STEM Supplemental Instruction
Effectiveness Report
Spring 2017

The purpose of this report is to evaluate the effectiveness of Supplemental Instruction (SI) in relation to meeting the STEM program objectives stated below:

- **Objective 2:** Increase the percentage of STEM Academy students and college-wide STEM students who successfully transition from Bridge-to-STEM to STEM by successfully completing both college-level Math and enrollment in at least one core science course.

- **Objective 3:** Increase the percentage of students, especially Hispanics, who complete the Citrus STEM Academy Program as measured by completion of at least one transfer-level Math course, at least one transferable core science course, and completion of a STEM Academy approved project.

Supplemental Instruction is one just activity Citrus College has implemented with the goal of achieving these objectives. Supplemental Instruction, a form of peer-to-peer tutoring, provides regularly scheduled, informal out-of-class review sessions for students who may want additional help.

In Spring 2017 Supplemental Instruction (SI) was offered for five courses – MATH030, MATH150, MATH151, MATH165, or MATH175 – for a total of 940 students. There were 321 students that attended at least one SI session and 619 that did not attend at all.

Table 1 Overall Course Enrollment and SI Participation

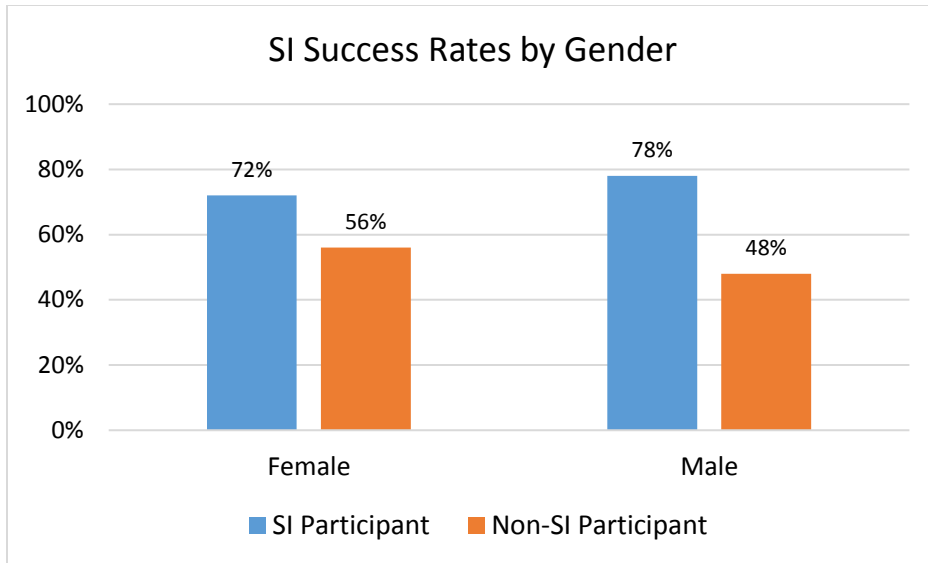| Courses	# of SI Supported Sections	Enrollment	SI Participants		Non-SI Participants	
			Count	%	Count	%
MATH030	8	330	106	32%	224	68%
MATH150	11	424	145	34%	279	66%
MATH151	1	44	12	27%	32	73%
MATH165	3	113	44	39%	69	61%
MATH175	1	29	14	48%	15	52%
Total	24	940	321	34%	619	66%

Success Rates based on SI Participation

Chi-square tests were used to examine if students who participated in supplemental instruction (SI) were more likely to be successful in MATH030, MATH150, MATH151, MATH165, or MATH175 compared to students who did not participate. Success was defined as students earning a final course grade of A, B, or C. Students earning a final course grade of D, F, FW, or W were considered unsuccessful.
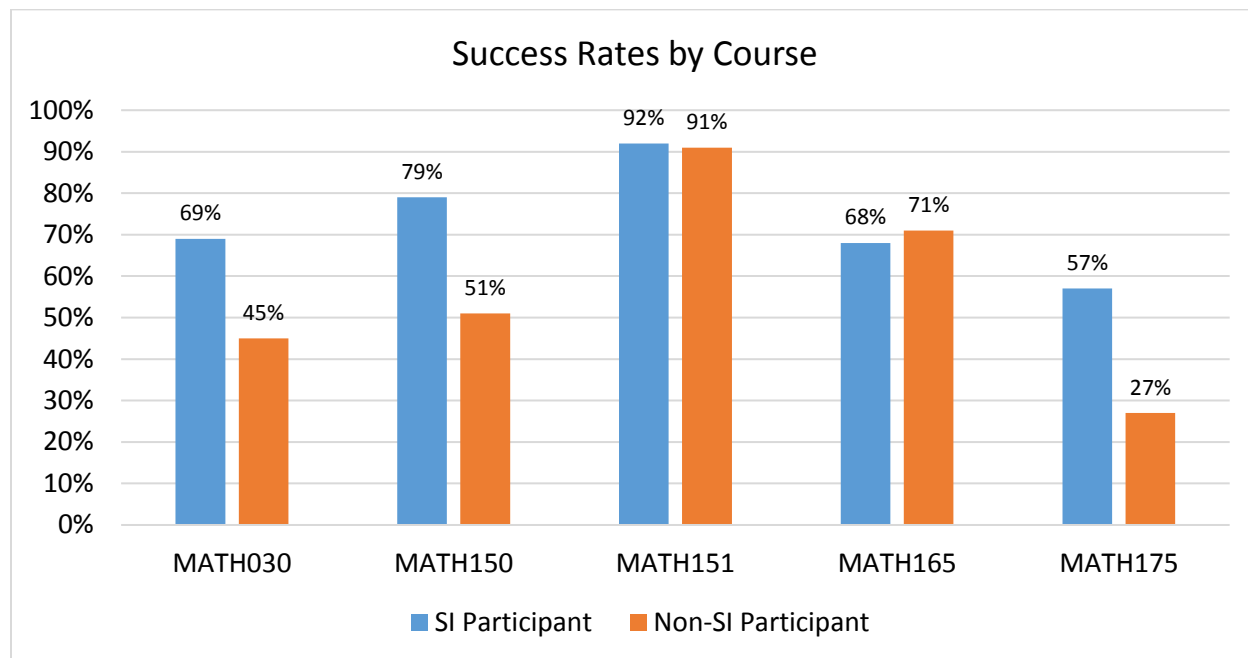
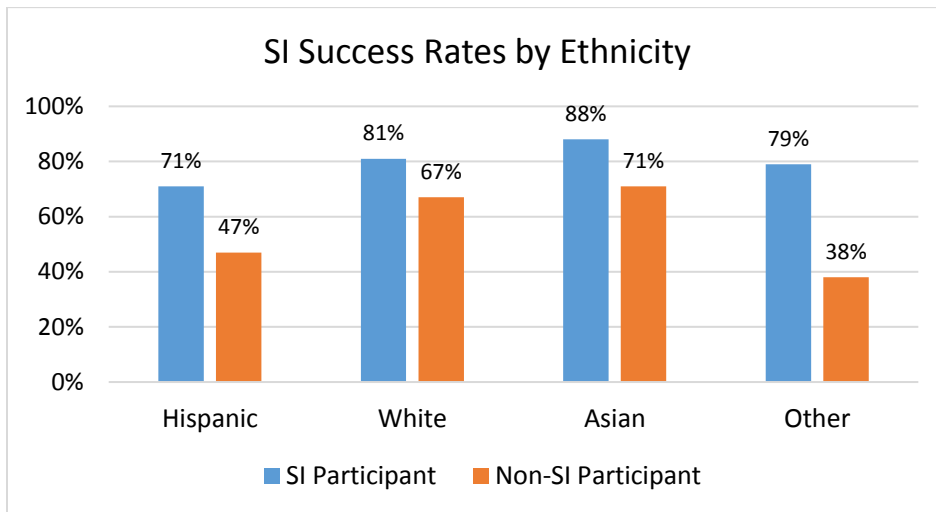**Figure 1** Success Rates by Course and SI Participation

