



STEM Center Study Groups Effectiveness Report Fall 2018

Introduction

The purpose of this report is to evaluate the effectiveness of Study Groups (SG) in the STEM Center. What follows are descriptive statistics, success rates, and statistical analyses for each math course with an embedded tutor that was offered under SG in fall 2018.

Study Groups are just one activity Citrus College has implemented with the goal of facilitating student learning and ultimately student success. Study Groups, which are held in the STEM Center, provide regularly scheduled out-of-class review sessions for students who may want additional help. All the mathematics classes in this analysis also have Embedded Tutors which provide additional in-class support.

Study Group Participation

In fall 2018 Study Groups (SG) were offered for four mathematics courses for a total of 1,097 students. The percentage of enrolled students participating in study groups is shown below. There were 82 students that attended at least one SG session, resulting in a 7% overall study group participation rate. **With a 16% overall participation rate, students who were in a MATH065/165 class attended study groups at a higher percentage than students in the other math courses.**

Course	# of SG Supported Sections	Enrollment	SG Participants Count	SG Participation Rate
MAH030	5	189	5	3%
MATH040	2	60	3	5%
MATH050/150	11	435	7	2%
MATH065/165	10	413	67	16%
Total	28	1,097	82	7%

The following table shows the Study Group participation for various math courses. Among the students that went to the STEM Center and participated in a study group at least once, **students in MATH065/165 attended the most study group sessions** – a total of 327 times – ranging from 1 visit to 52 visits in Fall 2018. This yields about 4.9 visits per student.

Course	SG Participants	# of Visits	Visit Average	Range
MAH030	5	5	1.0	1
MATH040	3	10	3.3	1 - 5
MATH050/150	7	48	6.9	1 - 21
MATH065/165	67	327	4.9	1 - 52
Total	82	390	4.8	1 - 52

Success Rates based on SG Participation

Chi-square tests were used to examine if students who participated in study group sessions (SG) were more likely to be successful in each course 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.

Table 1 Success Rates by Course and SG Participation

Course	SG Participant			Non-Participant		
	Success Count	Total	Success Rate	Success Count	Total	Success Rate
MATH030	2	5	40%	63	184	34%
MATH040	2	3	67%	20	57	35%
MATH050/150	4	7	57%	233	428	54%
MATH065/165	52	67	78%	222	346	64%
Total	60	82	73%	538	1015	53%

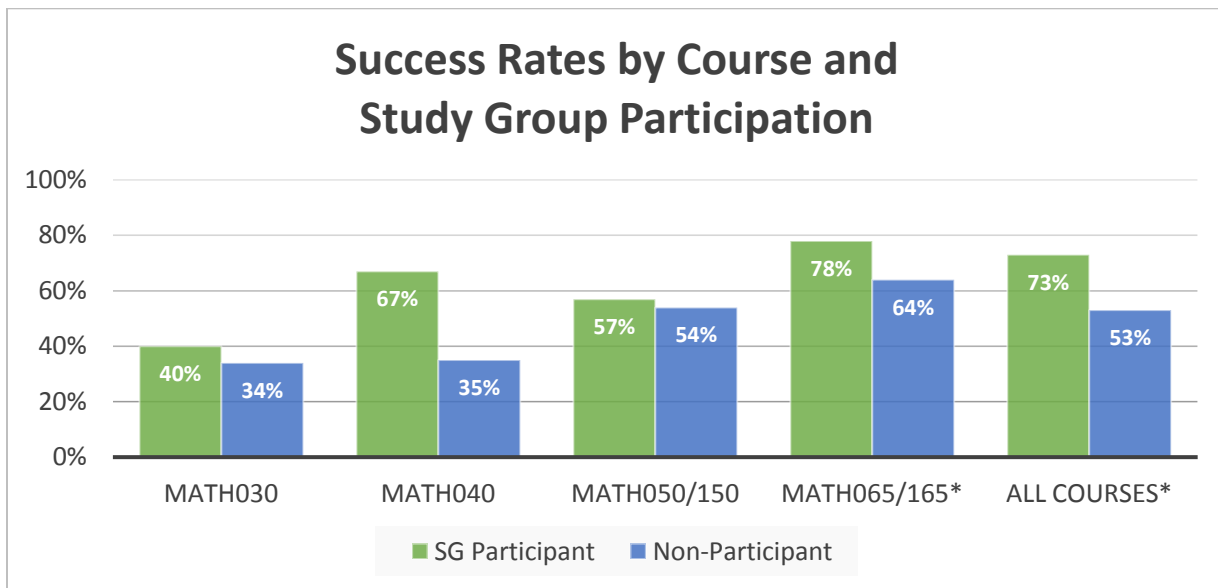


Figure 1

* Indicates statistically significant differences at $p \leq .05$.

