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Natural Sciences Supplemental Instruction Program: An Evaluation Study



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Introduction

Research has suggested Supplemental Instruction (SI), also known as Peer Assisted Study Sessions can support students in their efforts to succeed in their courses and programs (Lockie & Van Lanen, 1994.) At Gavilan College, the Natural Sciences department developed a SI program based on the University of Missouri- Kansas City model which has found that participants earn higher mean final course grades and have lower rates of course withdrawals (Arendale & Martin, 1997). Additionally, the program is designed to help participants develop better study skills and more effective critical reasoning strategies. The program at Gavilan College has been implemented in selected Natural Sciences courses for the past three academic years. In the Natural Sciences SI program, student leaders facilitate a series of guided group study sessions outside of class meeting times. Students choose to attend scheduled sessions that offer additional review, study skills assistance, further explanation of challenging topics, and test preparation.

The current study was designed to increase understanding of the effectiveness of the SI Science program. In addition, student feedback was collected to guide efforts to improve program operation.

Methods

Participant data

For purposes of this study, records were obtained for students participating in all SI courses for the past three academic years. Of the total 542 SI participants (attendees of at least one SI session) enrollments, 397 were unduplicated students. Of those students participating, 22.5% were male and 30.9% were white. Approximately, 55.4% were of Hispanic-origin and 53.6% were 25 and under. Women and Hispanic participants were over-represented in the SI program when compared to students taking Natural Science courses and the overall campus student population (See Appendix A, Figure A1, for Demographics of SI participants).

Success, retention, and grade performance analyses

Class Comparison: In order to contrast classes that had an SI intervention vs. those that did not, a historical comparison was designed. Courses pre-SI were compared against matched courses that received SI intervention. The courses were matched by instructor, time of day, and semester. Data from 24 classes composed 10 matched class sets, which included 271 SI participant students. Only classes that had a minimum of 50 participation hours were included in the SI intervention group.

The matched SI courses and the pre-SI course were compared on GPA and retention, and success rates. *GPA* was calculated with the use of a 4 point scale. *Success rate* is the proportion of students enrolled in a class at census who completed the class with a C or above. *Retention* is the proportion of students enrolled in a class at census who completed the class with any grade. The differences in pre and post SI courses were also compared to the overall departmental and campus performance.

Student Comparison -- Grades: In order to understand the effect of participation on student grade performance, individual student grades were correlated with hours of participation in the SI intervention. A total of 660 students' performance and participation data were analyzed. Only students that received a letter grade were included in the comparison.

Student Self-Report

Student Survey:

In order to assess the impact of the SI program from a student perspective and to solicit input on how to improve the program, a student survey was administered at the end of the Spring 2011 term. A draft of the SI survey was developed by SI staff and then was forward to three faculty members and the Director of the Office of Institutional Research for input. The survey was modified based on the input (See survey Appendix B). The survey questioned students about their reasons for participating in SI sessions, the impact of their participation, and their suggestions for improving the program.

The survey was administered at the close of the term in class to all students in classes that had a SI component. The survey was sent to 14 Biology and Chemistry classes. Nine classes administered and returned completed surveys. Of the classes that did not complete the survey, two did not complete the survey because of communication errors and three did not administer the survey by decision of the course instructor. A total of 169 students completed the survey, which was approximately 85% of the total SI course student population.

Student Focus Groups

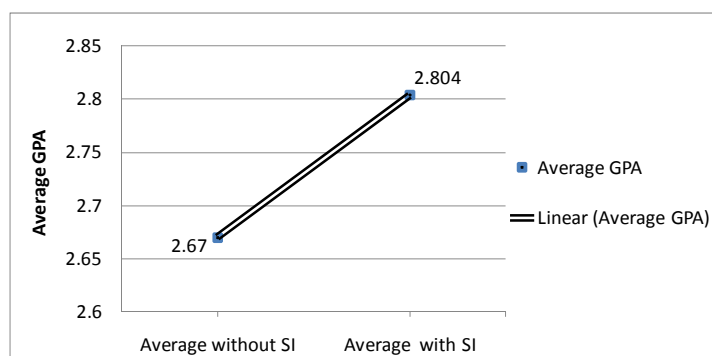
In order to obtain more information about how to improve the program, a series of focus groups were also conducted. The focus groups prompts were: *Was the program helpful; What worked well; and What needs improvement?* Nine focus groups were conducted with approximately 45 students. The sessions ran for approximately 15 minutes and were facilitated by the Director of Institutional Research and a student assistant. Two of the sessions were from a night class and all of the classes sampled had a lab/lecture structure.

