Effectiveness of the Supplemental Instruction Program in First-Year Engineering Courses - A Longitudinal Report (2015 - 2018)

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Abstract

This Complete Research Paper examines the effectiveness of the Supplemental Instruction (SI) program implemented at our university in first year engineering courses from its inception in the fall semester of 2015 through the fall semester of 2018. The program offers two sessions per week outside of the course that incorporates peer and collaborative learning strategies, married with course material review, to help students be successful in the course. This report provides a longitudinal view of the effects of SI, an examination of aspects of the program that are successful, areas for improvement, as well evidence for expansion to other courses. The study utilizes a mixed-methods approach, incorporating quantitative data relating to grades and attendance with qualitative data relating to student perceptions about SI. An analysis conducted for every semester starting in 2015 showed a minimum of 8 percent decrease in DFWQ% rates for SI attendees (students who attended 2 or more sessions) vs. non-SI attendees (students who attended 0 or 1 session). In spring semesters, the difference was even more pronounced, with SI attendees' DFWQ% rates at minimum being less than half of that for non-SI attendees. An interesting finding was the pronounced effect that regular attendance had on course grades for SI attendees with lower SAT scores, which embodies the mission of SI to assist underprepared students persist and be successful.

Introduction

As student retention and four-year graduation rates are of institutional and national interest and frequently referred metrics for college success, the historically successful and well-studied Supplemental Instruction (SI) program was introduced at the University of Texas at Austin in 2015 through a collaboration between the Cockrell School of Engineering and the Sanger Learning Center. The supported courses included Introduction to Electrical Engineering (EE 302) and Introduction to Computing (EE 306). These are required courses for the Electrical and Computer engineering students at the university, and report high percentages of D's, F's, Q's (drops), and W's (withdraws). In the fall of 2016 this program was expanded to the Network Analyses course (BME 311) in another engineering department at the university.

The SI program is an internationally recognized academic support program created in 1973 at the University of Missouri in Kansas City, to improve grades in historically "difficult" classes, promote student retention and increase graduation rates. In the thirty years since its creation, it has become widespread and is considered an effective academic support model [1]. The Supplemental Instruction (SI) program provides optional, non-remedial sessions designed to deliver content review and additional practice opportunities while developing transferable study effectiveness skills to benefit the student in all coursework at the institution.

Results from other studies have revealed that regular session attendance positively impacted exam scores, overall course grades and DFWQ% (Ds, Fs, Q-drops, Withdraws) rates, and that participants had an overall favorable perception of the SI program [1]-[5]. Some works have sought to determine factors that affect attendance in SI sessions, by using qualitative data on students attitudes to predict behaviors of attendance [6], [7]. This work in particular found that influential individuals (such as peers and professors) promoting attendance to SI sessions improved students' perceptions of the utility of the program and their self-reported intentions to attend sessions. We have similarly been interested in determining factors that influence or improve attendance to our engineering SI sessions, which we hope to leverage to better address the needs of the student population and to promote the Supplemental Instruction sessions as an effective intervention to address retention and fail rates.

There are a very limited number of reported data on the effect of supplemental instruction in pre-engineering and engineering courses. Current studies of SI in engineering courses show that students attending SI sessions perform better on exams and SI attendance was positively correlated with final course grades [2], [3], [8]-[15]. SI attendance improves persistence in the degree program with fewer leaving the degree [8], [14] and students attending SI complete more credits in their first year [2]. The benefits gained in SI have been shown to be transferable to non-SI courses [3] and affect both attendees and the SI session leaders themselves [15]. The SI program provides learning opportunities that are otherwise unavailable to students [3], and reaches greater proportions of underrepresented student populations (females and ethnic minorities) [9]-[13].

I. Motivation for Study

This study investigates the efficacy of the SI model in the Introduction to Electrical Engineering course (EE 302) since its inception in 2015 to the latest year, 2018, and more recently in the Introduction to Computing (EE 306) course in spring and fall of 2018. The SI model is well established in other departments at the university, implemented in economics, history, math, and other departments since the 1980s. Careful attention has been paid to individualize these programs to emphasize the academic skills students need to be successful in these specific courses. Over the course of the three years since implementing the SI program in EE 302, we have endeavored to identify the components necessary to individualize this program to engineering without compromising the authenticity of the SI model. Encouraged by our findings in EE 302, we offered SI to students in EE 306 and have now accumulated two semesters worth of data for the SI program in this course.

