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Impact of Supplemental Instruction in Entry-Level Chemistry Courses at a Midsized Public University

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Supporting Information

ABSTRACT: This paper examines the impact of supplemental instruction (SI)—nonremedial workshops that support regularly scheduled courses—on four different chemistry courses: General Chemistry I and II, and Organic Chemistry I and II. Differences in how SI impacts student performance in these courses are discussed, particularly in terms of whether students from underrepresented minority groups are affected differently from their peers. We found that SI appears to be most effective in courses at the beginning of the chemistry sequence and least effective in those in which students have already had to demonstrate effectiveness with the material in order to succeed in the course; its impact on performance in General Chemistry I appears to be quite high compared to a negligible impact in Organic Chemistry II. Impacts appear to be due to SI itself rather than the academic fitness of the students who opt to enroll in it. In the four courses examined, SI did not appear to have a different impact on students from underrepresented minority groups than it did on their peers.

KEYWORDS: *First-Year Undergraduate/General, Second-Year Undergraduate, Chemical Education Research, Minorities in Chemistry, Student-Centered Learning*

FEATURE: Chemical Education Research

COMPARING SUPPLEMENTAL INSTRUCTION ACROSS COURSES

This paper examines the impact of supplemental instruction (SI) on four chemistry courses taught at San Francisco State University (SFSU). SI involves workshops supporting regularly scheduled courses. They are not remedial, but "supplementary" courses, providing students with additional problems, cooperative learning, and peer instruction. The model was developed by Deanna Martin and colleagues.[1]

Much research has been conducted on SI's impact on students, mostly showing positive outcomes. Compared to peers, SI participants typically earn higher grades and are more likely to score above a "D".[2−4] Some studies also found higher graduation rates among participants.[2] Despite their better performance, SI takers often score lower on academic success predictors such as the SAT and ACT exams;[3] increases in performance, therefore, appear not to occur because stronger students use SI. Our own previous research has yielded similar findings.[5]

The findings specific to chemistry courses are similar. SI participants and participants in similar interventions, such as Peer-Led Team Learning,[6,7] generally perform better in the supported classes,[8−10] in subsequent courses in the sequence,[11] and have higher retention rates in the major.[12]

Another interesting area of inquiry is potential differential impacts on students from underrepresented minority groups (URMs).[13] Using SI to specifically support URM students started with Uri Treisman.[14] He demonstrated substantial learning improvements among African-American calculus students, compared to previous semesters. Despite this, most research suggests that SI benefits all ethnic−racial groups equally,[2,9] although research at SFSU found URM students seeming to benefit more from SI than their peers in some courses,[5] particularly Introductory Biology I.[15]

In this literature, only Peterfreund et al.[5] examined SI across different courses, and they did not try to delineate the reasons behind the observed differences. This article examines four different chemistry courses at SFSU that have had SI support for many years; it attempts to answer three major questions:

1. Are there different SI impacts in these four courses?
2. Are there differences in the relative SI impact on URM students?
3. Can these differences be explained by either students' characteristics or the skills required by the courses?

The paper examines SI in General Chemistry I and II (GC1 and GC2) and Organic Chemistry I and II (OC1 and OC2), the core chemistry curriculum at SFSU. SFSU's chemistry curriculum, however, differs considerably from the traditional model. According to the Chemistry Department's literature, from which Figure 1 was taken, there are four pathways through the introductory chemistry sequence, of which we are examining the one taken by Chemists and "Biology B" majors—majors such as microbiology that require more chemistry understanding than "Biology A" majors, such as zoology. The Chemistry and Biology B students take GC1,

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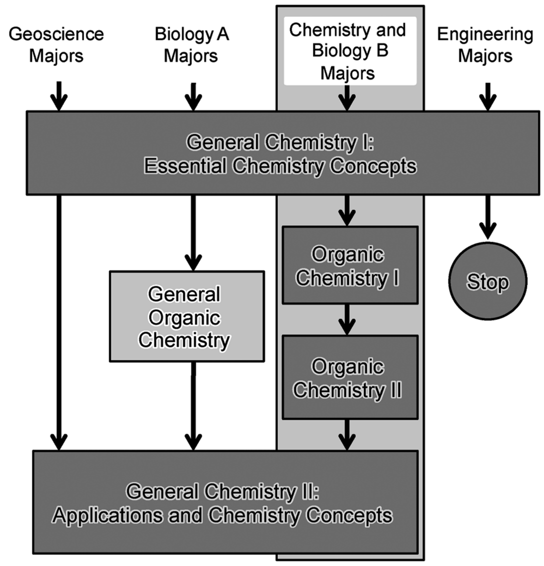

Figure 1. Chemistry curriculum at San Francisco State University.

which focuses on conceptual understanding of basic principles, then take OC1 and OC2 taught with a more traditional model. Finally, they take GC2, revisiting GC1 topics (and others) with a quantitative, problem-solving emphasis. This curriculum has been in effect since spring 2000.