Findings

Grade Comparison

The grades of students from SI supported courses were compared against students' grades from previous classes that were matched on time of day, term, and instructor. The results indicated that the SI course student grades were significantly higher compared to those students from previous courses that were unsupported ($t=-2.76, p=.006$). To illustrate, Figure 1 shows the average grade points of SI courses compared

Figure 1: Relationship between GPA and SI participation averaged over 10 class-set comparisons.



against matched non-SI courses. When examined independently, the improvements in grades were found for each matched course set (See Figure A2 in Appendix A).

Individual student hours of participation were also compared with students' final grades. Figure 2 illustrates the relationship between hours of SI participation and corresponding GPAs. Statistical analysis found that the greater the amount of SI participation the higher the grade in the course ($r=.804, p<.000$).

Success and Retention Comparison

Success and retention rates from courses that received SI support were compared against courses that were matched on time of day, term, and instructor. Figure 3 shows that when student performance data was combined together, students from SI intervention courses had higher rates of retention and success. When tested, however, these differences were not significant (retention: $t=-1.009, p=.331$; success: $t=-1.142, p=.254$). When examined course by course some courses saw improvement in success or retention while other did not (See Figure-set A3 and A4 in Appendix A for a course-by-course comparison of success and retention). These mixed results are in contrast to the significant grade point increases detailed above. Further examination found that the increases in retention and success rates of SI courses corresponded to campus-wide increase in success rates and contrasted decreases in retention rates (See Figure A5 in Appendix A). The campus-wide decrease in retention rates are likely due to the increased number of student adds and drops, thus increasing the total number of enrolled students who ultimately drop, while success rate increases may be due to students dropping courses that they expect to do more poorly in. (See Figure A6 in Appendix A).

Student Report on the Impact of Participation

Student surveys revealed that students who participated reported considerable impact on their content knowledge, study skills, and motivation (See

Figure 2 Average grade by hours of SI participation.

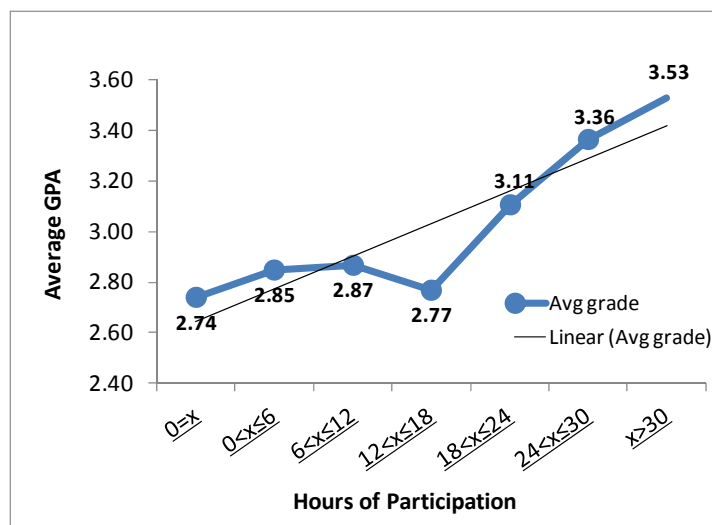


Figure 3 Retention and success rate comparison.

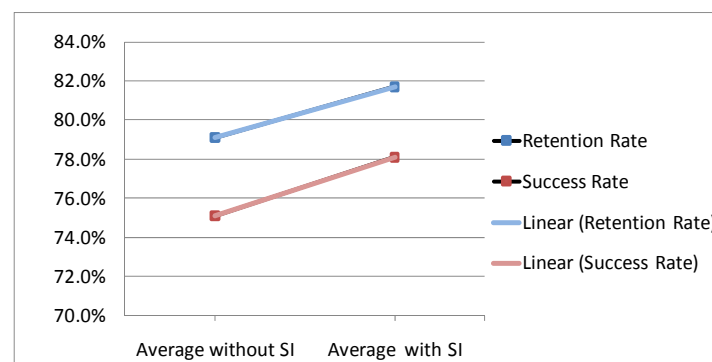


Table 1: Self-reported benefits of SI participation (n=105).

	% Helped
Helped understanding the material	93.80%
Helped study strategies	73.30%
Helped keeping up with the course	84.40%
Helped meeting other students	71.50%
Helped motivation to do well in class	86.60%
Helped enjoyment of the course	82.80%

Table 1). Nearly all participating students report the SI session helped increase their understanding of the material and their motivation to do well in the course.

Students' reasons for participation or non-participation

Students who reported attending SI sessions were asked about what were the reasons they attended SI sessions. The most popular response was *I knew that I needed help from the beginning* (32.5%), with many students also selecting *I was offered extra credit* (27.2%). For those students who did not attend, they were asked their reasons for not attending. The most frequent response reported was *I was not interested* (7.7%). See Figure-set A7 in Appendix A for the full listing of reasons for participation or non-participation.

Student Suggestions for Program Improvement.

Survey Comments

When examining write-in comments in the self-report student survey, several themes emerged (See Appendix C for text of actual comments):

- Flexible session schedule,
- Extra credit for participation,
- Less off-topic conversations,
- More notifications on the sessions,
- More structured sessions.