Students who attended study group sessions had higher success rates than students who did not. The results of several chi-square tests revealed **there was a statistically significant association between SG Participation and success in MATH065/165 courses**, $X^2(1, N=413) = 4.55$, $p = .033$. **In other words, the success rate of study group participants was significantly higher compared to non-participants in MATH065/165.** No other significant differences were found for the other courses.

Success Rates Disaggregated by Dosage of SG Participation

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

Overall, students who attended five or more SG sessions (i.e. High Dose participants) had the highest course success rate (84%), followed by students who attended 1-4 sessions (68%). Students who did not attend any SG session had the lowest final course grades (53%).

When courses were disaggregated, a similar pattern was found in which High Dose participants had the highest course success rates while Non-participants had the lowest. MATH050/150 had the most unexpected patterns in which non-participants had a higher overall success rate than low dose participants. However it is important to note that there were only 4 students who fell into the low dose group for MATH050/150. There was no high dose category for MATH030 because no student attended five or more SG sessions.

The results of several **chi-square analyses** (which measured success dichotomously as ‘successful’ or ‘unsuccessful’) revealed no statistically significant differences between high dose, low dose, and non-SG participants when disaggregated by course. However, **there was a statistically significant association between SG dosage and success when examining all courses combined**, $X^2(2, N=1,097) = 14.14, p=.001$. This indicates there was a significant difference in success rates between high dose, low dose and non-participants when looking across all courses.

In addition, **the association between SG dosage and success was marginally statistically significant for MATH065/165**, $X^2(2, N=413) = 5.48, p=.066$.

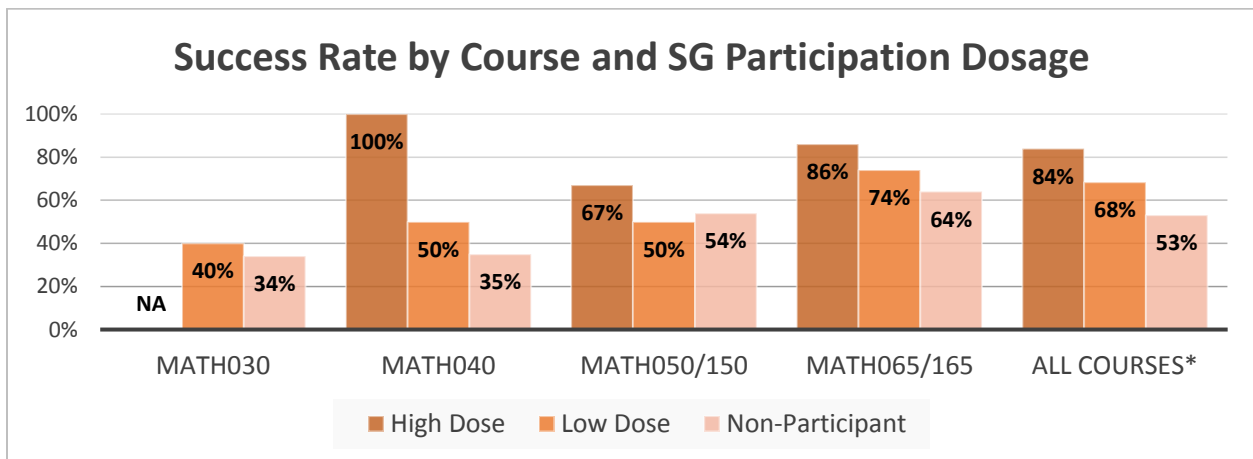


Figure 2

* Indicates statistically significant differences at $p \leq .05$.