■ SI WORKSHOP BACKGROUND

SI workshops started in chemistry at SFSU in spring 2000, when they were first introduced in OC1 and OC2. However, because the general chemistry courses were still under development and thus there was not a group of experienced students able to become facilitators until later, they were unavailable for GC1 until fall 2000 and for GC2 until fall 2002. During the time of the study, SI workshops were funded through the National Institute of Health's MBRS RISE program,[16] which helps talented URM students work toward Ph.D. degrees in biomedical sciences. Despite the program's URM focus, SI workshops were open to all students.

SI facilitators (the individuals running them) were undergraduates, graduate students, or (rarely) lecturers—in most cases they were undergraduate students who had recently taken the course themselves. The training and advisement for the SI facilitators was conducted by a single faculty member throughout the period of the study, who selected the facilitators based on their topical knowledge, maturity, personality, and competency with active learning approaches, as determined through interviews and conversations with faculty members familiar with them. Training was provided communally prior to the start of the semester and centered on teaching techniques and how to work with students. Additional advisement was provided on a regular basis throughout the year. Typically, one–three SI sections were offered per course, often led by different facilitators. If successful, facilitators were usually rehired for up to four semesters, depending on their graduation time.

Workshops focused on cooperative learning, with students typically being asked to work in groups to solve problems or address misconceptions and explore concepts in greater depth. Alongside group work, typical activities included exam preparation, working individually on problem sets, learning study skills, and mini-lectures. The facilitators also worked one-on-one with students having difficulties.

Workshops met once a week for 1.5 h. Students registered for the workshop at the same time as other classes and received one credit for attending, which enabled tracking participation through institutionally collected data. Grading was done based on attendance; students who registered but did not attend received an F; other grades were based on the proportion of sessions they attended. In our data, the vast majority of students received a grade of A in the SI workshops (between 89% and 95%, depending on the course). Although students could take as many SI workshops as they wished, they only received credit toward graduation for up to four workshops.

■ METHODOLOGY

Our data were gathered from SFSU's institutional records[17] in spring 2007 and represent all students taking these courses from the beginning of SI until fall 2006. There were two categories of information: grades and semesters from all courses and SI workshops; and student demographic information, including SAT I scores, high school GPA, gender, and ethnicity–race. Some caveats must be acknowledged, however.

Although most students registered, some attended workshops without registering—about 5–10 for every 20 registered, according to course surveys. Because the students who did not register are not identifiable in the institutional data, they are of necessity treated as nonparticipants. This potentially understates group differences.

Although there are many URM students at SFSU, 36% of the undergraduate population in fall 2006,[18] the numbers from specific racial–ethnic groups in individual classes are too small to maintain statistical power. Thus, we examined URM students together, compared to all non-URM students. Differences between racial–ethnic subgroups are lost in these analyses. Students providing no race–ethnicity data were considered non-URM students; some URM students may thus have been incorrectly placed.

Finally, students may enroll in courses multiple times. We examined performance for the last time (as of the fall of 2006) they received a grade. Students can also enroll in SI multiple times, not always for every time they take the supported course. We counted students as participants if they were in SI at any point, using the rationale that any benefits of participation should continue to other classes even if they were not in SI at the time. For a few students, this did not occur in their last semester in the course. If anything, we expected that doing this would decrease the demonstrable impact of SI because the effect of SI taken in a previous semester on a current course grade should be less than the immediate effect on a concurrently taken course.

■ PARTICIPANTS

Table 1 shows the demographic distribution of students in the four courses during the time period of the study. The clearest difference between these courses was the much higher proportion of engineers and other majors in GC1, which may have led to a somewhat lower percentage of females. The distribution of majors also differed between the organic chemistry courses and GC2. These differences are likely because of who was required to take the courses.