Focus Group comments

The focus group comment echoed the results from the self-report survey (See Appendix D for a summary of comments):

- Scheduling diversity,
- More notification and information about upcoming sessions,
- Greater organization in the individual sessions,
- Better preparation and consistency for SI leaders,
- Interactive online resources so students can participate asynchronously.

Summary

In an effort to closely examine the effectiveness and operation of the Natural Sciences Supplemental Instruction program, multiple sources of data were collected and analyzed. Prior to a discussion of the results, some limitations of the data need to be acknowledged. Firstly, the self-report survey and the focus group data is highly subjective since students are asked their opinions about the effectiveness and their suggested improvements in the program. While participants' opinions are very valuable for program improvement, they may be less reliable in assessing program impact. Another area of potential weakness in this study was the reliance on matched course comparison between different cohorts. As a result any differences in the student performance from these comparisons may be due to differences in student populations rather than SI participation. For example, the increases in student grades from pre-SI courses and SI courses may be due to an increase in students who were more prepared to excel in the corresponding courses.

While acknowledging these limitations, the findings seem to agree that there are individual and course benefits to the SI program. Firstly, when grades were compared both by SI course and individual hours of participation, SI students' grades were significantly higher. While not significant, student retention and success rates for students from SI courses were higher than previously matched courses' students. The increases in retention rates ran contrary to campus-wide drops in retention over the same period. SI success rate increases against matched courses corresponded to campus-wide success rate increases. Nevertheless, it appears as if students who participate seem to see grades increases. So, a student who without support was receiving a C after support might be receiving a B or an A.

The student survey correspondingly revealed that students felt as if the SI sessions were helpful in aiding understanding of the material and in motivation to do well in the course. These findings were echoed in students' focus group comments as well. Taken together there is strong evidence that students participation in the Physical Science SI program can contribute to improved student grade performance, which is notable considering the program has been serving a mostly Hispanic participants.

The study also provided some important suggestions for program improvement. In particular, students consistently suggested a greater diversity in scheduling. These suggestions corresponded to data that suggested the most likely reason students did not attend was scheduling conflicts. Another solution to scheduling challenges proposed by students was the development of an asynchronous SI option. Several student participants in the focus groups suggested online versions of the SI sessions which might include chat, uploaded diagrams, etc.

Another finding from the study was the variability and inconsistency in SI sessions. When performance data was examined course-by-course, some SI sessions did not seem to have as positive an effect on student performance. Moreover, the focus groups revealed that some sessions were not well organized, while others were extremely effective. These findings suggest the need for an improved training and coordination of the program.

In sum, the program has implemented a supplemental instruction model that seems to be benefiting students in a variety of areas. Most importantly, the program seems to have increased student performance. Students who are participating in SI have a greater retention and success rates and grade performance. As with any new program, there are several areas for improvement, including greater coordinating and the offering on an asynchronous option. Nevertheless, the Natural Science SI program seems to be having a significant impact on student course performance, thus aiding in their progress towards success.

References

- Arendale, D., & Martin, D. C. (1997). *Review of research concerning the effectiveness of Supplemental Instruction from the University of Missouri-Kansas City and other institutions*. Kansas City, MO: The University of Missouri-Kansas City. (ERIC Document Reproduction Service No. ED 370 502)
- Lockie, N. M., & Van Lanen, R. J. (1994). Supplemental Instruction for college chemistry courses. In D. C. Martin, & D. Arendale (Eds.), *Supplemental Instruction: Increasing achievement and retention* (pp. 63-74). San Francisco, CA: Jossey-Bass, Inc.

Appendix A: Additional Figures

Figure A1: Self-report demographics: Ethnicity, gender and age of SI participants compared to Physiology, Natural Sciences department, and campus populations.

