About the International Center for Supplemental Instruction

Supplemental Instruction (SI) is an academic assistance program that utilizes peer-assisted study sessions. SI sessions are regularly-scheduled, informal review sessions in which students compare notes, discuss readings, develop organizational tools, and predict test items. Students learn how to integrate course content and study skills while working together. The sessions are facilitated by SI Leaders, students who have previously done well in the course and who attend all class lectures, take notes, and act as model students.

The International Center for Supplemental Instruction at the University of Missouri-Kansas City serves as the international hub for Supplemental Instruction programs across the globe. In the United States of America, the International Center provides training, guidance, support, and resources for institutions of all types through training workshops in Kansas City and on site.

The International Center also has memoranda of understanding with five institutions around the world: University of Wollongong (Australia); University of Guelph (Canada); Nelson Mandela Metropolitan University (South Africa); Lund University (Sweden); and North-West University (South Africa—regional center). These institutions serve as national centers or regional centers and support institutions in their countries and regions in implementing Supplemental Instruction.

About the Supplemental Instruction Journal

Supplemental Instruction Journal (SIJ) seeks to publish the latest research in the field and to be the foremost resource for advancements and discoveries related to Supplemental Instruction. SIJ submissions are peer reviewed by national and international education professionals who work with or have worked in some capacity with Supplemental Instruction programs. SIJ is intended for a wide audience.

This issue marks the second publication of the Supplemental Instruction Journal. While the first issue, published in November 2014, included refereed papers from our 2014 International Conference on Supplemental Instruction, this issue is comprised of articles submitted, evaluated, and accepted for publication by SIJ’s Peer Review Board.

The articles in this issue explore the benefits of being an SI Leader; the impact of both traditional and online SI in health sciences and STEM fields; and the application of SI as a test-preparation model to improve outcomes for underrepresented students applying to professional school. We at the International Center for SI hope that these articles will broaden readers’ understanding of the benefits of SI programs and offer ideas for broadening SI’s application to affect change in new arenas.

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Call for Submissions

The Supplemental Instruction Journal is currently accepting submissions for its third issue.

Submissions must be submitted in APA format to SIJ@umkc.edu

Submissions are accepted on a rolling basis.

For more information, please visit info.umkc.edu/si/journal or email questions to SIJ@umkc.edu.
The Impact of Supplemental Instruction on the SI Leader
Christina Tran, Portland State University
Kelly Hartmann, Brea Olinda Unified School District, Orange County, California
Todd Cadwallader-Olsker, California State University, Fullerton
Martin Bonsangue, California State University, Fullerton

The Impact of Online Supplemental Instruction on Academic Performance and Persistence in Undergraduate STEM Courses
Patricia Spaniol-Mathews, Texas A&M University-Corpus Christi
Lawrence E. Letourneau, University of Nevada, Las Vegas
Ethan Rice, Texas A&M University-Corpus Christi

Application of Supplemental Instruction in an Undergraduate Anatomy and Physiology Course for Allied Health Students
Arimys Kalil, Kent State University
Carol Jones, Kent State University
Payman Nasr, California State University, Dominguez Hills

Implementing Supplemental Instruction (SI) Online to Create Success in High-Stakes Coursework for Pre-Doctoral Dental Students
Carrie Carter-Hanson, Johnson County Community College
Cynthia Gadbury-Amyot, University of Missouri-Kansas City
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Abstract

While the impact of Supplemental Instruction (SI) on the SI Leaders themselves has long been thought to be positive, few studies have directly addressed the effects of the experience of leading an SI workshop. This study, conducted at California State University, Fullerton, attempted to examine this impact quantitatively using a larger data set than previous studies. Subgroups studied included the sex of the SI Leaders, their first generation status and their underrepresented minority (URM) status. While differences in sex or URM status did not significantly correlate to differences in academic background and achievement, several significant differences emerged. Results showed that a higher proportion of men than women reported increased confidence and effectiveness in communicating with professors, peers, and students. Additionally, URM SI Leaders reported increases at a greater rate than their non-URM counterparts in their ability to effectively handle student conflict and communicate with peers. This information may help inform the context of the structure of Supplemental Instruction programs and the training of SI Leaders to better benefit them as well as the SI students.