In most cases, the demographics for the SI participants were very similar to those for the nonparticipants. However, some

Table 1. Course Demographics

Parameters	GC1 Course	OC1 Course	OC2 Course	GC2 Course
Students, *N*	2804	1603	1129	880
Students in SI, *N*	499	435	247	169
Female, %	57	65	63	67
URM, %	33	30	30	28
Chemistry/Biochemistry Majors, %[a]	12	25	27	19
Biology Majors, %[a]	34	58	62	55
Engineering Majors, %[a]	13	1	0	1
Other Majors, %[a]	41	17	11	26

[a]"Major" indicates most recent major at the time of data collection, not at the time the course was taken.

exceptions were found. In GC1 and OC2, SI participants were more likely to be biology majors (46% vs 31% not in SI for GC1; 72% vs 59% for OC2). Likewise, in OC1 and OC2, SI participants were more likely to be URM students (38% vs 27% in OC1; 37% vs 28% for OC2).

RESULTS

Enrollment over Time

SI started in GC1 in fall 2000; there were 2804 course takers between then and fall 2006. Of these, 499 (18%) participated in SI (21 not during their final semester). Participation varied over time, as shown in Figure 2A; SI enrollment ranged from 7% in spring 2002 to 33% in spring 2005. There was a gradual increase in course enrollment. The fall 2006 high, however, is likely partly because it was the last semester included in the data set and students who took the course for the first time in fall 2006 could not be removed from that group and counted in a later group because they retook the course. OC1 SI began in spring 2000; 1603 students took the course by fall 2006 and 435 (27%) participated in SI (only 44 outside their final semester), as shown in Figure 2B. SI participation ranged from 9% in spring 2003 to 47% in spring 2005. OC2 SI also began in spring 2000, with 1078 total students and 247 (22%) participating in SI, 49 outside their final semester. Participation ranged from 5% in fall 2001 to 42% in fall 2005, as seen in Figure 2C. GC2 SI started in fall 2002, with 880 total students, 169 (19%) in SI, (8 outside their final semester). Participation ranged from 8% in fall 2003 to 24% in spring 2005, seen in Figure 2D. In most cases, the number of students enrolling in SI increased over time; we believe this is because students became more aware of these workshops and their impact on performance, though this is not certain.

General Performance

Table 2 provides performance data for all courses. The first rows show students receiving "passing" grades (C− or greater, needed to advance to the next course in the sequence). The second rows show the average course grade, from 0.0 (F) to 4.0