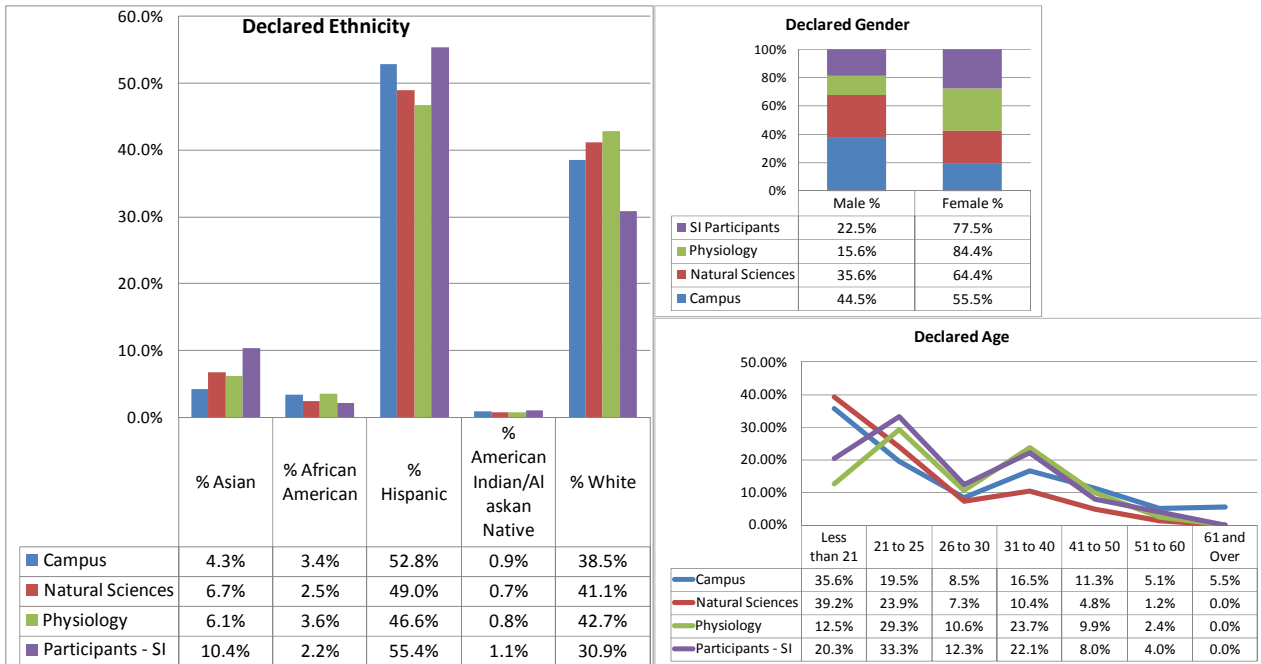


Figure A2: Comparison of GP by SI intervention by course.

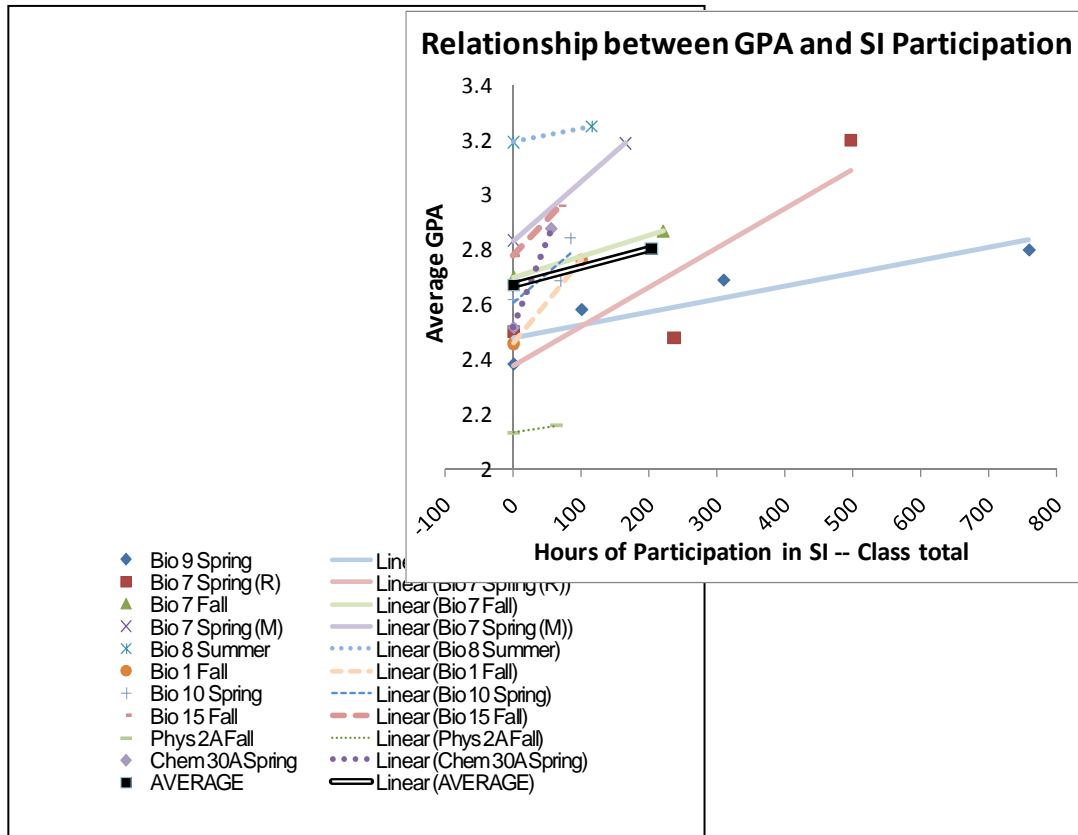


Figure-set A3: Trends in success rate of specific class comparisons with and without an SI Leader, compared with discipline rate and campus overall rate.