This longitudinal report of the SI program's three year operation will detail our findings, which we hope will be beneficial for further development of SI for this course, other engineering courses at the university and for other administrators of similar programs.

II. Limitations of Study

Limitations of assessing correlations between grade outcomes and SI session attendance occur due to the voluntary nature of the program. In order to control for self-selection bias, we considered standardized test scores (SAT and ACT) as indicators of student preparation for college level coursework. However, this only accounts for one of many factors that could impact grade outcomes such as possible qualitative moderators/mediators, such as student's prior and current educational experiences, variations in level of student preparation, help-seeking behaviors, overall motivation and type of mindset are just a few of the factors that make the analysis of student performance and SI attendance difficult. Future studies would benefit from exploring ways to account for these factors.

A review of the current literature revealed no one standard for comparing students according to their attendance to SI sessions; these levels are defined differently by each author [2,3]. Some studies group students enrolled in a class with SI support as no-, low-, medium-, and high-levels of use, categorized by a certain range of sessions. Other studies use a binary system, comparing non-attendees and attendees. A more recent study [16] on a variety of sophomore level engineering courses has indicated that the dependence of student performance on number of SI sessions attended is proportional, and that the cutoff could be considered to be as low as 1 or 2 sessions. Considering the lack of a consistent n-value for student SI usage in EE 302 or 306 between the fall and spring semesters, we defined the "SI" group as students attending 2 or more sessions (or returning students) and the "no SI" group attending 1 or has none.

Another limitation with respect to the qualitative data is our use of self-reported perceptions of the program. In general, we have found that student perceptions of the traditional SI model, which uses collaborative group activities and discussions to help students better understand course materials, were rated least preferred. This creates a tension with what has been shown in numerous studies [1], which is that SI's use of peer and collaborative techniques promotes the socio-emotional interactions within an educational environment that improves learning and retention. In future work, we are interested in assessing metacognitive awareness factors of students, prior to their involvement in SI, to see if these factors are affected or improved by the program's intentional implementation of peer and collaborative learning strategies.

IV. Definitions Used in Study

The following terms utilized in this study are defined according to the authors' and the university's use:

- Drop: students may leave a course without it being noted on their transcript up to the 12th class day.
- Fail: a student earning below a D- has failed a course.
- Q-Drop: students may leave a course after the 12th class day with a "Q" noted on their transcript [17].
- DFWQs: the number of students in the course who Q-dropped the class, made a D, F, or

withdrew (and received a W on their transcript)
- DFWQ% rates: the percentage of students in the course who Q-dropped the class, made a D, F, or withdrew (and received a W on their transcript), in comparison to the whole student population for that course.
- SI group: students who attended 2 or more sessions.
- non-SI group: students who attended 1 or no sessions.

Research Questions

To assess the impact of SI on freshmen engineering participants, this report addresses the following questions:
1] What are the trends of DFWQ% rates between students who attend SI versus students who do not attend over the three year period (fall 2015 - fall 2018)?
2] What are the trends in student motivation for attending SI over the three year period? How have they changed?
3] What are the trends in program perception and benefits of SI by participating students over the three year period?

Design and Implementation

The Supplemental Instruction model is a peer-assisted learning (PAL) model which employs active and collaborative learning strategies to review class material and develop transferable study skills. The SI program employs 2-3 undergraduate upper-class ECE students as SI leaders to lead two identical SI sessions each week for course enrollments of 200-300 students, providing multiple opportunities for students to attend a session each week. SI leaders are required to participate in pre-service training (9 total hours spread between 2 days) and to participate in weekly professional development meetings with SI leaders for other courses and the SI program coordinator within the Sanger Learning Center. These meetings provide the SI leaders with ongoing development of facilitation skills, content direction and continuous feedback. Regular observations were conducted by the SI Program Coordinator. The SI leaders were also responsible for collecting attendance at each session and administering programmatic assessment tools throughout the semester.

In an effort to continually improve the program, the SI Program Coordinator reformed the training activities for the fall 2017 semester, based on the learning outcomes of the University of Missouri Kansas City's Supplemental Instruction Training Conference program in the summer of 2017. The program strongly emphasized implementing peer-led, collaborative practices inside SI sessions, conducting observations early and often, and requiring all SI leaders to plan their sessions with engaging activities that they submitted prior to the session for feedback and iterative cycles of improvement.

At the end of each semester, the SI coordinator collates all attendance data, end of course grades and GPA, SAT scores and student demographic data. An end of semester survey is created and sent to all SI participants, to collect qualitative data on student perceptions of the program, aspects that are most beneficial and feedback on how to improve the program.

