

Supplemental Instruction Study: Evaluation of Impact

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Introduction

Supplemental Instruction (SI) is an instructional support program that relies on peer-assisted collaborative learning strategies in group sessions to help students be successful in specific SI-supported course sections. SI sessions are regularly-scheduled informal review sessions in which students engage in interactive study groups, discuss course content, learn and integrate study skills, participate in learning activities, and take mock exams. Funded by the Title V grant, the SI program at Santa Monica College was launched in fall 2008 to support classroom learning in basic skills courses; however, reliable data is not available prior to the winter 2009 term. The SI-session attendance tracking software was revised for the fall 2012 and the accuracy of the records has improved as a result.

SI-supported courses were originally sections of selected basic skills courses in math and English, but over time the SI-supported course offerings have expanded to include non-basic skills courses and courses in other disciplines, especially STEM disciplines. The SI program was institutionalized when the original grant ended and is currently funded jointly by the district and STEM grant.

Over the course of the study period which spans regular terms in academic years 2012-2013 and 2013-2014, SI-supported sections have been offered in 28 courses across 10 disciplines (see Table 1 below). SI has been utilized by 2,770 unique students enrolled in SI-sections across the study period. The SI program also serves students who request assistance, but are not enrolled in SI-supported course sections. Across the study period, 506 such students also received instruction through the SI program. Therefore the total number of students served is 3,276, however only enrollments from SI-supported sections are included in the analysis which follows.

Summary of Main Findings

- SI participation
 - About 6 in 10 students do not attend any SI sessions.
 - Students did not differ in the rates of SI-participation by ethnicity.
 - Students aged 30 and older had greater participation in SI compared to younger students.
 - Students with prior-term GPAs between 3.5 and 4.0 had greater participation in SI compared to students with lower GPAs.

- Students enrolled in STEM or non-Basic Skills courses had greater participation in SI compared to students enrolled in non-STEM or basic skills courses.
- SI Impact
 - Students who have at least minimal participation in SI successfully completed their enrolled courses at higher rates than students with no SI involvement.
 - Students who have at least minimal participation in SI persisted to the next semester at a higher rate than students who did not participate in SI.
 - Basic skills students who have at least minimal participation in SI progressed to the next course in the basic skills course sequence at a higher rate than students who did not participate in SI.
 - Participation in SI predicted student success, even after controlling for the influence of background characteristics including prior-term GPA.

Table 1. Number of SI-supported course sections by term.*

Course name	Fall 2012	Spring 2013	Fall 2013	Spring 2014	Total
ACCTG 1	3	1	1	3	8
ANTHRO 1	1	1	1	1	4
ANTHRO 5	1	0	1	0	2
ASTRON 3	2	1	0	0	3
BIOL 2	0	2	2	2	6
BIOL 3	0	0	1	2	3
BIOL 21	0	1	1	2	4
CHEM 10	4	2	3	4	13
CHEM 11	5	3	1	0	9
CHEM 12	0	0	0	3	3
ECON 1	0	0	2	1	3
ENGL 20	0	0	1	2	3
ENGL 21A	2	1	2	3	8
ENGL 21B	0	4	0	1	5
ENGL 85	2	4	4	8	18
MATH 2	2	3	2	3	10
MATH 7	3	2	4	4	13
MATH 8	1	0	1	2	4
MATH 18	5	2	1	2	10
MATH 20	5	6	5	1	17
MATH 31	5	5	7	5	22
MATH 54	2	4	3	3	12
MATH 81	4	3	1	5	13
MATH 84	4	1	2	3	10
MATH 85	1	2	3	0	6
PHYSICS 21	1	0	0	0	1
PHYSICS 23	0	0	0	1	1
SPAN 1	0	0	0	1	1
Total	53	48	49	62	212

*Sections with SI leaders who resigned prior early in the semester were excluded.