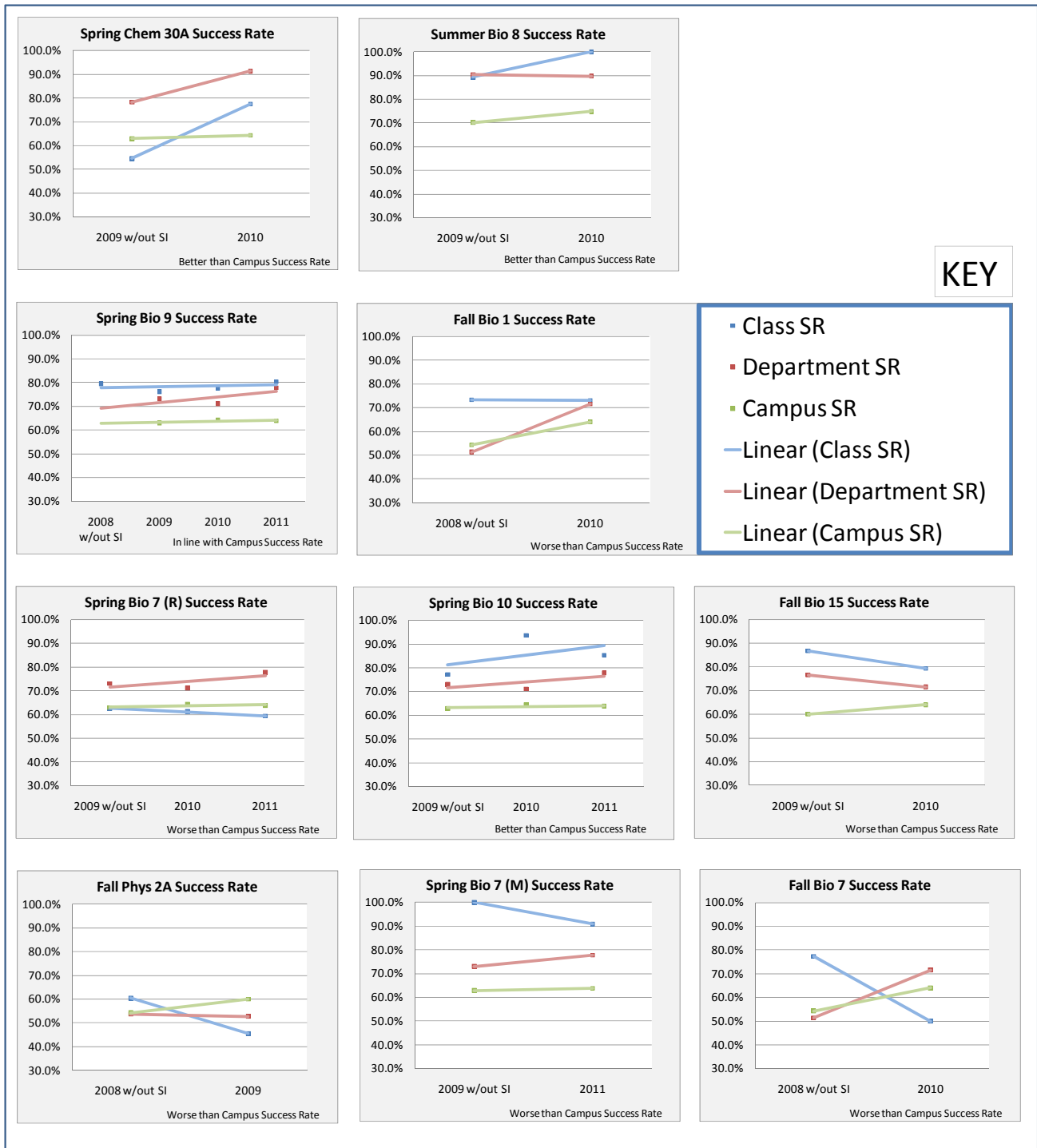


Figure-set A4: Retention rates by SI status and by course compared with campus and Natural Sciences department.



Figure A5: Success and retention rate trend for Biology and campus-wide.