Methodology

This study uses a mixed methods approach to investigate the research questions. By collecting both quantitative and qualitative data we gained a better understanding of the student population choosing to attend the SI sessions, their motivations for attending, and the perceived value of the sessions. Considering a combination of quantitative and qualitative measures, we took an interpretative approach to examine the relationship between SI attendance and student's academic performance.

As the SI program's effectiveness is aimed at reducing the the D's, F's, W's and Q drop rates (DFWQ%) rates in first year engineering courses and in turn retain more students to the ECE program, the collaborators have collected multiple types of data, including students' SI session attendance and grade outcome in the course, students' demographic data, and DFWQ% rates for attendees and non-attendees. As mentioned in the limitations section, the voluntary nature of the program does create some difficulty in making a direct link between higher SI attendance and student success. We, therefore, used SAT scores to group students with similar high school preparation, for a more accurate reflection of the effects of SI. Qualitative data was collected in the form of end of semester surveys administered to attendees from 2015-2018.

I. Quantitative Data Collection

Two forms of quantitative data were collected:
SI Program Usage: at the beginning of each session, students signed in with both their name and university unique identification number.
Grade Data: course letter grades and GPAs for all students enrolled in the course were gathered.
Attendance data was documented by the SI leader at the start of each session and reported to the Learning Center, where the SI coordinator maintained a database that connected with the university's registrar. The SI coordinator exported additional data regarding student information such as limited demographics and SAT scores. Additional demographics were provided by the School of Engineering's office of academic affairs.

Students attending zero or one session were categorized as the *no SI group*, whereas repeat attendees (those attending two or more sessions) were categorized as the *SI group*. With this definition of the *SI group* as those who returned, the quantitative data focuses on the outcomes for students who showed investment in using this resource versus those who did not. To examine the effects of SI on student academic performance, course grades were converted from nominal to ordinal data as per the university's numerical grade point equivalents.

II. Qualitative Data Collection

Qualitative data was used to answer research questions regarding students' perceptions of SI, its influence on attendance, and the perceived benefits of SI by participating students. The method of qualitative data collection was post-surveys. The survey comprised of 10-12 questions and was administered around the end of semester, on reading days before final exams. The survey was modified over the course of the three year period, improving on structure and verbiage to collect more accurate information, as well as the inclusion of new questions as trends emerged from past semesters, or removal of questions as the program evolved. In general, the survey collected students' names and university identifier numbers, and then polled the students on their awareness and intention of using the SI program. Students who used the SI service were asked to rate several aspects of the program, including the SI leaders, the group work model and perceived benefits of SI sessions and non-attendees were asked what factors would have improved their chances of attending SI sessions.

Findings and Discussion

In this study we examined the attendance data to gauge how well utilized this program has been over the past 7 semesters. The data in Figure 1 show that less than 40% of the students attended the sessions in all fall semester offerings of this course, prior to Fall 2018. A survey conducted to better understand the behaviors governing student attendance in optional SI sessions revealed that students preferentially utilize resources led by experts rather than peers, unless they are self-selected peer study groups [6], [7], [16]. This survey also revealed that students preferred activities where they were led through working the problems, rather than working through problems collaboratively [6], [7]. In fact only 60% of the students surveyed indicated a desire to attend these sessions, whereas more than 80% of the students planned on attending instructor and teaching assistant office hours, and peer study groups [7]. Given that not all students exhibit help-seeking behaviors, it is difficult to dramatically increase attendance in SI sessions.

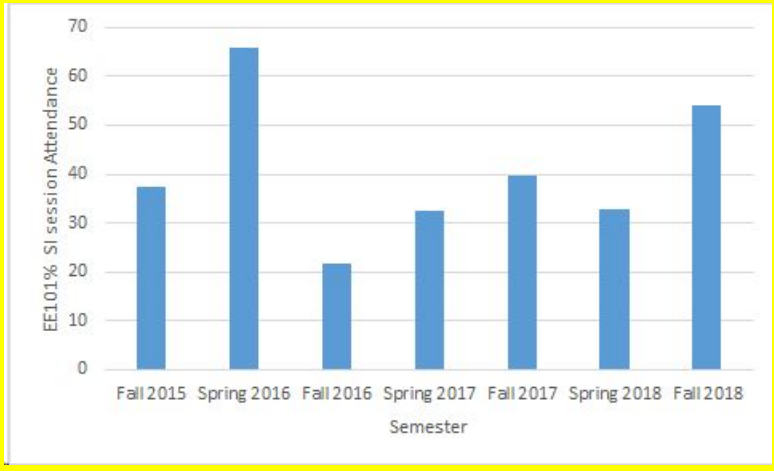

Figure 1: Percentage attendance in SI sessions in EE 302 (2015-2018)