Table 2. Basic Skills and STEM courses (alphabetically)

Basic Skills Courses	STEM Courses
ENGL 20	ANTHRO 1
ENGL 21A	ANTHRO 5
ENGL 21B	ASTRON 3
ENGL 85	BIOL 2
MATH 18	BIOL 3
MATH 20	BIOL 21
MATH 31	CHEM 10
MATH 81	CHEM 11
MATH 84	CHEM 12
MATH 85	MATH 2
	MATH 7
	MATH 8
	MATH 54
	PHYSICS 21
	PHYSICS 23

Utilization of Supplemental Instruction

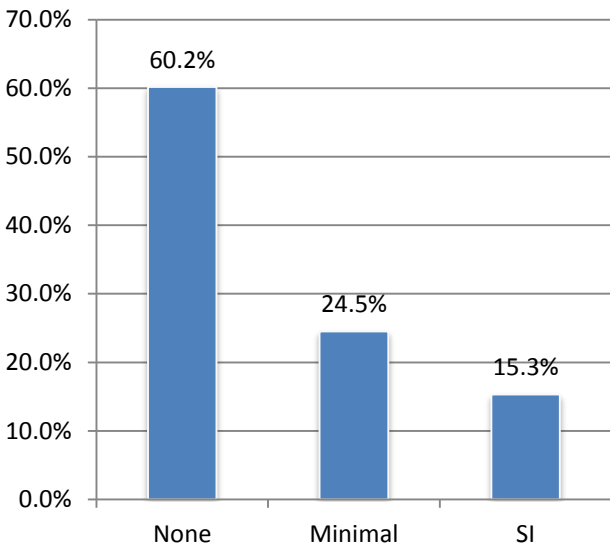
SI leaders keep track of attendance at SI sessions and records are inputted through the college’s student information system, Integrated School Information System (ISIS). As a result of prior evaluations of the program, students are encouraged to attend at least 5 SI sessions in order to receive a benefit from participation in the program.

Consistent with this recommendation, students were categorized based on the number of sessions the student attended during the semester:

- None – students who did not attend any SI sessions.
- Minimal – students who attended between 1 and 4 SI sessions.
- SI – students who attended 5 or more SI sessions.

Across the four semesters being studied, there were 7,694 enrollments in SI-supported class sections. Students enrolled in SI-supported course sections attended 2.14 sessions on average. In the majority of cases (60%) students never attended a single session. However, in about 15% of enrollments, the student did attend at least 5 SI sessions for the course enrolled(Figure 1).

Figure 1. % of enrolled students by level of SI participation.



Participation by Demographic Measures

Participation rates were examined to determine if they differed between students on the demographic measures of gender, ethnicity, and age group. Chi-square statistical analyses were conducted to test whether the rates at which students utilized SI differed between groups on the various demographic measures.

Female and male students did not differ in the rates at which they participated in SI (see Table 3). Among both genders, about 15% of students obtained the recommended amount of supplemental instruction. About a quarter of students had some exposure to SI and attended between 1 and 4 sessions.

Table 3. Level of SI participation by sex

	None (0 sessions)	Minimal (1 to 4 sessions)	SI (5+ sessions)
Female (n=3904)	58.9%	25.5%	15.7%
Male (n=3790)	61.5%	23.5%	15.0%
Total (n=7694)	60.2%	24.5%	15.3%

$\chi^2_{(2)}=5.908$; $p=.052$

Participation level in SI did differ significantly by ethnicity overall (Table 4). There's no indication that students differ in the rates at which they access SI by ethnicity. Traditionally underperforming groups of Hispanic and Black students attended SI at similar rates to White and Asian students.

Table 4. *Level of SI participation by ethnicity*

	None (0 sessions)	Minimal (1 to 4 sessions)	SI (5+ sessions)
Asian/Pacific Islander (n=969)	59.2%	23.9%	16.8%
Black/African-American (n=778)	61.1%	24.2%	14.8%
Hispanic (n=3695)	60.9%	24.1%	15.0%
Native-American/Native- Alaskan (n=17)	82.4%	5.9%	11.8%
Two or more (n=238)	67.2%	22.7%	10.1%
White (n=1405)	58.3%	26.2%	15.5%
Declined to state (n=592)	56.9%	25.8%	17.2%
Total (n=7694)	60.2%	24.5%	15.3%

$\chi^2_{(12)}=18.692$; $p=.096$

The proportions of students from each age group are summarized by level of SI participation in Table 5 below. A chi-square analysis reveals students of different ages attended SI sessions at different rates. The cells contributing most to the significant overall statistical result are shaded below. The pattern suggests students age 30 and older attended 5+ SI sessions at a higher rate.