Background

California State University, Fullerton (CSUF) is a large regional university of over 38,000 students in southern California. CSUF began its SI program in 2007 with two sections of a calculus workshop and two sections of a biology workshop. Based on the SI model of the University of Missouri-Kansas City (UMKC), the CSUF SI program uses peer-led workshops to facilitate the learning process. At CSUF, the goal of implementing an SI program was to reduce the achievement gap for URM students in STEM courses. (We
define URM as students who self-identify as Black, Hispanic, Native American, or multiple races. At CSUF, URM students make up almost 40% of the student body, including 37.4% Hispanic, 2.1% Black, 0.1% Native American, and 4.2% multiple races.) There is evidence that the SI program at CSUF is successful in helping to reduce the achievement gap for URM students in first-year calculus, especially for transfer students (Bonsangue et al., 2013). The SI program at CSUF has since grown to become one of the largest in the United States. In Fall 2015, CSUF’s SI program had 130 SI Leaders that were linked to 164 course sections across 13 departments, including departments in business, liberal arts, humanities and STEM disciplines. (Some SI Leaders are linked to more than one course section.) Many studies (Arendale, 2016; Dawson, van der Meer, Skalicky, & Cowley, 2014; Peterfreund, Rath, Xenos, & Bayliss, 2007; Barlow & Villarejo, 2004; Martin & Arendale, 1993) confirm the positive effects of SI workshops on SI participants, especially URM students, in terms of increased passing rates and improved grades.

The effects of leading a workshop on the SI Leader are less concrete, because there are no statistics such as “passing rate” as there are for students in SI-linked courses. However, in several studies, SI Leaders reported overall growth in areas such as effective communication, self-confidence, and professional development. In a meta-analysis of several studies, Stout and McDaniel (2006, p. 55) stated, “Leaders report academic improvement, increased communication and relationship-building skills, and personal and professional development,” and that students who engage with SI as a Leader “make the experience of attending college more positive ... and this in turn increases their sense of self, enabling them to strive to meet their personal, professional, and academic goals.” Furthermore, “When SI Leaders are carefully selected and trained, they experience many unforeseen benefits. Such benefits include increased understanding of the course material, improved communication skills, and enhanced interactions with faculty, students, other SI Leaders, and SI staff.” (2006, p. 56)

Lockie and Van Lanen (2008, p. 10) reported that SI Leaders experienced growth in several areas, including “improved leadership, communication skills and self-confidence as a result of their SI experience.” SI Leaders also reported developing better academic and personal habits. In addition, Zaritsky (2006, p. 28) found that “ninety-eight percent of SI leaders reported that being an SI leader helped them gain self-confidence. SI gave them the opportunity to strengthen their leadership and communication skills.”
In an evaluation of the SI program at Murdoch University, tutors (SI Leaders) were overwhelmingly enthusiastic in what they learned or gained from participating in the program (Beasley, 1997). Tutors felt an increase in their own confidence and a greater sense of self-worth from doing something meaningful for someone else. Furthermore, they reported greater insights about teaching and the value of discussion. Beasley (1997, p. 30) wrote, “For both tutors and tutees there was an increased awareness for a number of them of the value of discussing their views and ideas with their peers.”

More recent studies have examined the benefits to SI Leaders in a quantitative way. James and Templeman (2015) studied the emotional intelligence of SI Leaders using the Bar-On Emotional Quotient Inventory (Bar-On, 2004), and found that more effective Leaders tested higher on Social Responsibility, Impulse Control, and Reality Testing. However, the only score that increased significantly in pre/post testing for all Leaders was Problem Solving. In a case study of SI Leaders in an engineering program in Sweden, Malm, Bryngfors, and Morner (2012) gave a Likert-item questionnaire to 35 SI Leaders. This study found that the SI Leaders reported improved communication skills, interpersonal skills, leadership skills, self-confidence, and a deeper understanding of course content. However, there was not a consensus among the Leaders that the experience of leading an SI workshop led to better study skills or time-management skills, in contrast to other studies.

In this study, we used an instrument similar to, but not based on, that used by Malm, et al. (2012) to investigate the effects of leading an SI workshop on communication skills, leadership skills, and professional growth. In addition, we examined the differences in SI Leaders who identify themselves as non-URM, URM, male, and female. Our research questions were the following:

- Do SI Leaders believe that the experience of leading a semester-long SI workshop section had effects on their career choices, communication skills, leadership skills, and/or conceptual knowledge?
- Are there significant differences in reported effects between URM and non-URM SI workshop Leaders, or between male and female SI workshop Leaders?

