacy", and "grade motivation."

TABLE 2. Descriptive statistics on students' motivation to engage with organic chemistry

Measure	SI Group		Non-SI Group	
	M	SD	M	SD
Intrinsic Motivation Pre	11.82	4.37	9.92	4.07
Intrinsic Motivation Post	11.84	4.80	9.17	4.03
Career Motivation Pre	14.74	4.68	12.17	4.51
Career Motivation Post	13.03	5.08	11.08	4.18
Self-Determination Pre	15.41	3.03	14.06	3.33
Self-Determination Post	17.21	3.30	15.44	3.74
Self-Efficacy Pre	13.22	3.79	11.28	4.18
Self-Efficacy Post	13.62	4.48	11.08	4.40
Grade Motivation Pre	18.33	1.96	17.72	2.49
Grade Motivation Post	17.98	2.31	17.22	2.26
Overall Motivation Pre	73.53	13.28	65.14	13.51
Overall Motivation Post	73.69	15.77	64.00	12.41
Intrinsic Motivation Pre	11.82	4.37	9.92	4.07

To explore the effects of SI on students' motivation to engage with organic chemistry, we performed a repeated measures ANOVA with time (pre vs. post) as the within-subjects factor and group (SI vs. Non-SI) as the between-subjects factor. The overall model was significant (F5,88 = 13.19, p < .001, h2 = .43) suggesting that the within-subjects variable "time" accounted for about 43% in the variance in motivation scores. Specifically, changes over time were observed in students' a) career motivation (F = 13.43, p < .001, h2 = .13), which decreased for both SI and non-SI students, and b) self-determination (F = 28.26, p < .001, h2 = .24), which improved for both groups of over time. The interaction of "time" and "group" was not significant (F5,88 = 1.01, p = .42, h2 = .05) suggesting that the changes in students' motivation to engage with organic chemistry were not influenced by their participation in SI (Table 2).

Relationships Between Students' Engagement in SI and Motivation

A linear regression model was employed to explore whether and how the level of SI participants' engagement influenced their motivation to engage with organic chemistry. The overall motivation score on the post survey was used as the outcome variable and the level of SI engagement was used as the predictor. The levels included 1) sporadic attendance and minimal engagement, 2) regular attendance and engagement, and 3) highly active participation and engagement. The regression model was significant ($F_{1,56}$ = 4.03, p < .04, R^2 = .07). The adjusted R squared value suggests that the level of students' engagement in SI sessions (b = .26) accounted for about 7% of the variance in their motivation score.

To explore the relationships between students' levels of engagement and individual motivation factors, we constructed a correlation matrix using the Spearman Rho correlation coefficient because levels of engagement were assessed at the ordinal level (Table 3). This analysis shows that SI level of engagement is mildly positively correlated with the self-determination motivational factor (r_s = .22, p = .04). This suggests that the higher the level of participation and engagement of students in SI session, the higher their self-determination score.

TABLE 3. Correlation Matrix between SI Engagement and the various individual motivation factors.

		SI Engagement	Intrinsic Motivation	Career Motivation	Self Determination	Self Efficacy	Grade Motivation
SI Engagement	Spearman Rho	1.000	.170	.075	.216*	.193	.138

		SI Engagement	Intrinsic Motivation	Career Motivation	Self Determination	Self Efficacy	Grade Motivation
	Sig. (2-tailed)	.	.102	.472	.036	.062	.184
Intrinsic Motivation	Spearman Rho	.170	1.000	.699**	.367**	.689**	.312**
	Sig. (2-tailed)	.102	.	<.001	<.001	<.001	.002
Career Motivation	Spearman Rho	.075	.699**	1.000	.216*	.438**	.238*
	Sig. (2-tailed)	.472	<.001	.	.037	<.001	.021
Self Determination	Spearman Rho	.216*	.367**	.216*	1.000	.606**	.509**
	Sig. (2-tailed)	.036	<.001	.037	.	<.001	<.001
Self Efficacy	Spearman Rho	.193	.689**	.438**	.606**	1.000	.480**
	Sig. (2-tailed)	.062	<.001	<.001	<.001	.	<.001
Grade Motivation	Spearman Rho	.138	.312**	.238*	.509**	.480**	1.000
	Sig. (2-tailed)	.184	.002	.021	<.001	<.001	.

