El Camino College Supplemental Instruction (SI)
Analysis of Academic Outcomes
Fall 2003 – Fall 2009

Research Questions

How do academic outcomes for students in sections offering Supplemental Instruction (SI) differ from those that do not? Can the effects of SI be isolated from other potential effects?

For the purposes of this report, SI attendees are defined as those who attended at least 3 SI sessions for a given course.

Profile of Participants in SI Math Sections

A total of 1,542 identified math students participated in SI sessions between Fall 2003 and Fall 2009, a 27% participation rate for sections offering Supplemental Instruction. Students attending more than 3 sessions of SI were more likely to be older and female and less likely to be Asian-American (see Tables 1-2). Participants were also more likely to be first-generation college students (Table 1). Students who sought SI also had lower math assessment test scores, on average, than those who did not seek assistance (Table 3).

Table 1: Age, Gender and College Status

Age / Gender/ College Status	SI Participant	Non-Participant	*Difference*
Mean Age	24.5	21.2	*3.3*
Median Age	21.0	20.0	*1.0*
Percent Female	68%	57%	*10.9*
% First Gen.	55%	51%	*4.9*

Table 2: Percentage in Ethnic Group

Ethnic Group	SI Participant	Non-Participant	*Difference*
Asian	10.5	14.4	*-3.9*
African-Amer.	19.6	18.8	*0.8*
Latino	39.9	38.6	*1.3*
Amer-Ind.	0.7	0.5	*0.3*
Pacific Islander	1.0	1.1	*-0.2*
Two or More	0.2	0.2	*-0.1*
White	18.4	16.8	*1.6*
Unknown	9.8	9.6	*0.2*
Total	100.0	100.0	

Table 3: Mean Math Placement Test Scores (out of max of 120)

Math Placement Test	Participant	Non-Participant	*Difference*
Arithmetic	45.3	49.7	*-4.4*
Algebra	49.6	56.7	*-7.1*
College Math	36.4	38.5	*-2.1*

Overview of Research Plan

Course performance in terms of successful course completion (or success rates) was analyzed for math courses that had at least one section of SI between Fall 2003 and Fall 2009, inclusive. In addition, outcomes in SI sections by those who attended 3 or more SI sessions were compared with those who attended fewer than 3 (or did not seek SI assistance). Finally, analysis was also conducted using a logistic regression model to isolate the potential benefits of Supplemental Instruction from other possible influences.

SI is an academic support model that has been in use for more than three decades. Its primary aspect is an SI "coach," or peer tutor/instructional leader. The SI coach is a current student who was previously successful in the course they tutor. Coaches attend class, take notes like students, and provide tutoring assistance in class. After class, coaches hold SI sessions containing content-specific problem-solving, group work, and academic skill building. Coaches review exams and empower students to be active participants in the learning process. Faculty of SI sections provide support and coaches are well trained.

Overall Course Performance by Course Type

Success rates by course type were studied to determine if there is a possible "general" association of the SI model with overall course success. In the study, math sections were categorized into one of three types:

1) SI sections – Section with an in-class coach with work sessions lead by that coach,
2) Plug sections – Sections of the same course as an SI section, usually taught by the same instructor, in which SI was "plugged," or advertised, but with no in-class SI presence, &
3) Other sections – All other sections that were neither SI nor Plugs.

Table 4 provides a summary of overall success rates by course type and the calculated percentage-point difference between SI and other section types. More detailed results by course and section type can be found in Appendix A.

Success rates in SI sections for the terms studied were 6 percentage points higher on average than in Other sections; performance was 3 points higher than in Plug sections (Table 4). Courses with the largest positive differences in favor of SI were Math-130, with an 11-point

difference, and Math-23, with a 9-point difference (see Appendix A).[1] Courses where performance in SI sections was lower include Math-33, Math-73, and Math 150.

Results by course level showed that performance differences favoring SI were highest among basic skills courses, with an 8-point spread over "Other" sections and a 14-point spread over Plug sections. The SI advantage was lowest in degree-applicable courses, with Other course success 1 point higher and Plug course success 14 points higher than in SI sections.