With the exception of students in MATH165, students who attended Supplemental Instruction sessions had higher success rates than students who did not. The results of chi-square tests revealed the success rates were statistically significant for MATH030 and MATH150 students. Specifically, MATH030 SI participants were 69% successful compared to non-SI participants who were 45% successful. Similarly, MATH150 SI participants were 79% successful compared to non-SI participants who were only 51% successful. Even though SI-participants for MATH175 had much higher success rates than non-SI participants (57% vs. 27%), the difference was not statistically significant.

The success rates for all courses broken down by gender and ethnicity are shown in Figure 2 and Figure 3 on the next page. For a detailed look at the demographic success rates for each individual course - MATH030, MATH150, MATH151, MATH165, and MATH175 - please refer to the demographic results beginning on page 9 of this report.

SI Success Rates by Gender

Figure showing bar chart. SI Participant (blue) and Non-SI Participant (orange):
- Female: SI Participant 72%, Non-SI Participant 56%
- Male: SI Participant 78%, Non-SI Participant 48%

Figure 2 Success Rates by Gender for All Courses

Overall, females and male students who attended Supplemental Instruction had higher success rates that those who did not attend. As evident by a chi-square analysis, the differences in success rates for females χ^2 (1, N = 527) = 13.17, p < 0.001 and males χ^2 (1, N = 394) = 29.44, p < 0.001 were statistically significant.

SI Success Rates by Ethnicity

Figure showing bar chart. SI Participant (blue) and Non-SI Participant (orange):
- Hispanic: SI Participant 71%, Non-SI Participant 47%
- White: SI Participant 81%, Non-SI Participant 67%
- Asian: SI Participant 88%, Non-SI Participant 71%
- Other: SI Participant 79%, Non-SI Participant 38%

**Figure 3** Success Rates by Ethnicity for All Courses

When examining success rates across all courses by ethnicity, students who attended Supplemental Instruction had higher success rates that those who did not attend, regardless of their ethnicity. These higher success rates were statistically significant for Hispanics and students belonging in the "Other Ethnicity" category (i.e. African Americans, students with two or more races, and students who did not disclose their ethnicity).

Success Rates Disaggregated by Dosage of SI Participation

To further compare differences among participant groups, SI participation was broken down into two categories: Low Dose (i.e. students attending 1 – 4 SI sessions) and High Dose (i.e. students attending 5 or more SI sessions). Students that did not attending any SI sessions were considered non-SI participants.