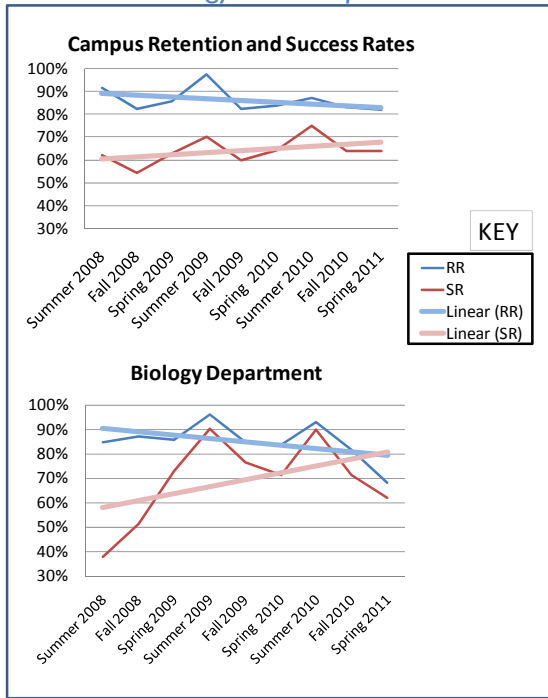


Figure A6: Add and Drop Frequency trends for Biology department and campus-wide.

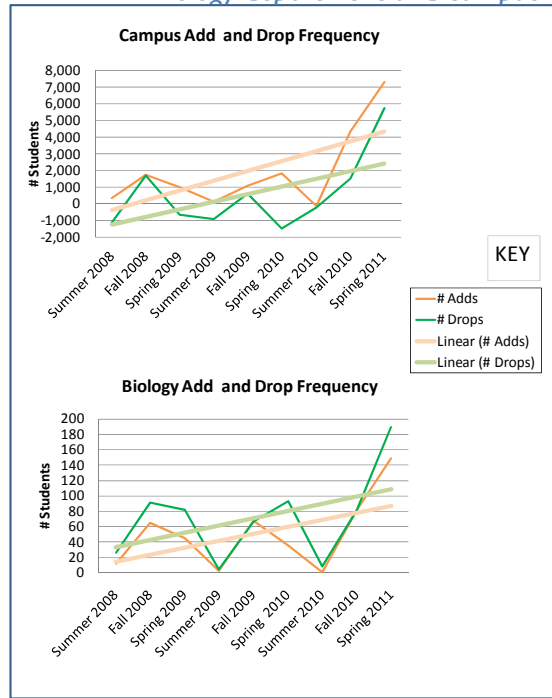
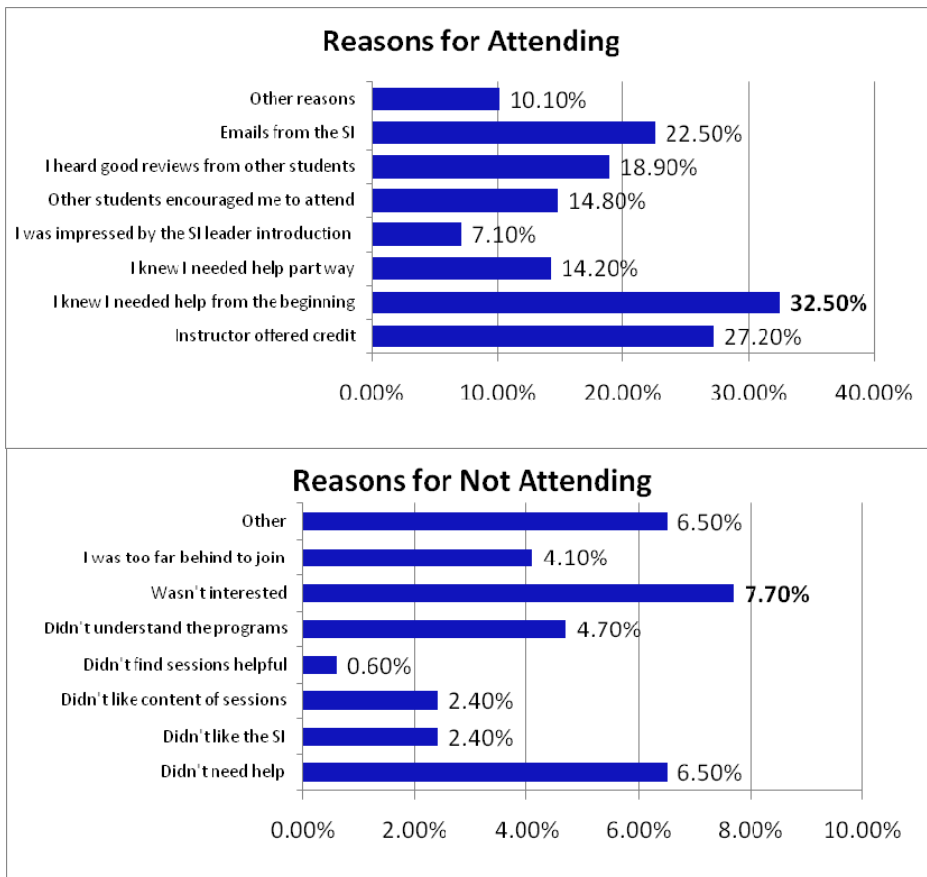


Figure-set A7: Students self-reported reason for attending or not attending SI sessions.