Table 5. *Level of SI participation by age*

	None (0 sessions)	Minimal (1 to 4 sessions)	SI (5+ sessions)
19 and younger (n=3261)	61.4%	24.8%	13.9%
20 to 24 (n=3414)	61.1%	24.1%	14.8%
25 to 29 (n=573)	56.4%	25.1%	18.5%
30 to 39 (n=273)	49.5%	26.4%	24.2%
40 to 49 (n=92)	56.5%	19.6%	23.9%
50 and older (n=81)	40.7%	23.5%	35.8%
Total (n=7694)	60.2%	24.5%	15.3%

$\chi^2_{(10)}=64.440$; $p<.001$

Rates of participation were also examined by student GPA (see table 6) to determine if there’s any evidence to suggest that students with higher prior-semester GPAs are more likely to attend SI than students with lower GPAs. Students who had earned fewer than 6 units were excluded. This means that first-time freshmen or students who had only completed non-credit coursework previously were also not included in this sample.

The chi-square analysis confirms that students differed significantly in their rates of SI participation based on their GPA. Students with the highest GPAs, 3.5 to 4.0, attended 5 or more sessions (22%) compared to students with the lowest GPAs: 2.49 and under (10-14%).

To compliment this analysis, a regression analysis was also conducted which examined how well students’ GPA predicted the number of SI sessions attended and permitted for keeping both variables as continuous various (i.e. not breaking them into categories) which has methodological advantages. According to this analysis, GPA explains only 1.3% of the variability in the number SI sessions attended which indicates it is a poor predictor.

Table 6. *Level of SI participation by GPA*

	None (0 sessions)	Minimal (1 to 4 sessions)	SI (5+ sessions)
1.99 and below (n=658)	68.5%	21.3%	10.2%
2.0 to 2.49 (n=999)	64.6%	21.4%	14.0%
2.5 to 2.99 (n=1132)	58.2%	24.6%	17.1%
3.0 to 3.49 (n=989)	55.9%	25.2%	18.9%
3.5 to 4.0 (n=734)	51.9%	26.6%	21.5%
Total (n=4512)	59.6%	23.9%	16.5%

$\chi^2_{(8)}=65.033; p<.001$

Participation by Course Designation

BSI and STEM courses were examined to see if students in courses of either designation differed in the rates at which they utilized SI. Again, chi-square statistical analyses were employed to determine whether the rates of participation differed to a greater degree than can be reasonably attributed to chance variation and the results are summarized in Tables 7 and 8.

Rates of SI participation overall did significantly differ by basic skills status (see Table 7), however only the *minimal* groups (see shaded cells) are contributing to this result. Similar proportions of SI students participated in 5 or more sessions, approximately 15%. Differences were observed among students who had minimal participation in SI, with students enrolled in non-basic skills courses attending between 1 and 4 sessions at a higher rate (26%) compared to students enrolled in basic skills courses (23%).

Table 7. *Level of SI participation by basic skills status of enrollments*

	None (0 sessions)	Minimal (1 to 4 sessions)	SI (5+ sessions)
Non-Basic Skills (n=3800)	58.7%	26.2%	15.1%
Basic Skills (n=3894)	61.6%	22.8%	15.6%
Total (n=7694)	60.2%	24.5%	15.3%

$X^2_{(2)}=32.035$; $p=.002$

A similar pattern occurs with the STEM and non-STEM comparison. While about 63% of students enrolled in non-STEM courses didn't attend any SI session, a smaller proportion (57%) (Table 8).

Table 8. *Level of SI participation by STEM status*

	None (0 sessions)	Minimal (1 to 4 sessions)	SI (5+ sessions)
Non-STEM (n=4539)	62.5%	22.5%	15.1%
STEM (n=3155)	56.9%	27.4%	15.7%
Total (n=7694)	60.2%	24.5%	15.3%

$X^2_{(2)}=28.622$; $p<.001$

Impact of SI participation

Using the same SI participation level categories (*none, minimal, SI*) groups were compared on 3 different success measures: successful course completion, persistence to the next semester, and in the case of basic skills students, progressed to a higher-level course.

Students successfully completed a course if they earned an A, B, C, or P grade. Unsuccessful grades are D, F, NP, and W. Any 'report delayed' or 'in-progress' grades were excluded.