In general, students who attended fiver or more SI sessions (i.e. High Dose participants) had the highest course success rate (83%), followed by students who attended 1-4 sessions (67%). Students who did not attend any SI session had the lowest final course grades (53%).
When courses were disaggregated, MATH030, MATH150, and MATH175 showed a similar pattern in which High Dose participants had the highest course success rates while Non-participants had the lowest.
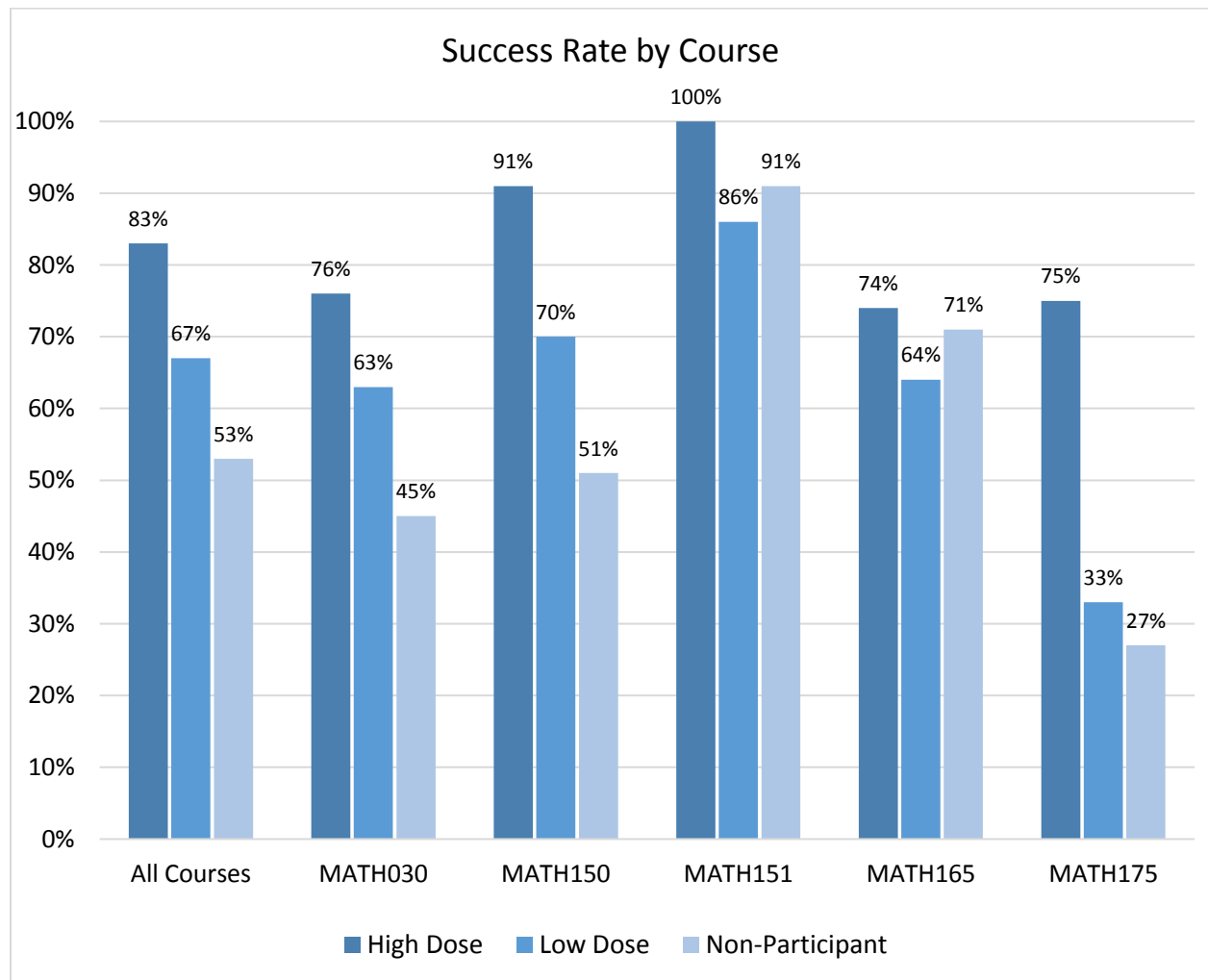
Figure 4 Success Rates by Course and SI Participation when disaggregated

The results of several one-way ANOVA analyses (which measured success continuously using students' final course grade) revealed that for MATH030, MATH150, and MATH175 the group differences for success rate were statistically significant. Specifically, for MATH030 the only group difference that was significant was between High Dose students (76%) and Non-participants (45%). Similarly, for MATH175 the only group difference that was significant was between the High Dose group (75%) and the Non-participants (27%). For MATH150, all group differences were significant. No significant differences between high dose, low dose, and non-SI participants were found for students enrolled in MATH151 or MATH165.

Table 2 Summary of one-way ANOVA Results

	df	*N*	*F*	*p*
All Courses*	2	940	29.96	0.000
MATH030*	2	330	9.13	0.000
MATH150*	2	424	27.63	0.000
MATH151	2	43	0.34	0.713
MATH165	2	104	2.44	0.092
MATH175*	2	29	3.41	0.048

*Indicates significance at $p \leq .05$

SI's Influence on Course Success: Logistic Regression Analyses

To gain a better understanding of how Supplemental Instruction relates to student success even when taking into account other extraneous variables not controlled for, a hierarchical logistic regression analysis was employed. This analysis examines whether SI participation predicted higher course grades above and beyond other influential factors such as students' pre-existing GPA, gender, and ethnicity. When looking at all courses, the analysis revealed that GPA and ethnicity were significant predictors. Supplemental Instruction was also a significant predictor, above and beyond the effects of students' gender, ethnicity and GPA.

In particular, the odds ratio revealed that as students' GPA increased by a unit, the odds of success increased by a factor of 2.6; in other words students were more likely to be successful if their preexisting, overall GPA was high. Based on the odds ratio for ethnicity, White students were 2 times more likely to succeed compared to Hispanic students which was the comparison group. Similarly, Asian students were found to be over 2 times (2.72) more likely to succeed compared to Hispanic students.

Most importantly, increased visits to SI positively predicted student success, even when taking into account the effects of pre-existing GPA, gender, and ethnicity. The odds ratio showed that high dose students that attended 5 or more SI sessions were over 4 times (4.29) more likely to succeed in their given math course compared to students who did not attend SI at all. Similarly, low dose students that attended 1-4 SI sessions were 1.7 times more likely to succeed in their given math course compared to non-SI participants.

Table 3 Hierarchical Logistic Regression Examining Predictors of Overall Course Success

Variables	B	S.E.	Wald	*p*-value	Odds Ratio
Step 1					
Pre-GPA*	0.97	0.11	75.62	.000	2.65
Gender (Female)	0.10	0.16	0.40	.526	1.11
Ethnicity (White)*	0.73	0.25	8.67	.003	2.08
Ethnicity (Asian)*	1.00	0.27	13.27	.000	2.72
Ethnicity (Other)	-0.22	0.31	0.51	.476	0.80
Step 2					
SI (Low Dose)*	0.57	0.21	7.55	.006	1.77
SI (High Dose)*	1.46	0.26	31.91	.000	4.29

*Indicates significance at p ≤.05

Logistic regression analyses were also conducted for each course. The results are summarized below.

For **MATH030** the analysis revealed that GPA, gender, and ethnicity were all significant predictors. Supplemental Instruction was also a significant predictor, above and beyond the effects of students' gender, ethnicity and GPA.

In particular, the odds ratio revealed that as students GPA increased by a unit, the odds of success increase by a factor of 2.3. The odds ratio for ethnicity showed that White and Asian students were over 2 times (2.35 and 2.55 respectively) more likely to succeed in MATH030 compared to the comparison group which was Hispanic students.

Lastly, SI participation (both high and low dose) positively predicted student success, even when taking into account the effects of pre-existing GPA, gender, and ethnicity. Based on the results of the odds ratio, high dose students that attended 5 or more SI sessions were 4 times more likely to succeed in MATH030 compared to students who did not attend SI at all. Similarly, low dose students that attended 1-4 SI sessions were 2 times more likely to succeed in MATH030 compared to students who did not attend SI at all.