* Correlation is significant at the 0.05 level (2-tailed).
** Correlation is significant at the 0.01 level (2-tailed).

SI Participation and Grades

SI (M = 81.29, SD = 11.83) and non-SI (M = 79.19, SD = 13.29) students did not differ significantly on the final grade percentage. Figure 2 shows the distribution of students' letter grades for SI vs. non-SI groups.

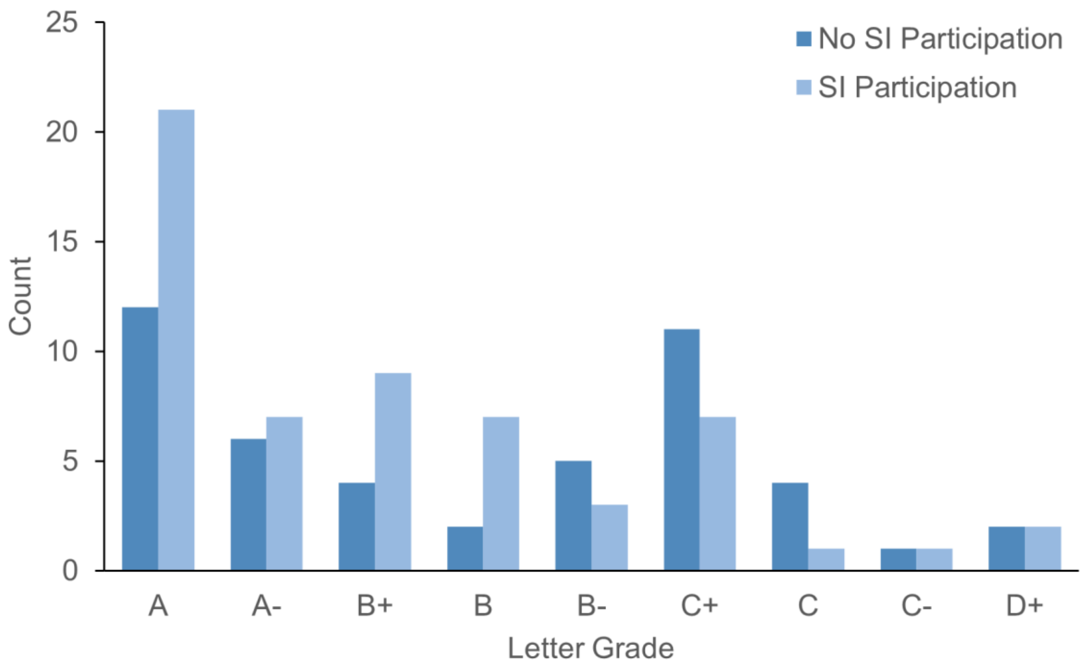

FIGURE 2. Breakdown of final grades: clustered bar count of letter grades by SI participation status

Independent sample t-tests demonstrated that students in the SI group significantly outperformed their non-SI counterparts on exam 3 (t_{92} = 1.58, p = .05, d = .34). The SI group also overall performed better than the non-SI group on exam 4, but this difference was not significant (p = .19) (Table 4).

TABLE 4. Summary of progress exam grades based on SI participation status.