Appendix B: Survey

Supplemental Instructor (SI) Program Survey: Science

In order to help us improve our courses, we would like to learn more about your experience as a student. Participation in this survey is voluntary. If you choose not to participate, it will not affect your status as a student or as a participant in any program. It is anonymous so please do not put your name on the survey.

1. Please identify the course, semester and year (eg, Human Anatomy, Sp, 2011): _____

a. Have you heard of Supplemental Instruction (SI) before?

- YES
 NO

b. Does this class have a designated SI leader/tutor?

- YES
 NO

c. Did your Instructor provide class credit for attending sessions?

- YES Not applicable/did not have SI leader
 NO

d. Approximately how frequently have you attended SI sessions for this class?

- SI sessions were offered but I Never attended (if you select this box please skip to question 2) Once a Month
 Once Once a Week
 Multiple times a Week

e. Why did you attend the SI sessions? (Check any that apply. Skip this question if you did not participate in SI sessions):

- Instructor offered Course Credit for attending
 I knew I needed help from the beginning
 I realized I needed help part way through the semester
 I was impressed by the introduction by the SI Leader at the beginning of the semester
 Other students encouraged me to attend
 I heard good reviews from other students
 Emails from my SI reminded me
 The Instructor recommended SI
 Other _____

f. How much did the SI tutoring session help you with the following? (Skip this question if you did not participate in SI sessions):

	Helped		Unaffected		Harmed
	5	4	3	2	1
<i>understanding the material</i>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
<i>study strategies</i>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
<i>keeping up with the course</i>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
<i>meeting other students</i>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
<i>motivation to do well in your class</i>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
<i>enjoyment of the course</i>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

2. If you DID NOT ATTEND any SI sessions or if you STOPPED attending SI sessions, please identify why: (check any that apply)

- I had schedule conflicts I didn't understand the program
 I didn't need the help I wasn't interested
 I didn't like the SI leader I felt unprepared and was too far behind to join in
 I didn't like the content of the sessions Other: _____
 I didn't find the sessions helpful _____

3. Please provide any suggestions as to how to improve the program on the back of this paper.

Appendix D: Focus Groups Responses

For those who participated in the SI program, what in particular was helpful?

- Email notification for upcoming sessions.
- Walking students through the diagrams used in the course visually and verbally.
- Emailing course content that supports lecture material.
- Interactive sessions, for example, when students write things up the board.
- More intensively exploring one topic, for example, looking closer at the kidney and its function and anatomy.
- Practice tests were helpful.
- Setting up a practice practical.
- Passion and competency with the subject matter.
- Communication and familiarity with the instructor.
- Making students think about the material not just providing answers.
- Practice with the material
- Leaders' personal interaction with participants.
- Reviewing classroom material and notes.
- Cooperative learning opportunities.
- Discussing, re-approaching class material out-loud with fellow students and with the SI as a guide.
- Particularly useful for test preparation, because of the opportunity to focus on key points.
- Opportunity to connect with other students.
- Good to get assistance answering questions.
- SI helps you learn better ways to approach the material.

For those who participated in the SI program, what in particular needs improvement?

- Improved notice of upcoming session times and location, both via email and in-person (ie. on the board or via the instructor).
- Recruitment sessions should include information, videos, and specific information about how the sessions worked. Also, they should be conducted more than once.
- Greater organization of sessions including starting on-time, having an agenda, and avoiding non-course-related socializing.
- SI leaders should meet regularly with instructors.
- Provide input to the instructor when a topic is not-completely understood in a session.
- Have leaders prompt questions, even they are not occurring naturally.
- Setting a session schedule via a poll.
- Flexibility and diversity in scheduling, for example weekend and evening times, Hollister sessions.
- Be a leader, be patient
- Locations should be reasonably quiet and scheduled locations should be more organized.

- Better preparation and training for the SI instructors to create greater consistency from the SI leaders.
- Make sure information is disseminated to everyone in one way or another.
- SI should be section-based, not shared with different instructors, eg. physiology this semester.
- Have available online sources of participation and information.

Would you find a website useful and if so what would it provide/look like?

- Sessions should be recorded and available through an interactive website.
- Linking resources (i.e. vocab lists, handouts, tests, etc.) so students can access these materials asynchronously.
- Having online chat regarding important topics.
- There should be a way through the site to contact SI leader.
- Email list constructed by the SI leaders were prone to errors, use website to prevent this and centralize communication.