Table 4 Hierarchical Logistic Regression Examining Predictors of MATH030 Course Success

Variables	B	S.E.	Wald	p-value	Odds Ratio
Step 1					
Pre-GPA*	0.84	0.17	25.13	.000	2.31
Gender (Female)	0.50	0.27	3.55	.060	1.65
Ethnicity (White)*	0.85	0.42	4.22	.040	2.35
Ethnicity (Asian)*	0.93	0.48	3.83	.050	2.55
Ethnicity (Other)	-0.29	0.56	0.26	.609	0.75
Step 2					
SI (Low Dose)*	0.78	0.34	5.26	.022	2.18
SI (High Dose)*	1.39	0.41	11.69	.001	4.02

*Indicates significance at p ≤.05

For **MATH150** the analysis revealed that GPA and ethnicity were all significant predictors. Supplemental Instruction was also a significant predictor, above and beyond the effects of students' gender, ethnicity and GPA.

In particular, the odds ratio revealed that as students GPA increased by a unit, the odds of success increased by a factor of 2.2. The results of the odds ratio for ethnicity found that Asian students were over 2 times (2.70) more likely to succeed in MATH150 compared to the comparison group which was Hispanic students.

Lastly, increased SI participation positively predicted student success, even when taking into account the effects of pre-existing GPA, gender, and ethnicity. The odds ratio showed that high dose students were over 8 times (8.20) and Low Dose students were almost 2 times (1.99) more likely to succeed in MATH150 compared to students who did not attend SI at all.

Table 5 Hierarchical Logistic Regression Examining Predictors of MATH150 Course Success

Variables	B	S.E.	Wald	*p*-value	Odds Ratio
Step 1					
Pre-GPA*	0.83	0.16	25.31	.000	2.28
Gender (Female)	-0.14	0.25	0.34	.561	0.87
Ethnicity (White)	0.44	0.35	1.54	.214	1.55
Ethnicity (Asian)*	0.99	0.41	5.91	.015	2.70
Ethnicity (Other)	-0.20	0.45	0.19	.661	0.82
Step 2					
SI (Low Dose)*	0.69	0.33	4.46	.035	1.99
SI (High Dose)*	2.10	0.47	20.20	.000	8.20

*Indicates significance at p ≤.05

For **MATH151, MATH165, and MATH175** SI participation was not a significant predictor of success.

MATH030 Demographic Results

In MATH030, there were a total of 330 students who earned a final grade in Spring 2017. Of these, 106 students attended at least one SI session, making the overall participation rate 32%. Students who did not attend SI had a lower success rate (45%) while SI participants had a statistically significant higher success rate (69%); χ^2 (1, N = 330) = 16.32, p < 0.001.

**Table 6** MATH030 Count and Success Rates by SI Participation

	Successful		Unsuccessful		Total	
	Count	%	Count	%	Count	%
SI Participants	73	69%	33	31%	106	100%
Non-SI Participants	101	45%	123	55%	224	100%
Total	174	53%	156	47%	330	100%

The table and figure below show the breakdown of SI participation and success rates by gender and ethnicity. Females and Hispanic students attended SI the most. In terms of success, students in all groups who attended SI had higher success rates in MATH030 compared to their group counterparts who did not attend any SI sessions. For females, males and Hispanic students, these differences in group success rates were statistically significant.

Table 7 MATH030 Enrollment by Gender

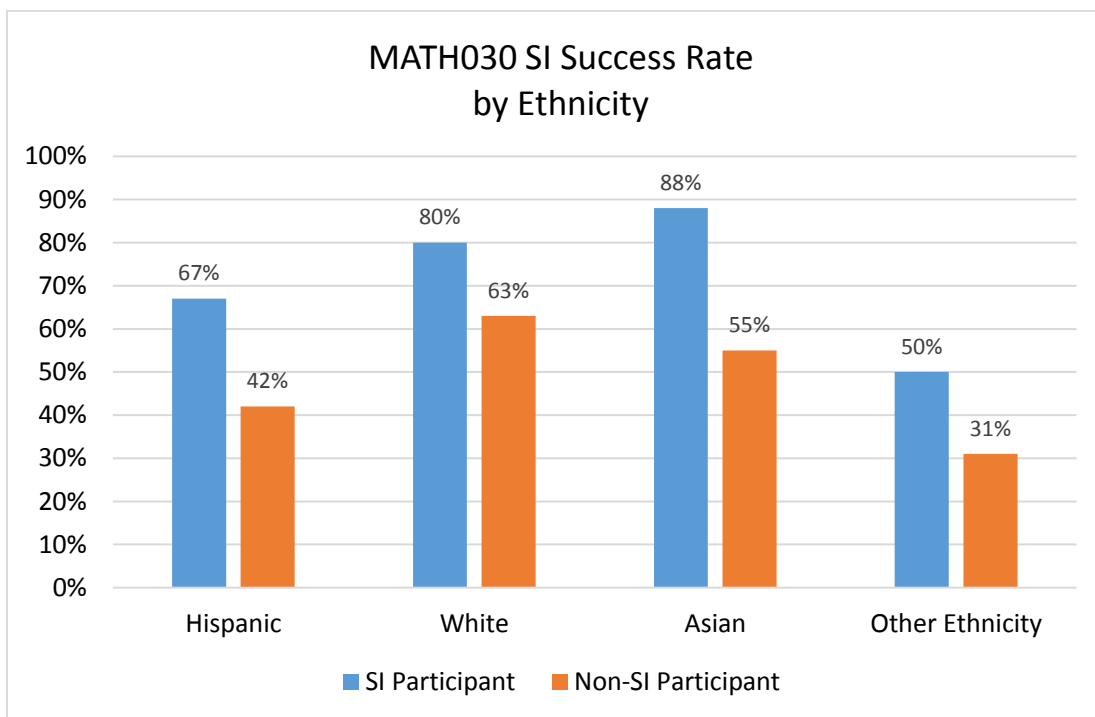|	**Female***	**Male***
SI Participants	72	32
Non-SI Participants	130	89
Enrollment Total	202	121
SI Participation Rate	36%	26%