Table 4: Success Rates by Section Type and Math Level (and Difference from SI)

Math Level	SI Section	Plug Section	*Difference (% pts)*	Other Section	*Difference (% pts)*
Basic Skills	58%	44%	*14*	51%	*8*
Degree-Applicable	50%	48%	*2*	45%	*5*
Transfer	60%	62%	*-2*	53%	*7*
All Math Courses	52%	49%	*3*	47%	*6*

*Difference discrepancies due to rounding error.

Overall Course Performance by Level of Attendance

The next step involved analyzing success within SI sections to determine if performance was greater for students who attended a critical number of SI sessions outside of class. SI professionals have agreed upon a session count of three as a critical level, after which the benefits of SI could more likely translate into improved content proficiency and course performance. Average participation rate in SI sections (3+ sessions attended) was 27%, with an interquartile range (middle 50%) of 21%-36%.

Table 5 shows course success rates by level in SI sections only, comparing students with 3 or more sessions attended with those who attended zero to 2 sessions. Course-level detail is available in Appendix B. Success rates for students attending at least 3 sessions of SI were much more likely to be successful in their math courses across the board compared to those who attended fewer than three. The average difference was 29 points. Depending on the course, the difference ranged from 17 to 42 percentage points. The largest advantage for SI attendees was found in degree-applicable, non-transfer courses.

Table 5: Success Rates by SI Attendance and Math Level

Math Level	>=3 Sessions	0 - 2 Sessions	*Difference (% pts)*
Basic Skills	75%	51%	*24*
Degree-Applic.	72%	42%	*30*
Transfer	77%	53%	*24*
All Math Courses	73%	45%	*29*

[1] A 34-point difference was found in Math-110, but this represents two sections/one term of data.

Isolating the Potential Effects of SI on Course Success

The data summarized above suggest that one or more aspects of SI sessions may have a positive impact on outcomes. The final stage of the analysis will attempt to isolate some of these variables to help determine if and how much SI session attendance impacts course success. For this analysis, only Fall 2009 SI sections were used (N=737).

A variety of factors may influence student success, some related to students' academic preparedness, others due to institutional factors. The use of a statistic model (logistic regression) that accounts for some of these factors provides an opportunity to determine the likelihood that SI participation, and not other factors, has a significant influence on course outcomes.

Based on correlation and t-test analyses (see Appendix C), the following factors were included in this analytical model:

- SI attendance (count of sessions attended)
- Cumulative GPA
- Entering Algebra placement test scores
- Instructor status (full-time vs. part-time)

In addition, demographic control variables were also included (age, gender, and ethnicity) to further isolate the effects of SI. The complete model is shown in Appendix C.

Overall, the model was statistically significant—r^2=.13, X^2=(1, N=670)=66.32, p<.001. Although the model explained only 13% of the observed variability of student outcomes, it predicted student outcomes correctly 63% of the time. Limitations of the logistic regression model may explain this discrepancy. Two variables in the model also were statistically significant, while controlling for the other variables in the models. These were *SI session attendance levels* and *algebra test score*. This indicates that attending Supplemental Instruction, and the more-the better, improves students' chances of successful course completion.

Conclusion

With few exceptions, students in SI-designated sections have greater course success than students in sections without SI (or plug sections without an in-class coach). Moreover, students in SI sections who attend 3 or more SI sessions outside of class are much more likely to be successful than students who attend zero or fewer than 3 sessions. Even when controlling for other factors such as student academic preparation and full-time instructor status, the effects of SI remain. Supplemental Instruction is recommended as an academic intervention with positive results.