One-way ANOVA analyses were conducted to measure success using students' final course grade. Grades were converted into a continuous variable using the following scale: A=4, B=3, C=2, D=1, and F/FW/W=0. Results showed there was a statistically significant difference between mean final grade for students in MATH065/165 and when all courses were combined.

Specifically, for **MATH065/165**, the mean final grade differences were statistically significant between the high dose group ($M=2.71$, $SD=1.23$) and the non-participant group ($M=2.00$, $SD=1.51$).

A similar pattern was found for **all courses combined** in which the differences between the high dose group ($M=2.60$, $SD=1.19$) and non-participants ($M=1.67$, $SD=1.51$), as well as between the low dose ($M=2.18$, $SD=1.34$) and non-participants were significant. No significant differences between high dose, low dose, and non-SG participants were found for students enrolled in the other three courses.

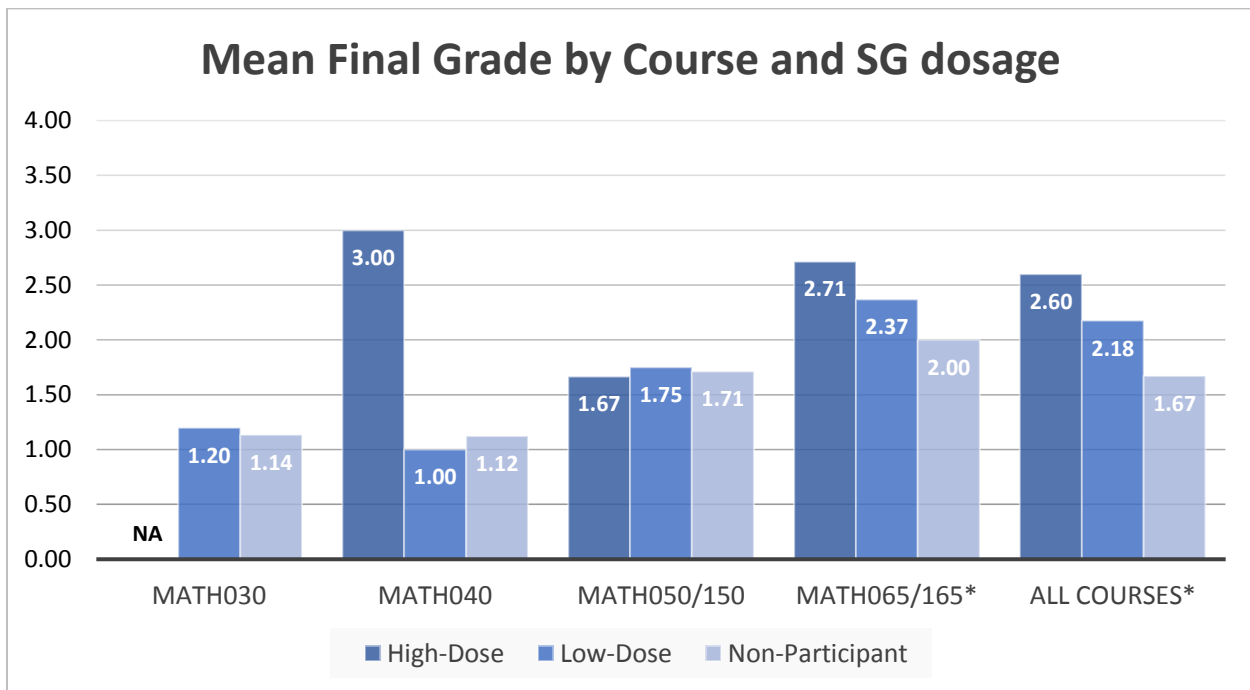


Figure 3

*Indicates statistically significant differences at $p \leq .05$.

Table 2 Summary of one-way ANOVA Results

Course	<i>df</i>	<i>N</i>	<i>F</i>	<i>p</i>
MATH030	1	189	.010	.919
MATH040	2	60	1.06	.352
MATH050/150	2	435	.008	.997
MATH065/165*	2	413	3.36	.036
All Courses*	2	1,097	10.40	<.001

*Indicates significance at $p \leq .05$.