In Table 1 we have listed the number of students who attended SI in each semester cohort. The spring semester enrollment in this course is significantly lower (12% to 18% of the fall enrollment), and the SI session attendance in those semesters has varied from ~32% to 66%. With small class sizes, attendance can be influenced by many factors such as marketing strategies implemented by SI leaders to promote the program in the classroom, and exceptional SI leaders devoted to teaching. These factors possibly explain the attendance spike in Spring 2016. The spike in Fall 2018 may be attributed to both SI leaders for this course offering exam reviews for each exam, meaning six sessions that students could attend, without attending regularly scheduled sessions. While those students who attend more than 2 sessions are considered the SI group, exam reviews do not tend to follow the SI session format (peer and collaborative activities) but do provide problem-solving practice.

Table 1: Number of students taking the course each semester in the no-SI and SI groups.

	No- SI group	SI group
Fall 2015	251	150
Spring 2016	16	31
Fall 2016	308	85
Spring 2017	35	17
Fall 2017	212	139
Spring 2018	43	21
Fall 2018	141	167

In Figure 2 we compare the DFWQ percentages between the *no SI* and the *SI groups*. In each semester we see that SI session attendance has a positive impact on passing the course, suggesting that there is a relationship between attendance and course completion. These percentage differences are more pronounced in each of the spring semester course offerings. As mentioned earlier, the spring cohort is significantly smaller in size, allowing for many more opportunities for one-on-one instruction, and smaller group work in SI sessions.

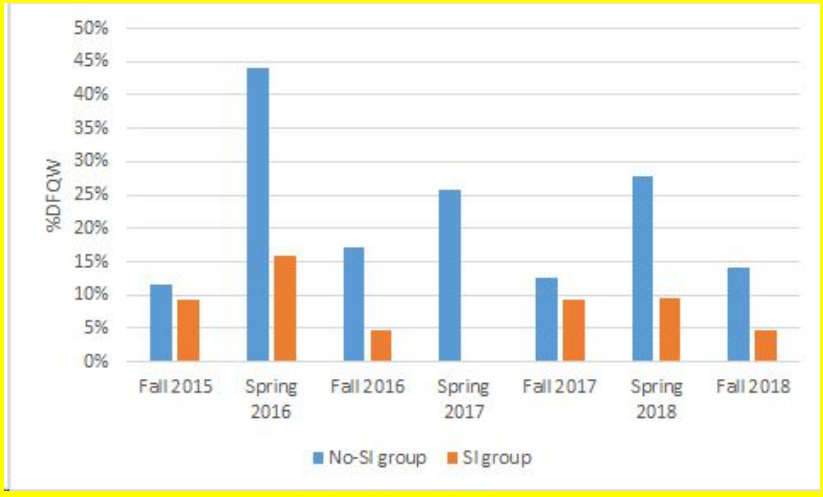

Figure 2: Comparison of %DFQW for SI and no-SI groups for EE 302

A chi-square test on the distribution of DFWQ percentages amongst the different attendance groups showed varying significance across semesters, as seen in Table 2. What is encouraging is when all semesters are combined, we see a highly significant difference between no-SI and SI groups.

Table 2: chi-square test on DFWQ%, Fall 2015- Fall 2018

	No - SI		SI		p-value
Semester	**Pass**	**DFQW**	**Pass**	**DFQW**	
Fall 2015	222	29	136	14	0.4868
Spring 2016	9	7	26	5	0.0390
Fall 2016	255	53	81	4	0.0038
Spring 2017	26	9	17	0	0.0214
Fall 2017	185	27	126	13	0.3293
Spring 2018	31	12	19	2	0.0948
Fall 2018	121	20	159	8	0.0043
All semesters combined	849	157	564	46	0.000002

In an effort to better compare student performance based on predictors of preparedness for college, the student population was divided into five groups, each with a 120 point range of SAT scores and then analyzed for course GPA and DFWQ% rates between *no-SI* and *SI* attendees. As seen in Tables 3 and 4, the data shows that students in the lowest SAT category (which we interpret as being underprepared) see the biggest gains from attending SI regularly, both by having higher course GPAs and lower DFWQ% rates than similar students who do not. It is difficult to conduct a statistical analysis on this categorized data, as the lowest SAT category changes each semester and thus makes a comparison unreliable.