**Methods**

In this study, we asked SI workshop Leaders about their self-perception of the effects of leading a semester-long SI workshop section. (From here on, we will simply use the term “workshop” to refer to a semester-
long workshop section.) To do so, we created an anonymous questionnaire in Google Forms containing twenty-six questions. The questionnaire started with background questions about the SI Leader’s gender, ethnicity, parents’ level of education, and other demographic information, followed by Likert-scale questions asking about the effect that leading a workshop had on him/her. The Likert-scale questions focused on communication skills, leadership skills, and professional growth (see Table 1).

Table 1

SI Leader Survey

<table>
<thead>
<tr>
<th>Question</th>
<th>1=Strongly Disagree</th>
<th>2=Disagree</th>
<th>3=Neutral</th>
<th>4=Agree</th>
<th>5=Strongly Agree</th>
</tr>
</thead>
<tbody>
<tr>
<td>Q12 has had a strong influence on my career choice.</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
<tr>
<td>Q13 has positively influenced my communication skills.</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
<tr>
<td>Q14 has improved my leadership skills.</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
<tr>
<td>Q15 I have become more aware of campus resources.</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
<tr>
<td>Q16 has taught me skills that have improved other areas of my life.</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
<tr>
<td>Q17 has helped me deal with student conflict.</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
<tr>
<td>Q18 has helped me become more effective when communicating with professors.</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
<tr>
<td>Q19 has helped me become more effective when communicating with peers.</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
<tr>
<td>Q20 has helped me become more effective when communicating with students.</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
<tr>
<td>Q21 has helped me deepen my understanding of core concepts.</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
</tbody>
</table>

The questionnaire was e-mailed to 153 SI Leaders who led workshops between 2009 and 2013 at CSUF.
The survey was conducted in the fall of 2013 and had a 58% response rate. The majority of the Leaders were from the College of Natural Sciences and Mathematics and led workshops in STEM fields. Table 1 shows ten Liker-scale questions (items 12 through 21) in which SI Leaders were asked about the effects of leading a workshop. Each item had five possible responses, where 5 corresponded to Strongly Agree and 1 corresponded to Strongly Disagree. The questions relating to demographic information are not listed in Table 1.

Results

Percentage of Responses

We examined and compared the percentage of respondents who responded with Disagree or Strongly Disagree (1 or 2), Neutral (3), or Agree or Strongly Agree (4 or 5). We found that a majority of SI Leaders responded Agree on every item (Table 2), although the majority did not always consist of the same participants. Almost all participants felt their communication skills were positively influenced (94.3%, Q13), felt an increase in the effectiveness of their communication skills with students (96.6%, Q20), and felt a deeper understanding of core concepts (97.7%, Q21). A large majority felt they had improved their leadership skills (87.1%, Q14) and skills that improve other areas of life (80.7%, Q16). A smaller group, but still a majority, reported that leading an SI workshop influenced their career choices (51.1%, Q12).

Table 2

<table>
<thead>
<tr>
<th>SI Leader Survey</th>
<th>Disagree (1 or 2)</th>
<th>Neutral (3)</th>
<th>Agree (4 or 5)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Q12 has had a strong influence on my career choice.</td>
<td>17.0%</td>
<td>21.6%</td>
<td>51.4%</td>
</tr>
<tr>
<td>Q13 has positively influenced my communication skills.</td>
<td>0%</td>
<td>5.7%</td>
<td>94.3%</td>
</tr>
<tr>
<td>Q14 has improved my leadership skills.</td>
<td>1.2%</td>
<td>11.8%</td>
<td>87.1%</td>
</tr>
<tr>
<td>Q15 I have become more aware of campus resources.</td>
<td>17.0%</td>
<td>23.9%</td>
<td>59.1%</td>
</tr>
<tr>
<td>Q16 has taught me skills that have improved other areas of my life.</td>
<td>5.7%</td>
<td>13.6%</td>
<td>80.7%</td>
</tr>
<tr>
<td>Q17 has helped me deal with student conflict.</td>
<td>14.9%</td>
<td>23.0%</td>
<td>62.1%</td>
</tr>
<tr>
<td>Q18 has helped me become more effective when communicating with professors.</td>
<td>10.2%</td>
<td>11.4%</td>
<td>78.4%</td>
</tr>
<tr>
<td>Q19 has helped me become more effective when communicating with peers.</td>
<td>11.4%</td>
<td>11.4%</td>
<td>77.3%</td>
</tr>
<tr>
<td>Q20 has helped me become more effective when communicating with students.</td>
<td>0%</td>
<td>3.4%</td>
<td>96.6%</td>
</tr>
<tr>
<td>Q21 has helped me deepen my understanding of core concepts.</td>
<td>0%</td>
<td>2.3%</td>
<td>97.7%</td>
</tr>
</tbody>
</table>
Of particular note was the fact that an overwhelming majority of participants agreed that the experience of leading an SI workshop had a positive effect on their communication skills (Q13, 94.3%) and their effectiveness in communicating with students (Q20, 96.6%). While this is somewhat expected, since the SI Leaders interact with students to a great degree, it is encouraging that so many SI Leaders agreed that their communication skills, especially with students, were positively affected by the experience.