*Indicates significant group success rate differences at p ≤.05

MATH030 SI Success Rate by Gender

Female: SI Participant 68%, Non-SI Participant 54%
Male: SI Participant 72%, Non-SI Participant 34%
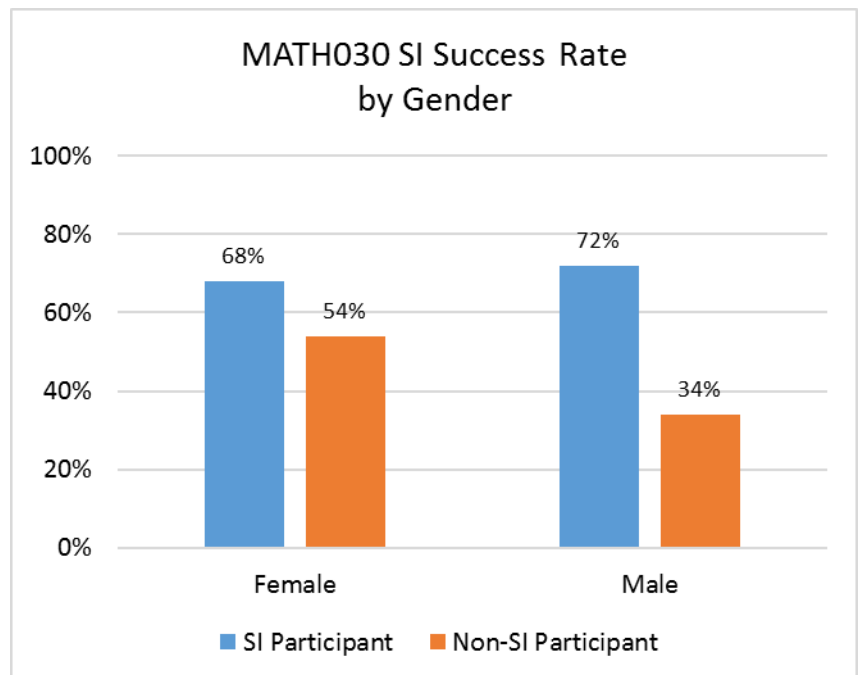
Table 8 MATH030 Enrollment by Ethnicity

	Hispanic*	White	Asian	Other Ethnicity
SI Participants	82	10	8	6
Non-SI Participants	162	27	22	13
Enrollment Total	244	37	30	19
SI Participation Rate	34%	27%	27%	32%

*Indicates significant group success rate differences at p ≤.05

MATH030 SI Success Rate by Ethnicity

Ethnicity	SI Participant	Non-SI Participant
Hispanic	67%	42%
White	80%	63%
Asian	88%	55%
Other Ethnicity	50%	31%

MATH150 Demographics Results

MATH150 had a total of 424 students who earned a final grade in Spring 2017. Of these, 145 students attended at least one SI session, making the overall participation rate 34%. Success rates comparing SI and Non-SI participants in MATH150 revealed that overall, non-participants had a lower success rate (51%) while SI participants had a statistically significant higher success rate (79%); χ^2 (1, N = 424) = 32.27, p < 0.001.

Table 9 MATH150 Count and Success Rates by SI Participation

	Successful		Unsuccessful		Total	
	Count	%	Count	%	Count	%
SI Participants	115	79%	30	21%	145	100%
Non-SI Participants	142	51%	137	49%	279	100%
Total	257	61%	167	39%	424	100%

The tables below show the breakdown of SI participation and success rates by gender and ethnicity. Females and students of "Other" ethnicity participated in SI at a higher rate. In terms of success, students in all groups who attended SI have higher success rates in MATH150 compared to their group counterparts who did not attend any SI sessions. For females, males, Hispanic and "Other Ethnicity" students, these differences in group success rates were statistically significant.

Table 10 MATH150 Enrollment by Gender

|	Female*	Male*
SI Participants	88	56
Non-SI Participants	139	134
Enrollment Total	227	190
SI Participation Rate	39%	29%

*Indicates significant group success rate differences at p ≤.05

MATH150 SI Success Rate by Gender

Female: SI Participant 76%, Non-SI Participant 53%
Male: SI Participant 84%, Non-SI Participant 49%
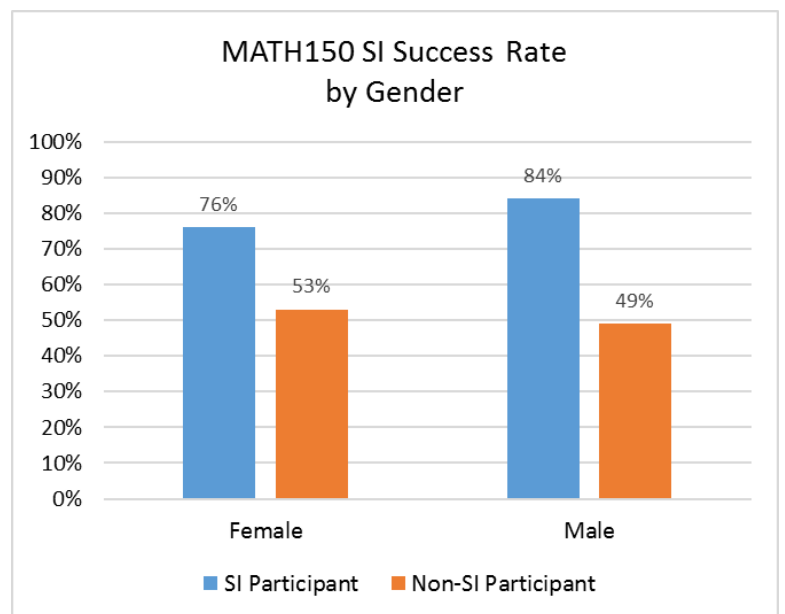
Table 11 MATH150 Enrollment by Ethnicity

	Hispanic*	White	Asian	Other Ethnicity*
SI Participants	101	19	12	13
Non-SI Participants	178	41	42	18
Enrollment Total	279	60	54	31
SI Participation Rate	36%	32%	22%	42%