Table 3. Mean Course GPA for EE 302 for different SAT score ranges, Fall 2015-Fall 2018.

	Fall 2015		**Fall 2016**		**Fall 2017**		**Fall 2018**	
SAT scores	**SI**	**no SI**	**SI**	**no SI**	**SI**	**no SI**	**SI**	**no SI**
1000-1120	2.66	1.88	n/a	1.86	2.22	1.66	n/a	n/a
1130-1250	2.22	2.17	2.25	1.92	1.9	1.86	2.33	n/a
1260-1380	2.92	2.71	2.68	2.27	2.12	2.45	2.49	1.92
1390-1510	2.66	2.78	2.85	2.74	2.6	2.69	2.81	2.57
1520-1600	2.78	3.2	3.35	2.99	3.27	3.16	3.25	3.13

Table 4. DFWQ% rates for EE 302 for different SAT score ranges, Fall 2015-Fall 2018.

	Fall 2015		**Fall 2016**		**Fall 2017**		**Fall 2018**	
SAT scores	**SI**	**no SI**	**SI**	**no SI**	**SI**	**no SI**	**SI**	**no SI**
1000-1120	25.0%	60.0%	n/a	50.0%	25.0%	0.0%	n/a	n/a
1130-1250	18.8%	16.7%	0.0%	39.3%	14.3%	0.0%	n/a	n/a
1260-1380	3.8%	10.9%	5.6%	24.3%	13.0%	8.8%	5.9%	14.3%
1390-1510	3.8%	6.6%	3.3%	8.8%	7.5%	8.0%	5.2%	13.3%
1520-1600	33.3%	3.5%	5.6%	5.9%	3.7%	11.5%	2.2%	9.5%

These results more accurately reflect our predictions of the impact of SI when comparing similar students. For certain semesters (fall 2016 and fall 2018), we did not see any students with the lowest SAT score category in the *SI group*, and therefore could not compare with the *no SI group*. There is evidence from other studies [2] that often the most underprepared students exhibit lower help-seeking behaviors, so we expect that while there are some students with low SAT scores who could benefit from SI but who do not attend. Additionally, the University of Texas' R1 admissions standards would likely produce a smaller number of students with low SAT scores, which could account for semesters where we see a small number or no students in the lowest range. One limitation is that between five and twenty percent of the student population did not have recorded SAT scores for any given semester, so were not included in this comparison.

The attendance and DFWQ% for EE 306 are shown in Figures 3 and 4. While the data is limited (from only 2 semesters), the trends are similar to those in EE 302. Especially notable is the sharp decline (from 23.8% to 5.26%, and 18% to 0%, in the two semesters respectively) in the DFWQ percentage with SI attendance. A similar chi-square test was performed for the EE 306 DFWQ% distributions for both semesters combined (Spring 2018 and Fall 2018), producing a p-value of 0.0047, indicating that it is a statistically significant difference between no-SI and SI groups for the EE 306 course, similar to the EE 302 statistical data.

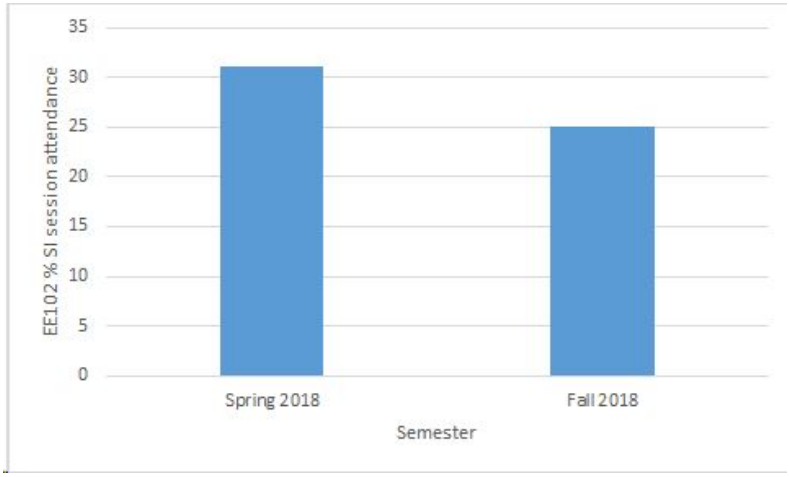

Figure 3: Percentage attendance in SI sessions in EE 302 (Spring 2018-Fall 2018)