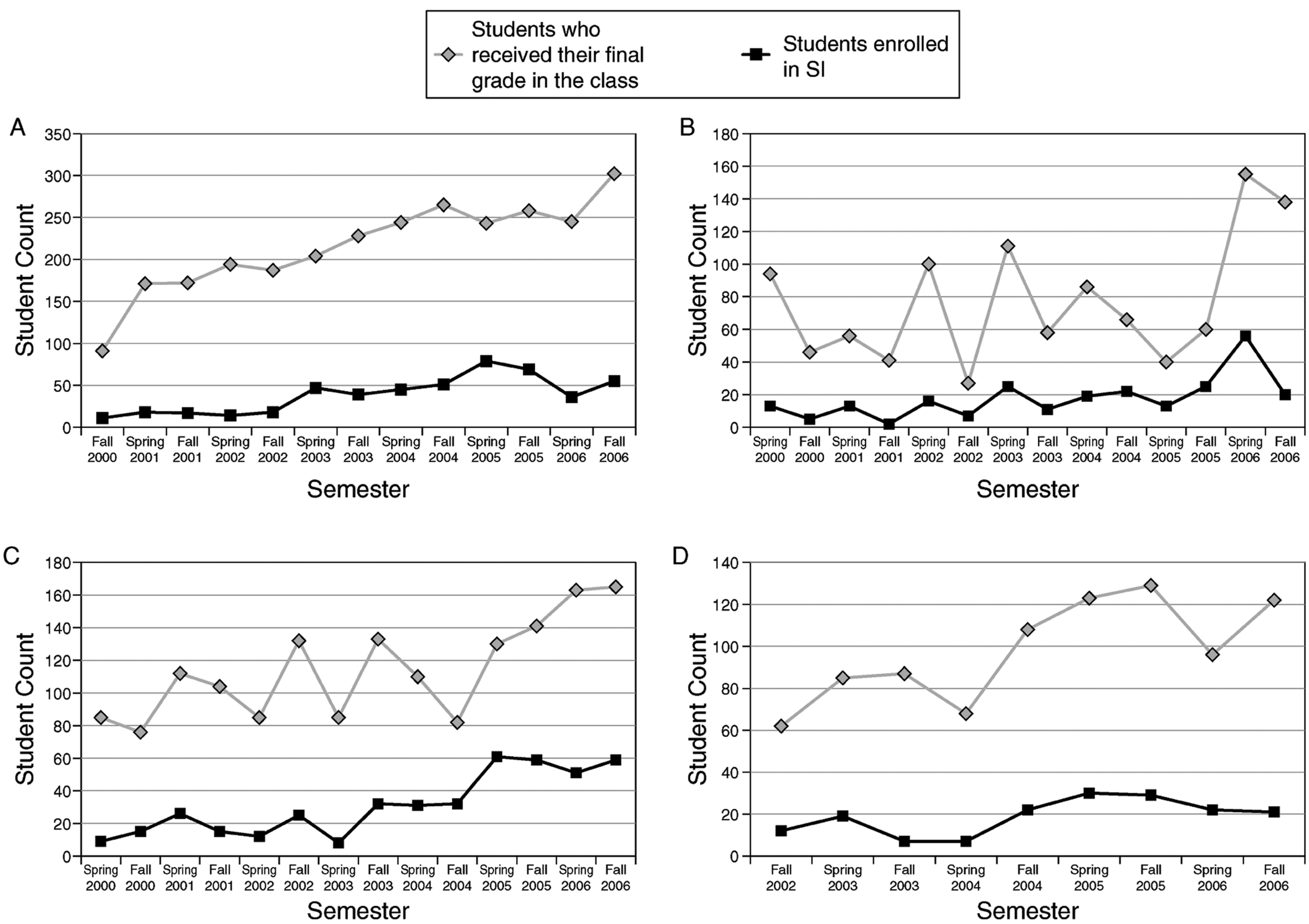

Figure 2. Comparison of student numbers for the four chemistry courses under consideration and corresponding SI participation: (A) GC1; (B) OC1; (C) OC2; (D) GC2.

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Table 2. Performance by URM and SI Status

		All		URM		Non-URM	
Parameters	All Students	SI	Non-SI	SI	Non-SI	SI	Non-SI
			GC1				
Passing, %	87	91	86	88	79	93	89
Average grade	2.59	2.72	2.56	2.48	2.25	2.88	2.70
Graduated, %	48	49	48	45	47	51	48
			OC1				
Passing, %	85	90	84	88	79	91	85
Average grade	2.65	2.79	2.60	2.54	2.21	2.95	2.73
Graduated, %	53	57	52	58	62	56	48
			OC2				
Passing, %	88	94	86	91	80	96	89
Average grade	2.68	2.82	2.64	2.57	2.34	2.96	2.75
Graduated, %	62	60	63	75	75	48	58
			GC2				
Passing, %	86	86	86	82	80	89	88
Average grade	2.66	2.61	2.67	2.25	2.37	2.78	2.77
Graduated, %	58	62	58	73	65	59	55

Table 3. Differences in Pass Rates

	SI vs Non-SI			URM vs Non-URM			Interaction of the Two	
Courses	*F* Values[a]	*p* Values[b]	Effect Size[c]	*F* Values[a]	*p* Values[b]	Effect Size[c]	*F* Values[a]	*p* Values[b]
GC1	9.0	0.003	0.13	22.6	<0.001	0.30	2.5	0.112
OC1	12.6	<0.001	0.20	12.7	<0.001	0.20	0.1	0.814
OC2	12.9	<0.001	0.21	6.4	0.011	0.07	1.3	0.256
GC2	0.0	0.926	0.03	4.5	0.033	0.19	0.1	0.720

[a]To save space, degrees of freedom have not been provided. Generally, larger numbers correspond to more substantial differences, but they are not truly comparable across groups with different numbers of participants. [b]The likelihood of this effect having occurred completely due to chance was 0.003 or 0.3%. A *p* value of less than 0.05 is traditionally considered statistically significant. [c]The effect size is equal to the difference between the means of the two groups divided by the standard deviation of the population. A value of 0.2 is considered a small effect, 0.5 a moderate one, and 0.8 a large one.[19]