*Indicates significant group success rate differences at p ≤.05
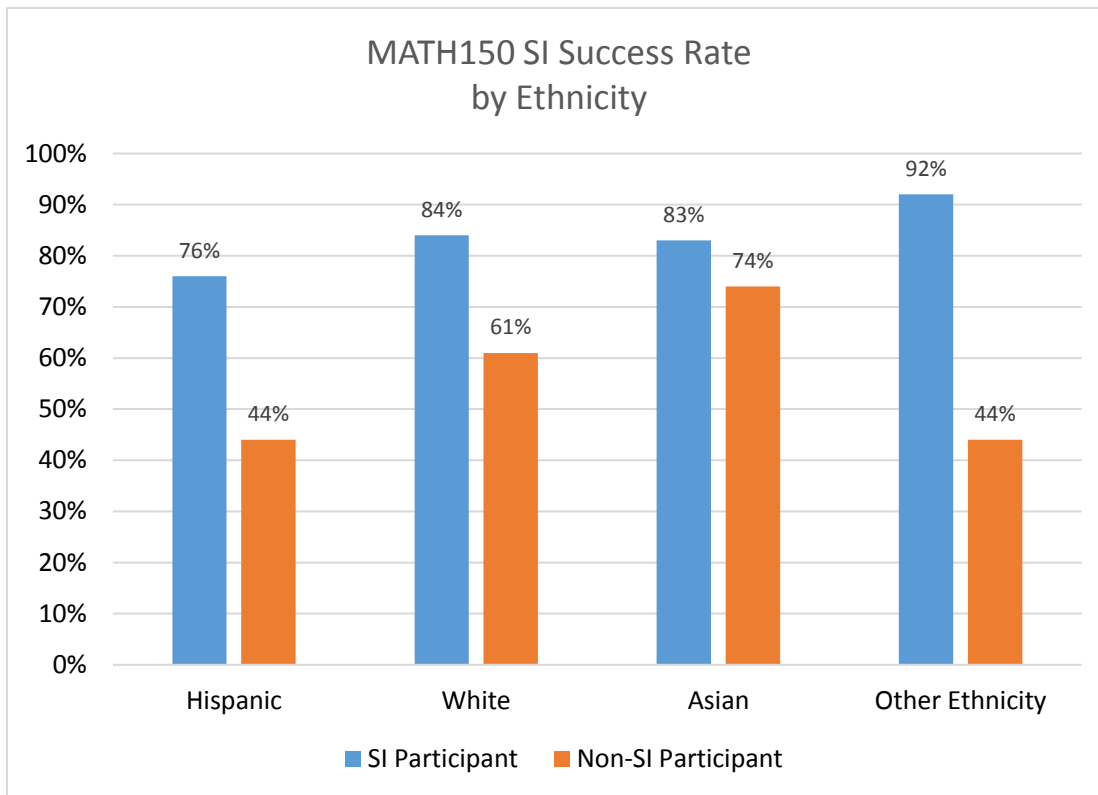
MATH151 Demographics Results

In Spring 2017, MATH151 had a total of 44 students who earned a final grade. Of these, 12 students attended at least one SI session, making the overall participation rate 27%. Students who attended SI had a slightly higher success rate (92%) than students who did not attend (91%). However, this difference in success rates was not significant; χ^2 (1, N = 44) = 0.001, p = 0.915.

Table 12 MATH151 Count and Success Rates by SI Participation

	Successful		Unsuccessful		Total	
	Count	%	Count	%	Count	%
SI Participants	11	92%	1	8%	12	100%
Non-SI Participants	29	91%	3	9%	32	100%
Total	40	91%	4	9%	44	100%

The tables below show the breakdown of SI participation and success rates by gender and ethnicity. From these tables we see that females and White students attended SI at a proportionally higher rate. In terms of success, only female and Hispanic students who attended SI had higher success rates in MATH151 compared to their group counterparts who did not attend any SI sessions. None of these differences in success rates however were statistically significant.

Table 13 MATH151 Enrollment by Gender

|	Female	Male
SI Participants	8	4
Non-SI Participants	12	20
Enrollment Total	20	24
SI Participation Rate	40%	17%

*Indicates significant group success rate differences at p ≤.05

MATH151 SI Success Rate by Gender

Female: SI Participant 100%, Non-SI Participant 83%
Male: SI Participant 75%, Non-SI Participant 95%
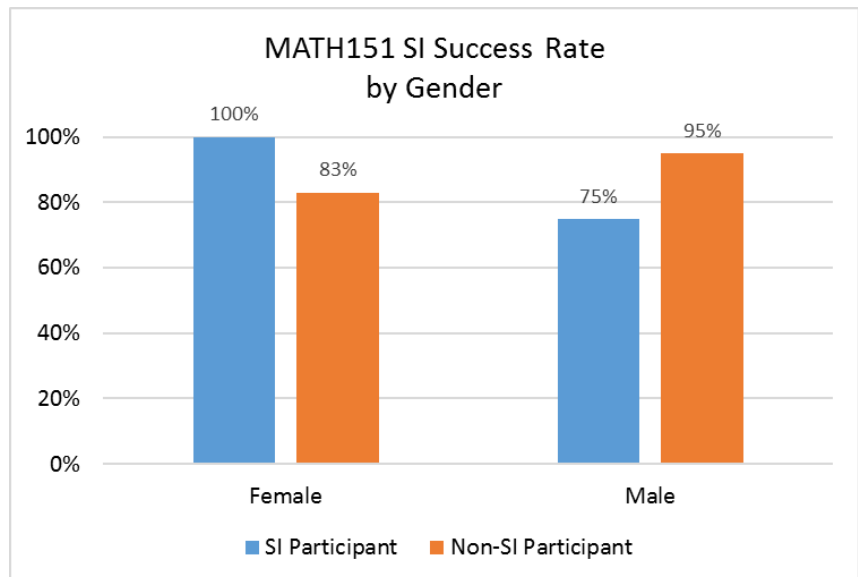
Table 14 MATH151 Enrollment by Ethnicity

	Hispanic	White	Asian	Other Ethnicity
SI Participants	6	5	1	0
Non-SI Participants	19	5	7	0
Enrollment Total	25	10	8	0
SI Participation Rate	24%	50%	13%	-