Success rates by level of SI participation are summarized in Table 9 below. Overall, 47.3% of enrollments resulted in a successful grade. A chi-square analysis reveals success rates differed significantly by level of SI received and all cells contributed to this result. Students who did not receive any SI performed most poorly, with about 38% of enrolled students earning a successful grade. Those students who had some

minimal exposure to SI by attending between 1 and 4 sessions did slightly better with 57% of grades being successful. The highest success rate, 66%, was observed among those students who received the recommended amount of SI (5+ sessions).

Table 9. *Course success by level of SI participation*

	Not successful	Successful
None (n=4630)	61.6%	38.4%
Minimal (n=1885)	42.6%	57.4%
SI (recommended) (n=1179)	34.1%	65.9%
Total (n=7694)	52.7%	47.3%

$\chi^2_{(2)}=387.207$; $p<.001$

Persistence rates by level of SI participation are summarized in Table 10. Students who enrolled in at least one course in the following regular semester were classified as having persisted. Because data for the fall 2014 term are not currently available, enrollments from spring 2013 were excluded for this analysis. The chi-square analysis found that persistence rates differed by level of SI participation and all cells contributed to this result. Students who had at least minimal participation in SI, persisted at a rate approximately 6% greater than students who had no participation in SI.

Table 10. *Next semester persistence by level of SI participation*

	Did not persist	Persisted
None (n=3348)	21.2%	78.8%
Minimal (n=1367)	14.9%	85.1%
SI (recommended) (n=813)	12.3%	87.7%
Total (n=5528)	18.4%	81.6%

$\chi^2_{(2)}=49.170$; $p<.001$

Basic skills enrollments in English and math were examined to determine whether students enrolled in SI-supported courses who participated in SI were more likely to have progressed to a higher course in the basic skills sequence towards college-level courses. Students' subsequent enrollments were examined and a student was considered to have "progressed" if he enrolled in a higher-level course within one year. As such only basic skills enrollments from fall 2012 and spring 2013 were included. The chi-square analysis revealed that the rates at which students' progressed one-level in the course sequence varied significantly by the level of SI participation. Students who participated in minimal (14%) or recommended levels (10%) of SI progressed to the next course at higher rates than those students who did not attend any SI sessions (5%).

Table 10. *Progression in basic skills sequence by level of SI participation*

	Did not progress	Progressed
None (n=942)	95.0%	5.0%
Minimal (n=215)	86.5%	13.5%
SI (recommended) (n=116)	90.5%	9.5%
Total (n=1273)	93.2%	6.8%

$\chi^2_{(2)}=21.264; p<.001$

The above analyses on successful course completion and persistence were repeated for STEM enrollments only and the pattern of results is consistent with the overall analyses summarized above. The data tables summarizing the STEM specific figures are presented in the Appendix.

Controlling for Student Differences

The issue of selection bias has been raised and program leaders and faculty have wondered if perhaps previous assessments showing that students who attend SI perform better than students who do not are due to pre-existing differences between students. Specifically, that better (i.e. higher performing) students are more inclined to utilize SI than poorer students.

As discussed earlier (see page 5), students with the highest GPAs (3.5 to 4.0) went to at least the recommended number of SI sessions at a greater rate than students with lower GPAs. Because background characteristics and prior performance (GPA) may confound the impact of SI participation on students' success in the course, we conducted a hierarchical logistic regression to examine the unique contribution of SI participation. Conceptually, this statistical analysis determines whether the level of SI participation predicts student success even after controlling for background variables of gender, ethnicity, and age, as well as prior performance (GPA). Table 11 below, lists the variables included in the predictive model. Variables which contributed significantly to the prediction of the outcome variable of student success are noted with asterisks.

Table 11. Variables included in predictive model

Variable Type	Variable Name
Background	Gender (dichotomous)
Characteristics (covariates)	Age* (continuous)
	Ethnicity* (categorical)
	GPA* (continuous)
Predictor	SI participation* (categorical)
Outcome	Student success (dichotomous)

The analysis confirmed that level of SI participation does predict student course success beyond the background characteristics. The analysis provides odds-ratios which can be interpreted as the odds of successful course completion depending on the level of SI participation. *Students who attended minimal number of SI sessions 2.020 times more likely to successfully complete the course and students who attended the recommended SI sessions were 3.236 times more likely to successfully complete the course compared to students who did not attend any SI sessions.*

STEM

The identical hierarchical logistic regression was repeated for STEM students only and confirmed the same pattern of results. SI-participation significantly predicted course success after controlling for the background variables. However, the impact of SI-participation was greater for the STEM subset of enrollments. *After controlling for background variables including GPA, STEM students who participated minimally in SI were 2.388 times more likely to successfully complete the enrolled course and students who participated in at least the recommended number of sessions were 3.309 times more likely to successfully complete the enrolled course compared to STEM students who did not participate in any SI sessions.*

Appendix: STEM enrollments only

The following 6 data tables replicate for STEM enrollments the same analyses presented for all SI-section enrollments in the main report.