Table 4. Differences in Grade Rates

	SI vs Non-SI			URM vs Non-URM			Interaction of the two	
Courses	*F* Values	*p* Values	Effect Size	*F* Values	*p* Values	Effect Size	*F* Values	*p* Values
GC1	21.3	<0.001	0.19	87.9	<0.001	0.48	0.5	0.490
OC1	19.2	<0.001	0.19	56.8	<0.001	0.44	0.8	0.361
OC2	8.5	0.004	0.18	28.8	<0.001	0.40	0.0	0.858
GC2	0.4	0.533	−0.05	26.7	<0.001	0.44	0.6	0.451

Table 5. Differences in Graduation Rates

	SI vs Non-SI			URM vs Non-URM			Interaction of the two	
Courses	*F* Values	*p* Values	Effect Size	*F* Values	*p* Values	Effect Size	*F* Values	*p* Values
GC1	0.0	0.919	0.02	0.5	0.461	0.02	0.3	0.572
OC1	0.2	0.677	0.10	3.4	0.064	−0.24	1.8	0.181
OC2	1.1	0.302	−0.08	18.9	<0.001	−0.37	1.1	0.302
GC2	0.5	0.467	0.08	1.7	0.193	−0.22	0.0	0.835

(A) of those who received grades (as opposed to withdrawals or incompletes). The last rows examine students enrolled up to a certain date who ultimately received a degree. The chosen date varied based on when students typically took the course in their academic careers. GC1 is typically taken during the first year so only students enrolled before fall 2003 were included, allowing three full years for graduation before fall 2006. The other three courses are taken later, so a cutoff of fall 2004 was used. The data have been disaggregated based both on participation in SI and status as a URM.

The data were analyzed using factorial ANOVA tests run on the SPSS statistical package to determine where the differences occurred. Table 3 shows the results of these tests in regard to pass rates, including the effect sizes of the differences. On this and subsequent tables, the signs of the effect sizes indicate their alignment with the usual results; positive numbers indicate that SI participants did better than nonparticipants and non-URM students did better than URM students.

As the data in Table 3 show, pass rates were higher among SI participants than nonparticipants in all but GC2. The effects

Table 6. SAT and High School GPA by Group

	Math SAT Score			Verbal SAT Score			High School GPA		
Courses	SI	Non-SI	Effect Size	SI	Non-SI	Effect Size	SI	Non-SI	Effect Size
GC1	496	533	0.42	477	497	0.20	3.18	3.22	0.10
OC1	504	540	0.39	467	500	0.31	3.30	3.31	0.00
OC2	517	534	0.18	478	484	0.06	3.37	3.33	−0.09
GC2	503	538	0.40	460	492	0.34	3.30	3.33	0.08

Table 7. Linear Regression Modeling with Course Grade as the Dependent Variable

	GC1 (R^2 = 0.197)		OC1 (R^2 = 0.159)		OC2 (R^2 = 0.116)		GC2 (R^2 = 0.197)	
Parameters	β Values	p Values	β Values	p Values	β Values	p Values	β Values	p Values
Took SI	0.143	<0.001	0.189	<0.001	0.067	0.179	0.089	0.062
URM	−0.086	<0.001	−0.076	0.072	−0.107	0.038	−0.098	0.047
SAT Math	0.223	<0.001	0.253	<0.001	0.178	0.006	0.318	<0.001
SAT Verbal	0.043	0.123	0.040	0.416	−0.001	0.984	−0.016	0.769
HS GPA	0.282	<0.001	0.176	<0.001	0.206	<0.001	0.200	<0.001

were small in OC1 and OC2 and very small in GC1.[19] URM pass rates tended to be smaller than those of their peers, though these effects were also small. There does not seem to have been any interaction between URM status and SI participation—being in SI did not affect URM students differently than their peers.

Table 4 shows the data in regard to average grades. Here there are small positive effects of SI participation on course grades in all but GC2. There are also small-to-moderate effects whereby non-URM students receive higher grades. There is no interaction between the two variables in any case.

Table 5 shows the data in regard to graduation rates. There was essentially no impact of SI participation on graduation rates, nor was there any interaction with URM status. Interestingly, in all but GC1, URM students were more likely to graduate than their peers, though this effect was small and not statistically significant in all but OC2. Although interesting, this is clearly unrelated to SI and thus not a focus of this paper.

Academic Predictors

SI participation was associated with increased course performance except in GC2, but it could be possible that this was because the SI participants were more academically able. To examine this, Mathematics and Verbal SAT I test scores and high school GPA were used as academic fitness measures; the averages by SI status are shown in Table 6, along with the effect sizes of the differences. In this case, effect sizes are negative if the SI group outperformed the non-SI group.