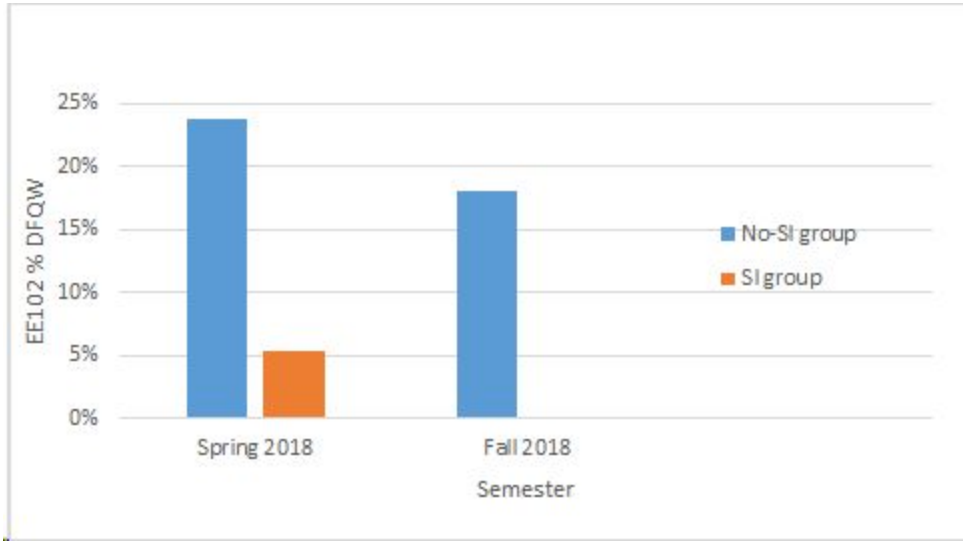

Figure 4: Comparison of %DFWQ for SI and no-SI groups for EE 306, Spring 2018-Fall 2018.

For continuity, we analyzed the course GPAs for EE 306, comparing students in the *SI* and *no SI* groups with similar SAT scores (as was done with EE 302) for spring and fall 2018 semesters (see Figure 5 and 6, respectively). In spring 2018, there were no students in the *no SI group* that

had SAT scores under 1120, but we saw that the *SI group* with the lowest SAT scores had an average course GPA similar to those students in the higher SAT categories, and was almost always higher than the *no SI group*. The only outlier was the second to last SAT range (1130-1250), who outscored all the other SAT categories, *SI* and *no SI*.

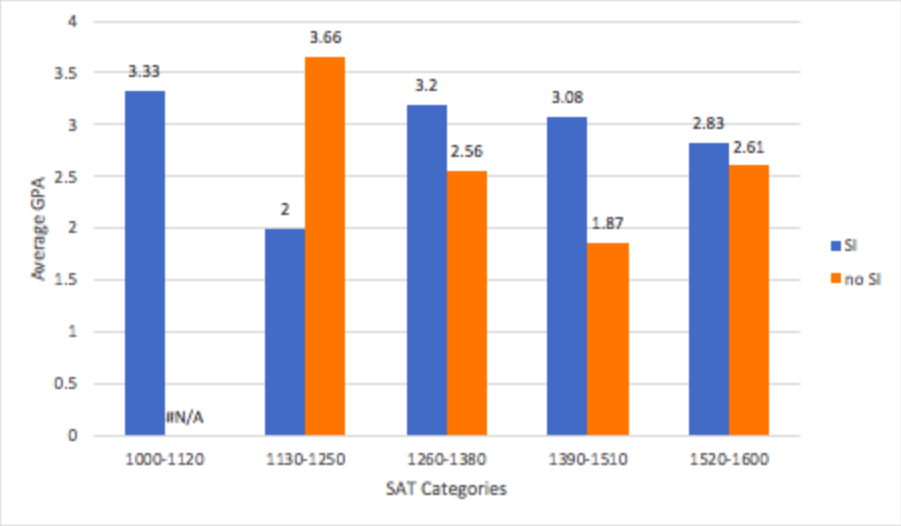

Figure 5: Average GPA for SI and no-SI groups, categorized by SAT score, for EE 306 in Spring 2018