Appendix A: Summary of Course Success Rates by Section Type

Course	Method	Successful	Not Successful	Total	% Successful	SI Minus*
MATH-12	SI	137	138	275	50%	
MATH-12	Plug	26	43	69	38%	**12%**
MATH-12	Other	1,378	1,630	3,008	46%	**4%**
MATH-23	SI	321	192	513	63%	
MATH-23	Plug	78	87	165	47%	**15%**
MATH-23	Other	2,635	2,301	4,936	53%	**9%**
Basic Skills Total	*SI*	*458*	*330*	*788*	*58%*	
	Plug	*104*	*130*	*234*	*44%*	***14%***
	Other	*4,013*	*3,931*	*7,944*	*51%*	***8%***
MATH-33	SI	36	29	65	55%	
MATH-33	Other	56	27	83	67%	*-12%*
MATH-40	SI	715	775	1,490	48%	
MATH-40	Plug	218	281	499	44%	**4%**
MATH-40	Other	5,763	7,798	13,561	42%	**5%**
MATH-70	SI	1,182	1,112	2,294	52%	
MATH-70	Plug	293	296	589	50%	**2%**
MATH-70	Other	8,867	10,230	19,097	46%	**5%**
MATH-73	SI	159	170	329	48%	
MATH-73	Plug	62	45	107	58%	*-10%*
MATH-73	Other	947	774	1,721	55%	*-7%*
Degree-Appl. Total	*SI*	*2,092*	*2,086*	*4,178*	*50%*	
	Plug	*573*	*622*	*1,195*	*48%*	***2%***
	Other	*15,633*	*18,829*	*34,462*	*45%*	***5%***
MATH-110	SI	29	4	33	88%	
MATH-110	Other	35	30	65	54%	**34%**
MATH-130	SI	187	114	301	62%	
MATH-130	Plug	78	57	135	58%	**4%**
MATH-130	Other	987	940	1,927	51%	**11%**
MATH-150	SI	169	134	303	56%	
MATH-150	Plug	58	25	83	70%	*-14%*
MATH-150	Other	749	576	1,325	57%	*-1%*
Transfer Total	*SI*	*385*	*252*	*637*	*60%*	
	Plug	*136*	*82*	*218*	*62%*	*-2%*
	Other	*1,771*	*1,546*	*3,317*	*53%*	***7%***
All Math Courses	***SI***	***2,935***	***2,668***	***5,603***	***52%***	
	Plug	***813***	***834***	***1,647***	***49%***	***3%***
	Other	***21,417***	***24,306***	***45,723***	***47%***	***6%***

Appendix B: Summary of Course Success Rates by Level of Attendance

Course	Attend Count	Successful	Not Successful	Total	% Successful	Diff.*
MATH-12	3+	72	24	96	75%	
MATH-12	<3	65	114	179	36%	**39%**
MATH-23	3+	112	38	150	75%	
MATH-23	<3	209	154	363	58%	**17%**
Basic Skills	*3+*	*184*	*62*	*246*	*75%*	
	<3	*274*	*268*	*542*	*51%*	***24%***
MATH-33	3+	29	12	41	71%	
MATH-33	<3	7	17	24	29%	**42%**
MATH-40	3+	235	100	335	70%	
MATH-40	<3	480	675	1,155	42%	**29%**
MATH-70	3+	438	144	582	75%	
MATH-70	<3	744	968	1,712	43%	**32%**
MATH-73	3+	76	44	120	63%	
MATH-73	<3	83	126	209	40%	**24%**
Degree-	3+	778	300	1,078	72%	
Applicable	<3	1,314	1,786	3,100	42%	**30%**
MATH-110	3+	12	0	12	100%	
MATH-110	<3	17	4	21	81%	**19%**
MATH-130	3+	61	17	78	78%	
MATH-130	<3	126	97	223	57%	**22%**
MATH-150	3+	81	29	110	74%	
MATH-150	<3	88	105	193	46%	**28%**
Transfer	3+	154	46	200	77%	
	<3	231	206	437	53%	**24%**
All Math	3+	1,116	408	1,524	73%	
	<3	1,819	2,260	4,079	45%	**29%**

Appendix C: Analysis of Course Success with Possible Influencing Factors

Possible factors that may be associated with course success in math include SI attendance, academic duration (cumulative units), GPA, age, entering math test scores, and full-time vs. part-time status of the instructor. A correlation analysis was conducted to determine if these factors are associated with course success in Fall 2009 math courses that included an SI component (Table 6).