Participation by Demographic Measures

Sex

The overall chi-square analysis was significant suggesting female students may participate in SI at a higher rate than male students.

Table 1. *Level of SI participation by sex*

	None (0 sessions)	Minimal (1 to 4 sessions)	SI (5+ sessions)
Female (n=1465)	54.2%	28.9%	16.9%
Male (n=1690)	59.2%	26.1%	14.7%
Total (n=3155)	56.9%	27.4%	15.7%

$X^2_{(2)}=8.203$; $p=.017$

Ethnicity

Students did not differ in their rates of SI participation by ethnicity.

Table 2. *Level of SI participation by ethnicity*

	None (0 sessions)	Minimal (1 to 4 sessions)	SI (5+ sessions)
Asian/Pacific Islander (n=614)	57.3%	26.7%	16.0%
Black/African-American (n=175)	53.7%	29.1%	17.1%
Hispanic (n=1180)	56.8%	27.5%	15.7%
Native-American/Native- Alaskan (n=8)	87.5%	0%	12.5%
Two or more (n=86)	69.8%	20.9%	9.3%
White (n=750)	56.9%	27.7%	15.3%
Declined to state (n=342)	54.1%	28.9%	17.0%
Total (n=3155)	56.9%	27.4%	15.7%

$X^2_{(12)}=11.734$; $p=.467$

Age

Students did not differ by age in the rates at which they participated in SI sessions.

Table 3. *Level of SI participation by age*

	None (0 sessions)	Minimal (1 to 4 sessions)	SI (5+ sessions)
19 and younger (n=1103)	56.3%	27.5%	16.2%
20 to 24 (n=1613)	58.4%	26.7%	14.9%
25 to 29 (n=267)	53.9%	28.8%	17.2%
30 to 39 (n=127)	49.6%	31.5%	18.9%
40 to 49 (n=36)	58.3%	30.6%	11.1%
50 and older (n=9)	44.4%	33.3%	22.2%
Total (n=3155)	56.9%	27.4%	15.7%

$\chi^2_{(10)}=6.907$; $p=.734$

GPA

Students differed in the rates at which they attended SI sessions by their previous term GPAs. Students with GPAs below 2.0 accessed SI at the lowest rates, with only 5% attending the recommended 5 or more sessions.

Table 4. *Level of SI participation by GPA*

	None (0 sessions)	Minimal (1 to 4 sessions)	SI (5+ sessions)
1.99 and below (n=108)	73.1%	22.2%	4.6%
2.0 to 2.49 (n=268)	59.0%	28.0%	13.1%
2.5 to 2.99 (n=458)	57.4%	27.5%	15.1%
3.0 to 3.49 (n=451)	56.3%	26.4%	17.3%
3.5 to 4.0 (n=409)	54.5%	27.4%	18.1%
Total (n=1694)	57.7%	26.9%	15.4%

$\chi^2_{(8)}=18.644$; $p=.017$

Impact of SI participation

STEM students who participated in minimal or recommended levels of SI succeeded in their enrolled courses at higher rates than students who did not attend any SI sessions.

Table 5. *Course success by level of SI participation*

	Not successful	Successful
None (n=1795)	59.1%	40.9%
Minimal (n=865)	39.1%	60.9%
SI (recommended) (n=498)	33.7%	66.3%
Total (n=3155)	49.6%	50.4%

$X^2_{(2)}=153.073$; $p<.001$

STEM students who did not participate in any SI sessions failed to persist to the next semester at a higher rate than students who participated in some SI sessions.

Table 6. *Persistence to next semester by level of SI participation (excludes spring 2014)*

	Did not persist	Persisted
None (n=1239)	21.5%	78.5%
Minimal (n=589)	16.0%	84.0%
SI (recommended) (n=349)	11.2%	88.8%
Total (n=2177)	18.4%	81.6%

$X^2_{(2)}=22.682$; $p<.001$