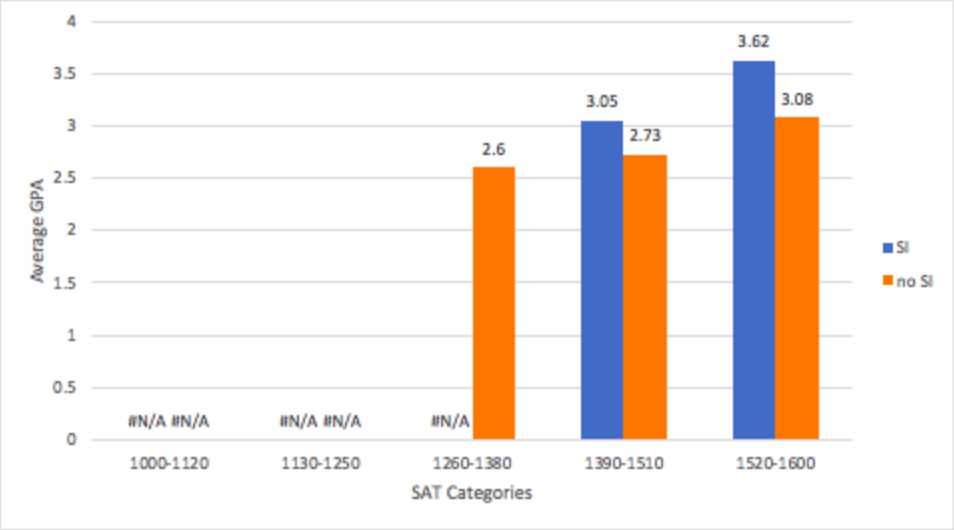

Figure 6: Average GPA for SI and no-SI groups, categorized by SAT score, for EE 306 in Fall 2018

For fall 2018, there were no students in the lowest two SAT ranges in the *SI group* or *no SI group*, and therefore could not compare them. However, we still see that the *SI group*

outperforms the *no SI group* for the other SAT categories. We expect that the University of Texas' admissions standards into the Cockrell School of Engineering would lead to a very small, if non-existant population of students in the lower SAT range. However, we are still bolstered by the results that students who may come in underprepared can highly benefit from regular SI attendance.

To address our third research question (What are the trends in program perception and benefits of SI by participating students over the three year period?), we compared answers from the post-surveys that had been administered fall 2015, fall 2017 and fall 2018 (the survey was not administered in fall 2016). Results of the survey can be seen Table 5. We see the percentage of students that agreed or strongly agreed (SA/A) that "SI sessions helped me to gain a better understand of the subject matter" increased significantly from fall 2015 to fall 2017 (52% to 72%) and then returned to about 57% in fall 2018. One positive outcome is that the majority of survey participants consistently SA/A that "SI sessions helped me perform better on exams" (about 60%, Table 5). Lastly, while this question was not present in the fall 2015 post-survey, from fall 2017 to fall 2018, we see a consistent increase in the percentage of participants who SA/A that "SI sessions helped me gain good study habits and self-discipline" (from 32% in fall 2017 to 56%). We see this an important measure of improvement, as the aspect of study strategies were not emphasized at the inception of the program, but is integral to the ultimate success of the programs and the students who participate.

Table 5. Student attendees rating of perceived benefits of SI sessions in EE 302, Fall 2015-Fall 2018 (Fall 2016 survey data unavailable)

	Agree/Strongly Agree		
	Fall 15	Fall 17	Fall 18
SI sessions helped me to gain a better understand of the subject matter	52%	72%	57%
SI sessions helped me gain good study habits and self-discipline	N/A	32%	56%
SI sessions helped me perform better on exams.	62%	60%	60%

We present below specific student comments that were collected in open ended questions on the survey, that highlight student perceptions of SI sessions in EE 302.
For the question, "Please tell us in your own words why you went to SI Sessions.":

- “It’s always nice to be retaught a difficult subject in different ways so that you’ll be sure to understand it”

- “I went to some to try to get a better understanding of the material. I don’t think they helped as much as they could have, as the instructors only went over a few problems quite quickly. More class interaction would be helpful, but I can't imagine how it should be implemented.”

- “I expected the SI sessions to get me ahead but they felt more like remedial classes.... way too slow”

In response to the question, “Anything else you’d like to tell us?”:

- “The SI session tutors were very helpful, especially their review sessions before exams. I do wish that there was less group work in daily SI sessions though. Reviewing the material at the beginning of the SI session for everyone, and then doing the problems together as a class on the white board was most helpful for me.”