	SI Participation		Statistic	Std. Error
Exam 1	No	Mean	85.42	2.176
		Std. Deviation	13.059	
		Minimum	39	
		Maximum	98	
	Yes	Mean	85.16	2.119
		Std. Deviation	16.137	
		Minimum	0	
		Maximum	100	
Exam 2	No	Mean	88.97	1.618
		Std. Deviation	9.706	
		Minimum	53	
		Maximum	100	
	Yes	Mean	88.66	.974
		Std. Deviation	7.416	
		Minimum	67	
		Maximum	100	
Exam 3	No	Mean	73.31	3.073
		Std. Deviation	18.436	
		Minimum	33	
		Maximum	100	
	Yes	Mean	79.19	2.226
		Std. Deviation	16.953	
		Minimum	32	
		Maximum	100	
Exam 4	No	Mean	75.64	2.905
		Std. Deviation	17.429	
		Minimum	42	
		Maximum	98	
	Yes	Mean	78.67	2.019
		Std. Deviation	15.376	
		Minimum	41	
		Maximum	100	

Given the differences in exam 3 scores for SI and non-SI students, we performed linear regression analyses to estimate whether students' motivation scores predicted their Exam 3 performance within the SI group vs. the non-SI group. The regression model for the non-SI group was significant ($F_{5,30}$ = 8.17, p < .001, R^2 = .57). Motivation variables explained about 57% of the variance in Exam 3 score for the non-SI group. The only significant predictor was post-survey Career Motivation, and this was a negative predictor, meaning the higher the exam score, the lower the student's career motivation (b = -.64, t = -2.86, p < .008). When this analysis was performed for the SI group, the regression model was significant ($F_{5,52}$ = 9.11, p < .001, R^2 = .47). Motivation variables included as predictors explained about 47% of the variance in the outcome variable exam 3 score. Interestingly, the motivation variables that predicted the exam 3 score for SI students were both positive predictors: post-survey self-efficacy (b = .77, t = 3.55, p < .001) and post-survey grade motivation (b = .54, t = -3.48, p = .001). This indicates that the higher the SI students' self-efficacy and grade motivation, the higher their Exam 3 score.

Moreover, an ANCOVA analysis was performed to explore the effect of SI participation (between-subjects factor) on exam 3 performance, given the differences between SI and non-SI groups on the pre-test of motivation (covariate). The overall model was significant at $F_{2,91}$ = 3.63, p = .03. After accounting for the effect of the covariate pre-motivation ($F_{1,92}$ = 4.665, p = .03), SI participation did not produce a significant effect on exam 3 performance ($F_{1,92}$ = .82, p = .37). This suggests that the differences in exam 3 performance between SI and non-SI students could be explained in part by the differences in pre-motivation, rather than SI participation.

Participating students met in a collaborative setting with a near-peer leader once a week in a low-stakes environment to complete problem sets, talk through concepts, and prepare for exams. Prior studies suggest that SI programs improve academic outcomes [2,5] and expand social networks [12]. To the best of our knowledge, this is the first study to not only measure SI attendance, but also account for different levels of engagement during the SI session. Additionally, this study surveyed the motivation of students throughout the semester, rather than focusing solely on academic social outcomes. One of the main challenges encountered during this study was assessing student engagement. More than a third of surveyed participants had little to no engagement in their SI group and less than a quarter of participants had high engagement based of SI group leaders' assessments of student engagement (Figure 1). This challenge is not unique to this study and has been previously encountered by other researchers [7]. If students are less engaged, then it becomes harder to discern what impact SI is making on their motivation.

After breaking down motivation into the different factors described by Glynn [17], a correlation matrix was calculated to investigate the correlation between SI engagement and each motivation factor. This showed there is a mild positive correlation between SI engagement and self-determination, which may suggest that students who actively participate in SI groups feel more in control over their success in the course. This could be due to students feeling comfortable approaching the SI leader with questions about difficult concepts, ensuring their questions get answered. Self-determination is also theorized to play a significant role in the process of individuals developing intrinsic motivation in academic disciplines [8].