Appendix C: Survey Comments

- **Having an actual separate class would be better with less noise and interruptions** by the other students in SI. Sometimes the study room got really full with other students not in SI and it was difficult to concentrate.
- It is a great program keep it.
- I have no suggestions. I feel this was a great help with my other students of the course. I will attend other course if offered.
- **More flexible schedule.** I know the SI leaders volunteer the time they do give but it would make it easier for more people to attend. Eg evening and weekend sessions. From what I've heard the SI leaders did a wonderful job for those who did attend and they don't want any improvement on the program
- Each hour attended = 1 extra credit point instead of 5 hours attended = 2 points
- Just don't stop the program
- I found them helpful and informative just wish I hadn't had schedule conflicts
- Program seems organized, not much work needed to improve
- This is a great program. I wish my schedule was less hectic or else I would have used this service much more!
- It would be nice to have at least a 30 minute session be part of class time, extend the class time.
- [REDACTED] was very helpful. She knew her stuff.
- Continue it for those who are unable to find time at home like me. I was happy to have the SI leaders and helped me cause it was hard to learn at times by myself. I have kids, single mom, and couldn't understand but going was very helpful.
- Making times more convenient and also maybe more motivation for us to join. Maybe **make a class period of an SI session so we can see what it is like.**
- Everything they did was helpful, it just didn't work with my busy schedule
- Actually teach material, don't just expect student to know everything
- If times were set, say twice a week, I could arrange my full time schedule at work to attend
- Maybe have better times to meet
- extra credit for attending
- Have instructor or full time SI leaders, with both as students our schedules usually collide
- I like the program the way it is
- More early morning hours, maybe **a different classroom than IS109** for all sessions
- They helped me out a lot even though I wasn't able to attend much. They helped over email also. Loved it!
- Have **SIs that do not carry a lot of credits themselves**
- Offer more instruction times and **provide access to more slides and ALL models.**
- Keep the program! I wouldn't still be in this class if the SI instructors hadn't been around.
- Give credit for attending.
- Don't get rid of the program
- More times to have the sessions during the week because everyone has such different schedules
- Keep the program going, Very helpful
- **Do more visuals and drawings**
- I was unable to make it to the sessions, however **during class they were very helpful!**
- Doesn't need to improve. Our SI leaders were excellent and were a big help when it came to understanding material that wasn't gone over in class to the full extent.
- Keep the program
- Smart girls.

- Maybe have more than one SI leader so more people can make it.
- I had to work during most of the SI sessions and it was hard to make the other ones because I live so far away. I also was doing well in the class so it didn't seem like the drive here would be worth it. I currently have a 96% in the class. Also I didn't like our SI leader since she did not seem intelligent. **She was having a conversation with a girl in our class** about how she missed a math problem on her test because she didn't know scientific notation. I'm pretty sure elementary students know that.
- Keep it going, great help.
- Have two Si leaders per class for more flexible hours.
- Paula was awesome.
- My opinion of improving the program would be to **allow some "tutoring"** to this program because from experience, I go to SI sessions still feeling completely lost of certain subjects and unable to make connections with other aspects of class material in lecture. So instead of making it a student-lead discussion, we should be allowed some more explanation so we can understand what is going on so we can explain material to other students. Overall, however, SI has been absolutely beneficial to my learning and my grade has really improved compared to classes I have taken where I did not attend SI.
- If money is an issue to keep the program you can **make it a volunteer program or offer it as a unit pass/nopass supplemental course** for people to enroll in.
- No improvements, they help to better understand the material.
- **Hollister sessions. More visual and more interaction**
- I had a hard time because of the availability of hours of the sessions
- Chem 30 A and B needs an SI leader
- It was very helpful especially if you need extra credit
- No improvements, just do not cut SI because it helped me greatly and will certainly help other students to come.
- Have an SI leader for every section of the class since different sections go over different materials
- Went to two different SI leaders which helped understanding. 2 different ways of teaching
- sessions needed to be **more organized**.
- I was in [redacted] physio class. All SI leaders were following [redacted] class. In fact, this past week [redacted] class took a test and I received two separate emails from the other SI leaders saying there would be no SI sessions until the following week. It would have been extremely helpful to have an SI leader for [redacted] class, especially since I was repeatedly told that what I was learning was something [redacted] class was not going over.
- It seems it would be more appropriate for **each Bio 9 class to have at least one SI leader** vs one class having three and the other having zero. If it is impossible to have one for each class, it would be helpful if all the other leaders would go over sections we were currently on or at least haven't been tested on, especially if it was something we were unclear on or confused on. IT seemed like some of the SI leaders were hesitant or flat out refused to go over items or sections we were needing support on since "their class" was in a different section. Overall I was disappointed and found the most sessions a waste of time and irrelevant to our class.
- I feel there were SI for all of the Bio9 classes and when we needed help they did not want to help us because we were at different chapters compared to [redacted] class. that was not right. So if [redacted] class was in chapter 14 and we were on chapter 16 **they refused to help us**. And also if Saturday are scheduled for SI tutoring **and they never showed**. That did not help me.
- Si leaders should maybe help or encourage people to give **emails to each other** so they will be able to help each other more easily
- No improvements. it was the most helpful SI I've ever attended by far at Gavilan
- **weekend availability**
- no suggestions, SI leader was just fine
- **more organization** would have help