SG Participation and Success Rates by Gender

The tables and figures below show the breakdown of study group participation and success rates by gender. As shown in Table 4 and Table 5, **female students participated in study groups at a higher rate than male students overall. MATH065/165 had the highest study group participation rate across both genders.**

Table 3 Female Study Group Participation Rates

Course	SG Female Participants	Total Females	Female SG Participation Rate
MATH030	1	95	1%
MATH040	1	35	3%
MATH050/150	3	216	1%
MATH065/165	46	249	18%
All Courses	51	595	9%

Table 5 Male Study Group Participation Rates

Course	SG Male Participants	Total Males	Male SG Participation Rate
MATH030	4	92	4%
MATH040	2	24	8%
MATH050/150	4	213	2%
MATH065/165	18	155	12%
All Courses	28	484	6%

In terms of success rates, **females and males that attended at least one study group session had higher success rates than non-participants when looking at each course individually and across all courses.** The only case in which SG participants had a lower success rate than non-participants was for females in MATH050/150. **It is important to note that in 3 out of the 4 courses in this report, there were less than 5 students that attended study group sessions for each gender.**

Because of the low sample sizes for SG participation, the decision was made not to conduct further statistical analyses based on gender.

Table 6 Female Success Rates by Study Group Participation

Course	Female SG Success Rate	Female Non-SG Success Rate
MATH030	100%	45%
MATH040	100%	44%
MATH050/150	33%	55%
MATH065/165	76%	69%
All Courses	75%	58%

Table 7 Male Success Rates by Study Group Participation

Course	Male SG Success Rate	Male Non-SG Success Rate
MATH030	25%	24%
MATH040	50%	18%
MATH050/150	75%	55%
MATH065/165	78%	58%
All Courses	68%	48%

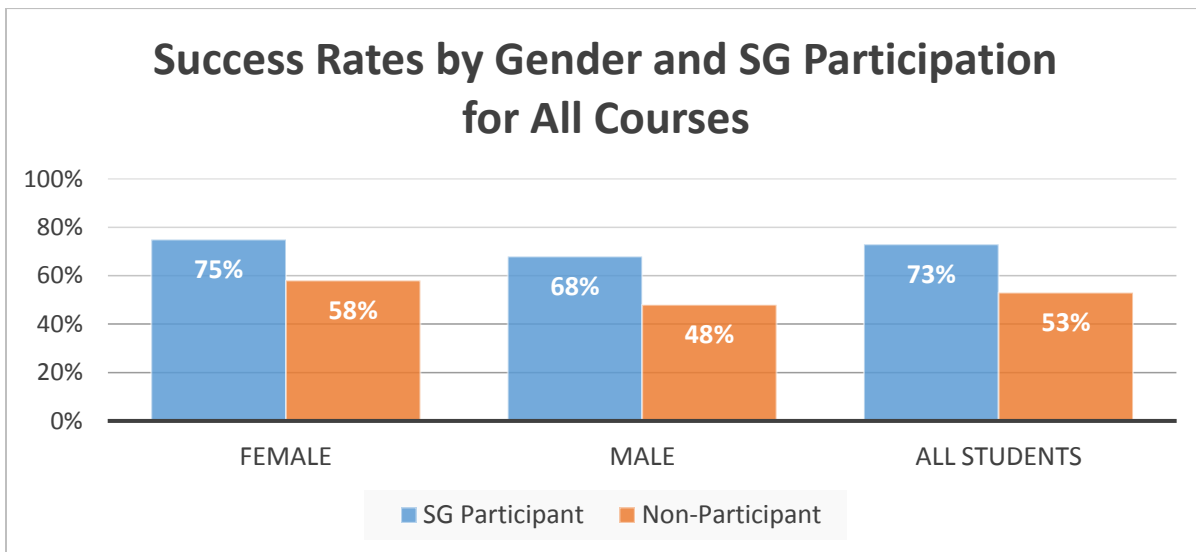


Figure 4

SG Participation and Success Rates by Ethnicity

The tables and figures below show the breakdown of Study Group participation and success rates by ethnicity. As shown in Tables 8 - 11, **students in the other ethnicity category participated in study groups at the highest rate** followed by White, Asian, and Hispanic students.

MATH065/165 had the highest study group participation rate across all ethnicities.