- “There would be times where some professors were slightly ahead of others so in the SI session many students would be at different levels of understanding of the material learned that week.”

As mentioned in the data collection section, the survey was updated to include other questions of interest, as well as modify the language of some questions to more accurately gauge students perceptions of the program. In fall 2018, we administered the post survey to students enrolled in EE 302 and EE 306, as SI sessions were offered for both courses. 83% of survey participants reported they would recommend SI sessions to a friend for the EE 302 course and 95% reported they would recommend SI sessions to a friend for the EE 306 course. Specifically looking at the results for the updated EE 306 survey in fall 2018, survey participants SA/A 80% or higher on aspects such as SI’s impact on end of semester grade outcomes, understanding of course material and exam performance (see Table 6). We are encouraged by these results and will continue to analyze these trends to better understand students’ motivations and perceptions of the SI program.

Table 6. Student attendees rating of perceived benefits of SI sessions in EE 306, Fall 2018

	Agree/Strongly Agree
As a result of attending SI, I'm more likely to get a higher grade in this course.	85%
As a result of attending SI, my understanding of the course material improved.	92%
SI sessions helped me perform better on exams.	83%

Again, we present below specific student comments that were collected in open ended questions on the survey, that highlight student perceptions of SI sessions in EE 306.
For the question, "Please tell us in your own words why you went to SI Sessions.":

- "I went to SI Sessions because the professor goes through the material to quickly for me and I end up just copying what he write and not understanding it. I have to go back later and learn the material. I need to practice more problems or practice specific skills such as identifying supermeshes/nodes. Algebra is easy peasy."

- "EE 306 was a very challenging class for me, and I went to SI Sessions because they helped reinforce my understanding of key concepts and helped me prepare for exams and do homework that I didn't necessarily understand before the session."

- "Other members of my fig went and I went with them."

In response to the question, "Anything else you'd like to tell us?":

- "I like to learn at my own pace rather than at others'"

- "One of the leaders for SI Sessions was good, but the other was too fast for me. After a few sessions, more people came who understood the material better than me so the sessions went by more quickly and I couldn't follow so they became unhelpful in the end."

- "SI sessions were very helpful for the assignments and for the preparation of the exam. They explained exams problems and tricks not taught in class"

Summary

Since fall 2015, we have sought to perform a type of continuous improvement cycle for the SI program, that includes planning the SI program intervention, implementing the SI program, evaluating the intervention through multiple forms of data collection and analysis, and finally making needed changes to the intervention. While we see specific trends play out within each academic year, we also wanted to take a birds-eye view of our data, to report overall findings and answer research questions that were not possible within singular semesters.
Every semester since its inception, we see that the student population who attend SI sessions regularly have a lower DFWQ rate than those who do not, which has been shared with the following cohort of students in the next semester's course. While we have compared end of course GPAs for these two groups, we have learned a more accurate comparison can be accomplished by controlling for SAT scores and indeed, we see larger impact for students with the lowest SAT scores.

We do not see a consistent trend from semester to semester, in terms of percentage of students who attend SI sessions, in relation to the entire course enrollment, despite creating and sharing marketing materials that highlight the GPA differences seen between SI and no SI groups at specific points in the semester. We interpret some of this variation as related to the course enrollment, student perception of their preparedness, preference of type of academic support and other time commitments. Other studies have shown that behaviors of attendance can be influenced by peer or professor promotion [6], [7]. Some SI programs require that students register for SI sessions at the beginning of the semester, in an effort to control for student attendance. Other programs target students after the first exam performance, again inviting students who may have performed poorly to take advantage of a well-recognized support program that has vast evidence of positive impact to student outcomes. In future, we may choose to explore a registration system for SI sessions in EE 302.

From our survey data, we found that students who participated in SI sessions had an overall favorable perception of the program. Every semester since its initial execution, over 50% of students agreed or strongly agreed that attending SI sessions helped them gain better understanding of the material, as well as perform better on exams. We also saw an improvement in the program's ability to instruct students on employing more effective study habits and strategies. Most compelling has been the positive outcomes (both GPA, DFWQ rates and qualitative survey data) that are seen with SI usage in the EE 306 course. We plan to continue our data collection and iterative improvement cycle in implementing SI into this course. In comparing outcomes for EE 302 and EE 306, we can see that SI is even more successful for the EE 306 course. We interpret this to mean that expansion of SI to other freshmen engineering courses would be a worthy investment and offer our findings as evidence for other administrators and faculty who are looking to implement a similar program.

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