The statistic used for this correlation analysis was the Pearson Product Moment Correlation (*r*). Factors that showed statistically significant association include level of SI attendance, critical attendance level (3 or more SI sessions), cumulative GPA, instructor status, and arithmetic and algebra placement test scores. A particular factor is said to be "associated" with another if the two change in similar ways (e.g., as one goes up, the other goes up or down). Attendance factors showed weak to moderate association ($r>0.2$, $p<.01$), while all others showed weak association ($p<.05$).

The potential model variables were also tested individually by comparing values of students who attended SI sessions with those who did not (Table 7), by use of a T-Test. Factors that were statistically significantly different between the two groups were course success rate, attendance, cumulative GPA, instructor status, algebra placement test, and student age and gender.

Table 6: Correlation of Course Success and Possible Influencing Factors – Fall 2009 SI Sections

Possible Factor		Course Success
Success	Pearson Correlation	1
	Sig. (2-tailed)	
	N	737
Attendance	Pearson Correlation	.225**
	Sig. (2-tailed)	.000
	N	737
Attend3	Pearson Correlation	.282**
	Sig. (2-tailed)	.000
	N	737
CUM_UNITS	Pearson Correlation	-.036
	Sig. (2-tailed)	.327
	N	737
Cum_GPA	Pearson Correlation	.085*
	Sig. (2-tailed)	.022
	N	737
Other	Pearson Correlation	.013
	Sig. (2-tailed)	.722
	N	737
AGE	Pearson Correlation	-.048
	Sig. (2-tailed)	.196
	N	737
InstrStatus	Pearson Correlation	-.089*
	Sig. (2-tailed)	.015
	N	737
Arith. Test	Pearson Correlation	.089*
	Sig. (2-tailed)	.046
	N	507
Algebra Test	Pearson Correlation	.134**
	Sig. (2-tailed)	.001
	N	670
Coll. Math Test	Pearson Correlation	.073
	Sig. (2-tailed)	.423
	N	123

Table 7: Descriptive and T-Test Statistics – Fall 2009 SI Sections

	Participants	**Non-Participants**				
Model Variables	**N=279**	**N=458**	t	df	*p*	Sig.
Course Success	**71%**	**42%**	7.957	735	.000	***
Attendance	**10.0**	**0.3**	29.486	735	.000	***
Cumulative Units	**26.4**	**24.1**	1.303	601	.193	
Cumulative GPA	**2.20**	**1.94**	2.676	589	.008	**
Term Credit Load	**10.8**	**11.3**	-1.938	735	.053	
Instructor Status	**100%**	**91%**	5.300	735	.000	***
Arithmetic Test	**45.2**	**48.6**	-1.655	441	.099	
Algebra Test	**52.8**	**59.0**	-2.976	508	.003	**
Age	**23.7**	**21.4**	4.818	735	.000	***
Female	**65%**	**57%**	2.141	735	.033	*
Asian [a]	**11%**	**14%**				
Black	**18%**	**18%**	.081	585	.936	
Latino	**40%**	**38%**	.579	582	.563	
White	**20%**	**18%**	.913	562	.362	
Valid N (listwise)	**193**	**299**				

[a] T-test analysis excluded since Asian may serve as a comparison group with other ethnicities.

Table 8: Logistic Regression Results Predicting Successful Course Outcomes – Fall 2009 SI Sections

	ß	Wald X^2	*p*	Odds Ratio
Attendance	.10	33.58	<.001	1.10
Cumulative GPA	.02	.13		1.02
Instructor Status	-.68	3.27		.51
Algebra Test	.01	7.34	<.01	1.01
Age	-.02	.81		.99
Female	.11	.43		1.12
Black	-.51	3.62		.60
Latino	-.06	.07		.94
White	.12	.24		1.13
Constant	.23	.12		1.26