Table 8 Hispanic Students Study Group Participation Rates

Course	SG Hispanic Participants	Total Hispanic Students	Participation Rate
MATH030	4	132	3%
MATH040	1	47	2%
MATH050/150	4	328	1%
MATH065/165	42	291	14%
All Courses	51	798	6%

Table 9 White Students Study Group Participation Rates

Course	SG White Participants	Total White Students	Participation Rate
MATH030	0	22	0%
MATH040	0	4	0%
MATH050/150	2	59	3%
MATH065/165	11	65	17%
All Courses	13	150	9%

Table 10 Asian Students Study Group Participation Rates

Course	SG Asian Participants	Total Asian Students	Participation Rate
MATH030	0	8	0%
MATH040	0	1	0%
MATH050/150	0	16	0%
MATH065/165	4	26	15%
All Courses	4	51	8%

Table 11 Other Ethnicity Students Study Group Participation Rates

Course	SG Other Ethnicity Participants	Total Other Ethnicity Students	Participation Rate
MATH030	1	27	4%
MATH040	2	8	25%
MATH050/150	1	32	3%
MATH065/165	10	31	32%
All Courses	14	98	14%

In terms of success rates, **Hispanic, Asian, and students of other ethnicity that attended at least one study group session had higher success rates than non-participants when looking across all courses.** The only case in which SG participants had a lower success rate than non-participants was for White students overall. **It is important to note that in 3 out of the 4 courses in this report, there were less than 5 students that attended study group sessions for each ethnicity.**

Table 12 Hispanic Success Rates by Study Group Participation

Course	Hispanic SG Success Rate	Hispanic Non-SG Success Rate
MATH030	25%	32%
MATH040	0%	37%
MATH050/150	50%	54%
MATH065/165	76%	60%
All Courses	69%	51%

Table 13 White Success Rates by Study Group Participation

Course	White SG Success Rate	White Non-SG Success Rate
MATH030	-	41%
MATH040	-	50%
MATH050/150	50%	61%
MATH065/165	18%	74%
All Courses	23%	63%

Table 14 Asian Success Rates by Study Group Participation

Course	Asian SG Success Rate	Asian Non-SG Success Rate
MATH030	-	63%
MATH040	-	0%
MATH050/150	-	50%
MATH065/165	100%	73%
All Courses	100%	62%

Table 15 Other Ethnicity Success Rates by Study Group Participation

Course	Other Ethnicity SG Success Rate	Other Ethnicity Non-SG Success Rate
MATH030	100%	31%
MATH040	100%	17%
MATH050/150	100%	52%
MATH065/165	70%	76%
All Courses	79%	49%