Further tests were conducted to examine the relationship between SI participation and grades. For the first two exams in the course, there was no statistically significant difference in exam scores between SI and non-SI students. However, by exam 3, there was a significant improvement for the SI group and some improvement for exam 4, but the difference for exam 4 was not statistically significant. This discrepancy might be partly attributed to students seeking additional resources for help after exam 3, leading SI group participation to have less of a notable effect on exam scores by exam 4. This increase in statistical significance seen in exam 3 could be attributed to the nature of the exams. Exams 1 and 2 introduce basic principles of Organic Chemistry such as acidity, basicity, chirality, and isomerism. However, exam 3 is where the reaction portion of the class begins. Students participating in SI sessions had the opportunity to learn effective study strategies from their near-peer leaders, whereas the students not participating may not have modified their study habits. By exam 4, students who did not perform as well could have adjusted their study habits to score similar to students participating in SI.

Following this, we performed linear regression analyses to understand what effect post-survey motivation variables may have had on exam 3 scores for SI and non-SI students. The regression model for SI students showed that their exam scores were positively predicted by self-efficacy and grade motivation. These findings suggest improving self-efficacy can be a promising approach towards improving student academic outcomes. The regression model for non-SI students was also statistically significant, but only post-survey career motivation was significant. Career motivation was a negative predictor for non-SI students, indicating that non-SI students with higher exam scores had lower career motivation. It is possible that this result may be attributed to the fact that students taking CHM2210 are predominately on a pre-professional track and are less likely to be pursuing a career in Organic Chemistry. In addition, given that career motivation was not found to be a negative predictor for the SI group, this suggests SI participation has some influence on students' career motivation, and future studies should investigate this to find ways to increase career motivation outside of SI.

Our data also suggests that at the beginning of the semester, more motivated students chose to participate in SI (Table 2). Motivated students are known to take more active ownership of their own learning, including taking advantage of opportunities to improve their learning [19]. We conducted an ANCOVA analysis to measure the effect of SI participation on exam 3 performance, controlling for motivation to account for this potential selection bias, and found there was no significant effect on their exam 3 score. This suggests that self-selection from motivated students could account for the previously reported improved exam scores. We also observed that at the end of the semester, overall motivation of students participating in SI increased while those not in SI decreased, but these findings were not statistically significant enough to conclude this difference was caused by SI group participation.

Some limitations of this study include a lack of formalized training for SI leaders before starting the semester. This training could help SI leaders feel more confident during SI sessions to ensure students are receiving quality instruction. Additionally, as this study tracked students' motivation from the beginning to the end of the semester, students who did not complete the survey at the end of the semester were excluded from analysis, greatly reducing our sample size. Moreover, as many students were not highly engaged during the SI sessions, it is difficult to say with certainty what effect SI groups have on student motivation. Finally, given that we found more motivated students chose to be a part of SI, some of our results may be subject to selection bias.

Further studies with more diverse samples and across higher education institutions (e.g., community colleges, public and private universities) should be conducted to find effective methods to get students motivated about Organic Chemistry, as then they will be more likely to join an SI group and benefit from

SI. Additionally, more studies are needed to determine how best to trigger and maintain student engagement during SI sessions in Organic Chemistry, as well as in STEM courses overall. SI leaders have a limited amount of time to meet with students each week, making the efficient use of this time crucial.

CONCLUSION

To date, many studies have been conducted examining the role of Supplemental Instruction (SI) programs in regard to students' academic outcomes. These studies report that students who participate in SI are more likely to earn higher exam scores and final grades. The aim of our study was to explore how SI participation affects students' learning outcomes, including exam scores and final grades, as well as their motivation. Based on our data, we have reached the same conclusion as other studies, at least on the surface. However, we show that this difference could be, at least in part, due to students' pre-existing motivation rather than SI participation status. Our findings suggest that while SI programs have historically been shown to improve student outcomes, this could be due to selection bias where more motivated and higher-achieving students seek out additional learning opportunities, including SI programs. Further studies are needed in order to elucidate our findings more thoroughly.

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