With the exception of high school GPA in OC2, the non-SI group consistently had higher academic fitness measures than those in SI, although the effects were negligible for high school GPA and much smaller for OC2 than for the other courses. Although not shown, these differences are consistent for both URM and non-URM students. The SI participants do not appear to have done better because they were academically more able; if anything, in the absence of SI one might predict that they would do worse in the class than their peers.

Regression Modeling

To determine what variables independently contributed to the final grade in the class, a linear regression model[20] was run. Students' data were excluded if they did not have values for all of the variables. The results for the four courses are shown in Table 7. The β values show the relative independent contribution of the variable to the final grade in the class, with higher numbers meaning a greater contribution, while the p values tell how statistically significant the relationship is.

From this, it can be seen that SI has a statistically significant independent relationship with the grade in the course in both GC1 and OC1, but it does not reach the level of significance in the other two courses. This can be compared to the other predictors of success: SAT Math scores and high school GPA are independently significant predictors in all four courses, while SAT Verbal scores are not significant in any. Being a URM student has a negative association with course grades, though the size of this relationship is relatively small when the other factors are controlled for—it is interesting to note, however, that URM status negatively impacts grade even when SAT and high school GPA are controlled for.

■ DISCUSSION

Having examined SI impact and its relationship with URM status, we now return to the questions that began this paper:

1. Are there different SI impacts in these four courses?
2. Are there differences in the relative SI impact on URM students?
3. Can these differences be explained by either students' characteristics or the skills required by the courses?

The answer to the first question is definitely yes. The impact of SI participation was high in GC1 and OC1, but lower in OC2 and GC2. Although GC2 showed no SI impact on grades in the ANOVA analysis, linear regression modeling suggested this was because of the lower academic preparedness of the SI takers, and when this was included in the model, the impact of SI was small, but probably real. In OC2, on the other hand, a positive grade impact of SI was shown with the ANOVA but disappeared in the linear regression model when other factors were included.

For the second question, there did not seem to be any significant difference in the SI impact on URM and non-URM students in these courses. This is consistent with much of the existing literature, but differs from what we found in Introduction to Biology I at SFSU.[15] It is not clear what particular features of that course and its accompanying SI workshop made it particularly beneficial for URM students, but whatever factors were at work, they do not seem to have been in effect in chemistry.

Table 8. Summary of Key Findings

Parameters	GC1	OC1	OC2	GC2
Differences between Courses:				
Course Focus	Conceptual	Conceptual	Conceptual	Quantitative
	Qualitative	Qualitative	Qualitative	Problem solving
	Guided discovery	Traditional teaching	Traditional teaching	Experimental methods
Course Demographics	57% Female	65% Female	63% Female	67% Female
	33% URM	30% URM	30% URM	28% URM
	46% Chem/Bio	83% Chem/Bio	89% Chem/Bio	74% Chem/Bio
	13% Engineering	1% Engineering	0% Engineering	1% Engineering
	41% Other majors	17% Other majors	11% Other majors	26% Other majors
Differences in Outcomes:				
Impacts on Course Performance	Impact SI	Impact SI	Impact SI	No impact SI
	Impact URM	Impact URM	Impact URM	Impact URM
	No interaction	No interaction	No interaction	No interaction
Differences for SI Participants	Higher grades	Higher grades	Higher grades	No grade difference
	Slightly higher pass rate	Higher pass rate	Higher pass rate	No pass rate difference
	Lower MSAT	Lower MSAT	No MSAT difference	Lower MSAT
	Lower VSAT	Lower VSAT	No VSAT difference	Lower VSAT
	No HS GPA difference	No HS GPA difference	No HS GPA difference	No HS GPA difference
Linear Regression on Course grade	High impact SI	High impact SI	No impact SI	Near impact SI
	High impact URM	No impact URM	Low impact URM	Low impact URM
	High impact MSAT	High impact MSAT	High impact MSAT	High impact MSAT
	No impact VSAT	No impact VSAT	No impact VSAT	No impact VSAT
	High impact HS GPA	High impact HS GPA	High impact HS GPA	High impact HS GPA

Explanations of Differences

The answer to the third question is less clear. To start the discussion, Table 8 examines the primary findings for each course, and how they differ.