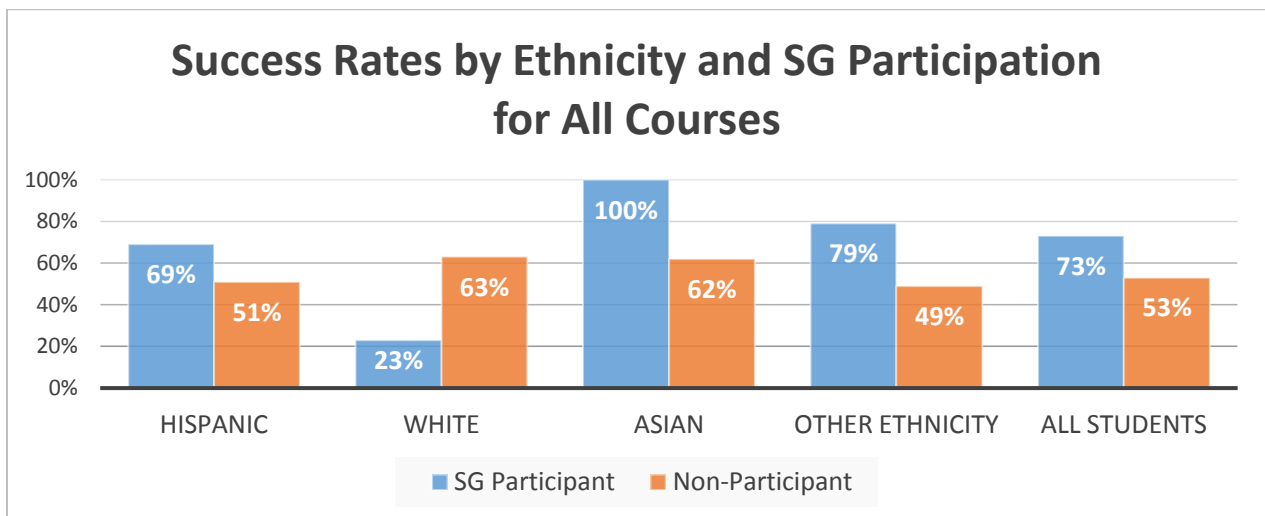


Figure 5

Because of the low sample sizes for SG participation, the decision was made not to conduct further statistical analyses based on ethnicity.

SG's Influence on Course Success: Logistic Regression Analyses

To gain a better understanding of how study groups related to student success even when taking into account other factors, a hierarchical logistic regression analysis was conducted. This analysis examined whether SG 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 pre-existing GPA was a significant predictor. In particular, the odds ratio revealed that as students' GPA increased by a unit, the odds of success in the course increased by a factor of 2.0; in other words, students were two times more likely to be successful if their pre-existing, overall GPA was high, regardless of whether they attended study group sessions. This suggests that the greatest predictive variable of an individual student's success may be their pre-existing GPA (i.e. students' cumulative GPA prior to taking the course).

Interestingly, ethnicity was also a significant predictor. Specifically, white students were 1.81 times more likely to be successful in the math course, compared to the comparison group which were Hispanic students.

Table 4 Hierarchical Logistic Regression Examining Predictors of All Courses Success

Variables	B	S.E.	Wald	p-value	Odds Ratio
Step 1					
Pre-GPA*	0.713	0.099	51.634	0.000	2.04
Males	-0.322	0.17	3.573	0.059	0.73
White*	0.591	0.258	5.242	0.022	1.81
Asian	0.103	0.394	0.068	0.794	1.11
Other Ethnicity	-0.196	0.268	0.536	0.464	0.82
Step 2					
SG Participant	0.384	0.308	1.556	0.212	1.47

*Indicates significance at $p \leq .05$

Because of the low sample sizes for SG participation in 3 out of the 4 courses in this report, the decision was made to conduct a logistic regression analysis for MATH065/165 only. The results are summarized below.

For **MATH065/165** the analysis revealed that **GPA was a significant predictor.** In particular, the odds ratio revealed that as students GPA increased by a unit, the odds of success increase by a factor of 2.1. Neither gender, ethnicity, nor SG participation were found to be significant predictors.

Table 5 Hierarchical Logistic Regression Examining Predictors of MATH065/165 Course Success

Variables	B	S.E.	Wald	p-value	Odds Ratio
Step 1					
Pre-GPA*	0.761	0.205	13.734	0.000	2.14
Males	-0.519	0.318	2.666	0.103	0.60
White	0.875	0.5	3.059	0.080	2.40
Asian	0.321	0.687	0.218	0.641	1.38
Other Ethnicity	0.027	0.531	0.003	0.960	1.03
Step 2					
SG Participant	-0.185	0.38	0.237	0.627	0.83

*Indicates significance at $p \leq .05$

Conclusion

Students who attended at least one study group (SG) session in fall 2018 had higher success rates than students who did not. However, the results of several chi-square tests revealed there was a statistically significant association between SG Participation and success only when examining all courses combined and for MATH065/165.

Similar results were found when study group participation was broken down into two categories. Students who attended five or more SG sessions (i.e. High Dose participants) had the highest course success rate across all courses, followed by students who attended 1-4 sessions. Students who did not attend any SG session had the lowest final course grades. While the association between SG dosage and success was statistically significant across all courses, it was only marginally significant for MATH065/165. A primary limitation of this data were the low group sizes, particularly for the high dose and low dose categories.

The findings of the logistic regression examined whether study groups participation predicted student success even when taking into account other extraneous variables like students' gender, ethnicity, or cumulative GPA prior to the course (i.e. Pre-GPA). Results revealed the number of study group sessions attended did not significantly predict final course grade when controlling for other contributing factors. However, results indicated that a students' pre-existing GPA was a significant predictor of how well a student performed for MATH065/165 and when looking across all courses.