**Comparison of Subgroups of Participants**

We compared subgroups of participating SI Leaders to determine if there were any significant differences in their responses. We compared respondents who identified themselves as female or male, first generation student or non-first generation student, and URM or non-URM. We first compared those who identified themselves as female and male. For each pair of subgroups, we report the median response to each questionnaire item in Table 3 using the Mann-Whitney $U$-test to evaluate the differences in responses on each item. We chose to use the Mann-Whitney $U$-test due to the fact that the Likert-scale data are ordinal and that the data is heavily skewed towards responses of 4 or 5, meaning that we could not assume that the data is normally distributed. Mann-Whitney’s $U$-test provides a better test of statistical significance in this situation than the more common $t$-test.

Table 3

*Median Responses of Female and Male Participants*

<table>
<thead>
<tr>
<th>SI Leader Survey</th>
<th>Female ($N=44$)</th>
<th>Male ($N=43$)</th>
<th>$U$</th>
<th>$p$-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Q12 has had a strong influence on my career choice.</td>
<td>4</td>
<td>4</td>
<td>890</td>
<td>0.6254</td>
</tr>
<tr>
<td>Q13 has positively influenced my communication skills.</td>
<td>5</td>
<td>5</td>
<td>796</td>
<td>0.1209</td>
</tr>
<tr>
<td>Q14 has improved my leadership skills.</td>
<td>4</td>
<td>5</td>
<td>745</td>
<td>0.0581</td>
</tr>
<tr>
<td>Q15 I have become more aware of campus resources.</td>
<td>4</td>
<td>4</td>
<td>792</td>
<td>0.1776</td>
</tr>
<tr>
<td>Q16 has taught me skills that have improved other areas of my life.</td>
<td>4</td>
<td>5</td>
<td>864</td>
<td>0.4451</td>
</tr>
<tr>
<td>Q17 has helped me deal with student conflict.</td>
<td>4</td>
<td>4</td>
<td>848.5</td>
<td>0.3893</td>
</tr>
</tbody>
</table>
Q18 has helped me become more effective when communicating with professors. 4 5 731.5 0.0485*
Q19 has helped me become more effective when communicating with peers. 4 5 801.5 0.1858
Q20 has helped me become more effective when communicating with students. 4 5 694 0.01331*
Q21 has helped me deepen my understanding of core concepts. 5 5 780 0.0748

* indicates significance at the $p < 0.05$ level

In Table 3, we report the median responses of female and male participants to each question. When we ran a Mann-Whitney’s $U$-test to evaluate the differences in responses on each item, significant differences between the two groups were found in the responses to Q18 ($U=731.5, p<0.05$) and Q20 ($U=694, p<0.05$). We detail these two items in Table 4. Females were more likely than males to simply agree, rather than strongly agree, with Q18, and males were more likely than females to strongly agree with Q20.