*Indicates significant group success rate differences at p ≤.05

MATH151 SI Success Rate by Ethnicity
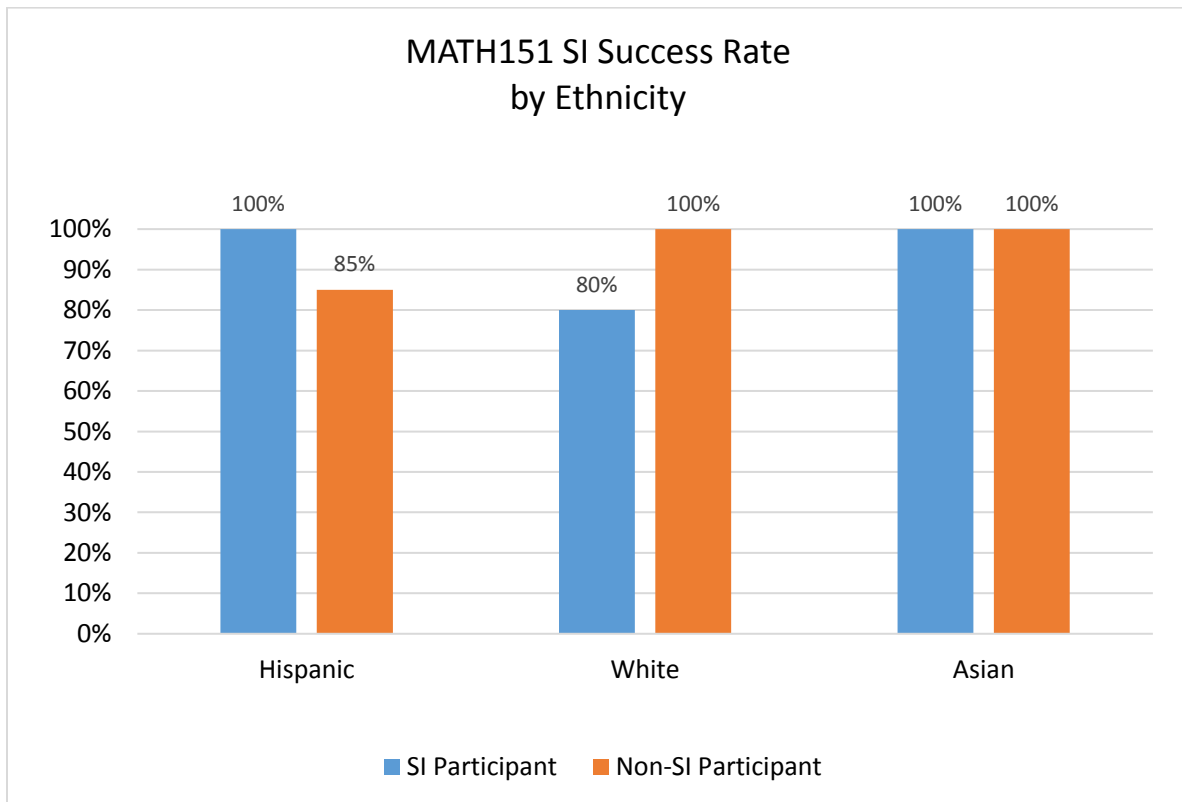
MATH165 Demographics Results

In MATH165 there were a total of 113 students who earned a final grade in Spring 2017. Of these, 44 students attended at least one SI session, making the overall participation rate 39%. Contrary to expectations, students who attended SI had a lower success rate (68%) compared to Non-SI participants (71%). However, this difference in success rates was not significant; χ^2 (1, N = 113) = 0.102, p = 0.749.

**Table 15** MATH165 Count and Success Rates by SI Participation

	Successful		Unsuccessful		Total	
	Count	%	Count	%	Count	%
SI Participants	30	68%	14	32%	44	100%
Non-SI Participants	49	71%	20	29%	69	100%
Total	79	70%	34	30%	113	100%

The tables below show the breakdown of SI participation and success rates by gender and ethnicity. Females, Hispanic students, and students of "Other" ethnicity attended SI at a proportionally higher rate. With the exception of female and Hispanics, students who attended SI had higher success rates in MATH165 compared to their group counterparts who did not attend any SI sessions. However, the differences in success rates were not statistically significant.

Table 16 MATH165 Enrollment by Gender

|	Female	Male
SI Participants	32	12
Non-SI Participants	37	29
Enrollment Total	69	41
SI Participation Rate	46%	29%

*Indicates significant group success rate differences at p ≤.05

MATH165 SI Success Rate by Gender

Female: SI Participant 66%, Non-SI Participant 73%
Male: SI Participant 75%, Non-SI Participant 66%
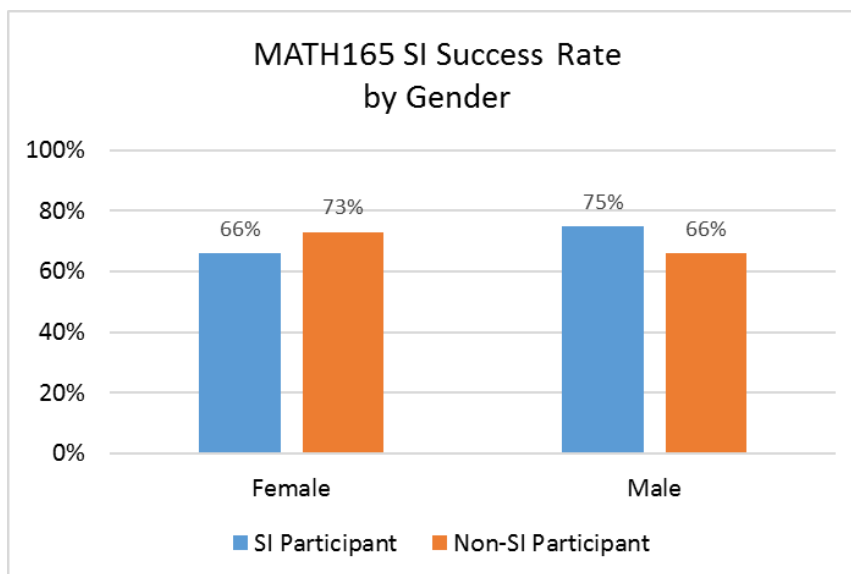
Table 17 MATH165 Enrollment by Ethnicity

	Hispanic	White	Asian	Other Ethnicity
SI Participants	36	2	1	5
Non-SI Participants	45	9	9	6
Enrollment Total	81	11	10	11
SI Participation Rate	44%	18%	10%	45%