It does not appear that differences in course focus corresponded to differences in SI impact. Although GC2 showed a low impact of SI and was the only course with a quantitative focus, OC2 also showed a low impact and used essentially the same methods as OC1, which showed a substantially higher impact. Similarly, GC1 used guided discovery and OC1 used traditional teaching methods; both SI showed a substantial impact.

Similarly, student demographics varied by course, but these do not correspond to differences in SI impact. GC1 had far more students majoring in something other than chemistry- or biology-related fields, yet showed a similar impact level to OC2, which was dominated by chemistry and biology majors—and OC2 showed a much lower impact yet had essentially the same distribution of students as OC1.

There was one major difference between the courses with high SI impacts and those with less impact: their place in the chemistry course sequence and, one might expect, the amount of new material and approaches to that material the courses introduced. GC1 was the first college-level chemistry course most students took. One would expect that many had never previously encountered much of the material or the approaches to the material. It makes sense that this would create a situation in which these students would particularly benefit from the extra assistance provided by SI.

Students in OC1 already had some experience with chemistry, but the course was, in many ways, very different from GC1. Students were introduced to many concepts and ways of thinking they had not previously experienced. Additionally, OC1 was only the second course in the sequence, and thinking about chemistry would still have been new to many students.

OC2, however, was taken after both of these. By then, students had a full year of chemistry experience. Also, because the course is a continuation of OC1, it seems likely that students would not have to master as much new material to succeed. Additionally, they would have already succeeded in both GC1 and OC1; they would have already had to overcome their academic difficulties to get to that point. It is not surprising that students would require less outside assistance to be successful.

GC2 is similar to OC2, as students had some experience with chemistry beforehand, so learning about chemistry would not be a new experience. Also, GC2 was an extension of GC1, so students would have had prior experience with the underlying concepts. On the other hand, GC2 introduced a quantitative approach not present in either GC1 or organic chemistry, and this approach may have given students difficulty. Thus, it may not be surprising that GC2 saw a greater SI impact than OC2.

■ CONCLUSIONS AND LIMITATIONS

There appear to be clear benefits of SI in courses where students are being newly introduced to chemical concepts and methods, but these benefits seem to drop off when students are more experienced with the material. One might conclude that if a department wished to increase student performance, that department would be best served in introducing SI into entry-level courses such as GC1 and OC1. Conversely, continuing to support SI throughout the sequence might not be a particularly effectively use of money. This might be expected for courses outside chemistry as well.

This finding is not utterly conclusive, however. Other factors may have accounted for the discovered differences yet escaped detection because of the limitations of the available data. One issue could be differences in how SI workshops were presented. We know from surveys that different facilitators ran their workshops differently and had different degrees of topical knowledge. In fact, an examination of student grades based on the facilitators of the SI sections showed considerable variation from facilitator to facilitator, although with the small number of students per facilitator this difference only reached statistical significance in OC2. Still, there was no indication of systematic variation—undergraduate, graduate student, and faculty facilitators all had essentially identical ranges of student scores. Nor was there any indication that SI facilitator styles differed systematically by course, as we would expect, given that training was consistent across all courses.

Second, we could not gather data regarding all population demographics that may have related to SI impact. We do not, for example, know postbaccalaureate or transfer student status, though anecdotal reports suggest that about one-quarter of the students in these classes may have already had bachelor's degrees and many more had previously been college students before coming to SFSU, nor do we know who took college-level chemistry at other institutions; none of these variables was available through the data sources. Related to this is overall experience in college, which we could not determine as we had no data for pre-SFSU experience yet knew that it was important for a significant proportion of the students. If these factors affected performance in the class, and students in these circumstances were more or less likely to take SI, it could easily have influenced our findings.

A next step in this research would be to broaden the investigation to a wider set of courses, to collect a broader set of data (such as information about postbaccalaureate and transfer status), and to examine institutions beyond SFSU. With a broad enough data set, it should be possible to identify the factors influencing SI impact with greater confidence. It should also allow examination of why some courses show a greater benefit for URM students while others, such as the courses examined in this paper, do not.

Another next step would be to examine the impact of the activities undertaken within SI sections on student performance. This would help determine which activities were most successful and important, and allow the development of an ideal model for SI.

■ ASSOCIATED CONTENT

Supporting Information

Three additional data tables. This material is available via the Internet at http://pubs.acs.org.

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(17) We thank Anne Shen for making this possible.

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