*Indicates significant group success rate differences at p ≤.05

MATH165 SI Success Rate by Ethnicity
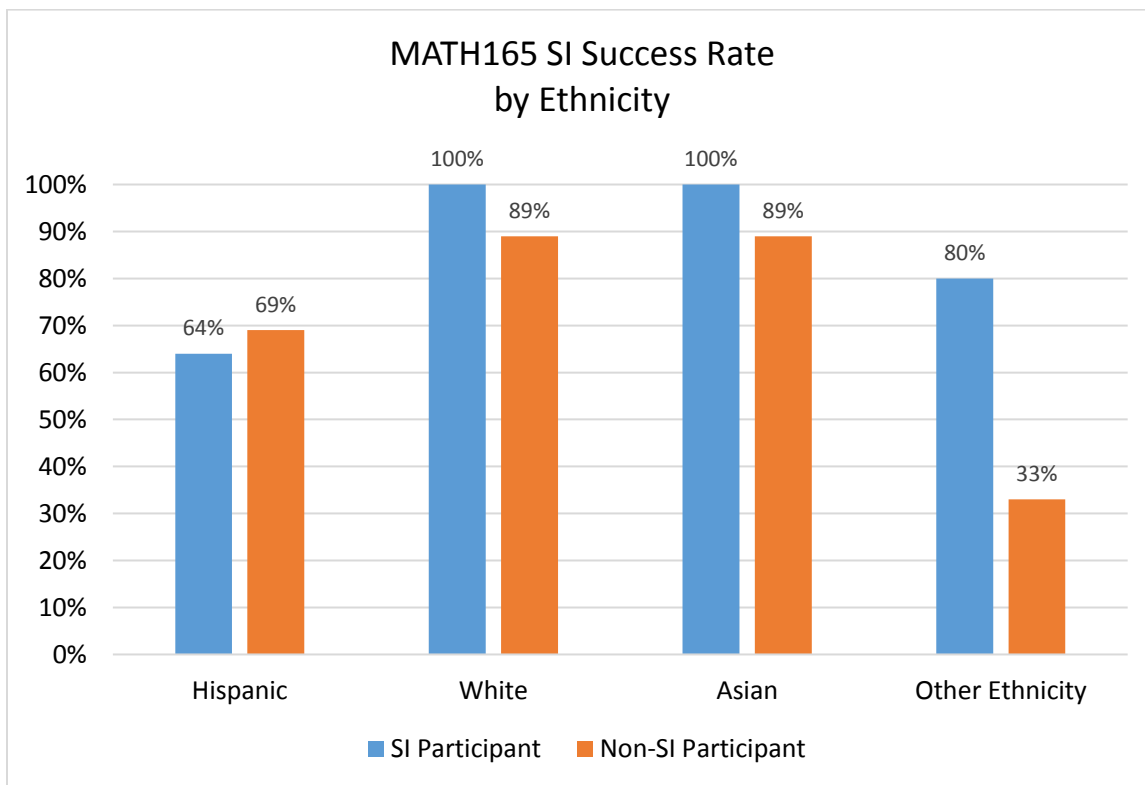
MATH175 Demographics Results

MATH175 had a total of 29 students who earned a final grade in Spring 2017. Of these, 14 students attended at least one SI session, making the overall participation rate 48%. Non-participants had a lower success rate (27%) while SI participants had a much higher success rate (57%). Due in part to the low sample size, this difference in success rate was not statistically significant; χ^2 (1, N = 29) = 2.77, p = 0.096.

**Table 18** MATH175 Count and Success Rates by SI Participation

	Successful		Unsuccessful		Total	
	Count	%	Count	%	Count	%
SI Participants	8	57%	6	43%	14	100%
Non-SI Participants	4	27%	11	73%	15	100%
Total	12	41%	17	59%	29	100%

The tables below show the breakdown of SI participation and success rates by gender and ethnicity. From these tables we see that males and Hispanic students attended SI at a proportionally higher rate. In terms of success, students in all groups who attended SI had higher success rates in MATH175 compared to their group counterparts who did not attend any SI sessions. The one exception was for females as the success rate for SI and Non-SI participants were equal. However due to the small group size counts, the differences in group success rates were not statistically significant.

Table 19 MATH175 Enrollment by Gender

	Female	Male
SI Participants	3	10
Non-SI Participants	6	8
Enrollment Total	9	18
SI Participation Rate	33%	56%

*Indicates significant group success rate differences at p ≤.05

MATH175 SI Success Rate by Gender

Female: SI Participant 33%, Non-SI Participant 33%
Male: SI Participant 70%, Non-SI Participant 25%
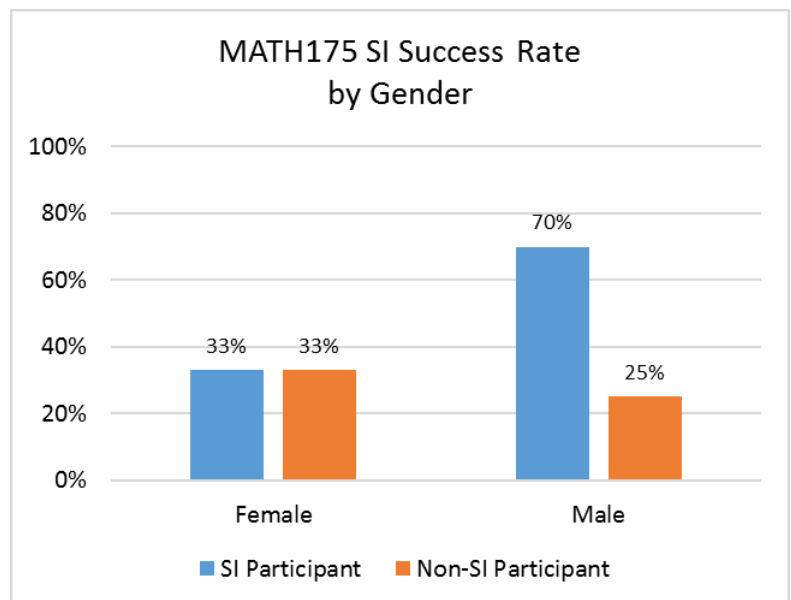
Table 20 MATH175 Enrollment by Ethnicity

	Hispanic	White	Asian	Other Ethnicity
SI Participants	10	1	3	0
Non-SI Participants	10	0	5	0
Enrollment Total	20	1	8	0
SI Participation Rate	50%	100%	38%	-

*Indicates significant group success rate differences at p ≤.05