<table>
<thead>
<tr>
<th>SI Leader Survey</th>
<th>Population</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
</tr>
</thead>
<tbody>
<tr>
<td>Q18 has helped me become more effective when communicating with professors.</td>
<td>Female (N=44)</td>
<td>2.3%</td>
<td>11.4%</td>
<td>15.9%</td>
<td>29.5%</td>
<td>40.9%</td>
</tr>
<tr>
<td></td>
<td>Male (N=43)</td>
<td>2.3%</td>
<td>4.7%</td>
<td>6.7%</td>
<td>25.6%</td>
<td>60.5%</td>
</tr>
<tr>
<td>Q20 has helped me become more effective when communicating with students.</td>
<td>Female (N=44)</td>
<td>0%</td>
<td>0%</td>
<td>4.5%</td>
<td>50.0%</td>
<td>45.5%</td>
</tr>
<tr>
<td></td>
<td>Male (N=43)</td>
<td>0%</td>
<td>0%</td>
<td>2.3%</td>
<td>25.6%</td>
<td>72.1%</td>
</tr>
</tbody>
</table>

In Table 5 (below), we report the median responses of first generation and non-first generation participants to each question. The Mann-Whitney’s $U$-tests found no significant differences between the two groups.
In Table 6 (below), we report the median responses of URM and non-URM participants to each question. When we ran a Mann-Whitney’s U-test to evaluate the differences in responses on each item, significant differences between the two groups were found in the responses to Q12 ($U=932$, $p<0.01$), Q15 ($U=837.5$, $p<0.05$), and Q17 ($U=845$, $p<0.05$). We examine these three items in more detail in Table 7 (below). URM participants were more likely to strongly agree with all three of these statements than non-URM participants.

### Median Responses of First-Generation and non-First Generation Participants

<table>
<thead>
<tr>
<th>SI Leader Survey</th>
<th>First Gen ($N=35$)</th>
<th>Non-First Gen ($N=53$)</th>
<th>$U$</th>
<th>$p$-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Q12 has had a strong influence on my career choice.</td>
<td>4</td>
<td>4</td>
<td>1043</td>
<td>0.3093</td>
</tr>
<tr>
<td>Q13 has positively influenced my communication skills.</td>
<td>5</td>
<td>5</td>
<td>933</td>
<td>0.9583</td>
</tr>
<tr>
<td>Q14 has improved my leadership skills.</td>
<td>5</td>
<td>5</td>
<td>883</td>
<td>0.6755</td>
</tr>
<tr>
<td>Q15 I have become more aware of campus resources.</td>
<td>4</td>
<td>4</td>
<td>980.5</td>
<td>0.6432</td>
</tr>
<tr>
<td>Q16 has taught me skills that have improved other areas of my life.</td>
<td>4</td>
<td>5</td>
<td>822.5</td>
<td>0.3244</td>
</tr>
<tr>
<td>Q17 has helped me deal with student conflict.</td>
<td>4</td>
<td>4</td>
<td>1136</td>
<td>0.06417</td>
</tr>
<tr>
<td>Q18 has helped me become more effective when communicating with professors.</td>
<td>5</td>
<td>5</td>
<td>829.5</td>
<td>0.3656</td>
</tr>
<tr>
<td>Q19 has helped me become more effective when communicating with peers.</td>
<td>5</td>
<td>4</td>
<td>947</td>
<td>0.8612</td>
</tr>
<tr>
<td>Q20 has helped me become more effective when communicating with students.</td>
<td>5</td>
<td>5</td>
<td>859.5</td>
<td>0.5038</td>
</tr>
<tr>
<td>Q21 has helped me deepen my understanding of core concepts.</td>
<td>5</td>
<td>5</td>
<td>777.5</td>
<td>0.1048</td>
</tr>
</tbody>
</table>
Table 6

Median Responses of UMR and non-URM Participants

<table>
<thead>
<tr>
<th>SI Leader Survey</th>
<th>URM (N=26)</th>
<th>Non-URM (N=50)</th>
<th>U</th>
<th>p-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Being an SI Leader ...</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Q12 has had a strong influence on my career choice.</td>
<td>5</td>
<td>3.5</td>
<td>932</td>
<td>0.0014*</td>
</tr>
<tr>
<td>Q13 has positively influenced my communication skills.</td>
<td>5</td>
<td>5</td>
<td>722</td>
<td>0.3358</td>
</tr>
<tr>
<td>Q14 has improved my leadership skills.</td>
<td>5</td>
<td>5</td>
<td>738.5</td>
<td>0.2804</td>
</tr>
<tr>
<td>Q15 I have become more aware of campus resources.</td>
<td>4.5</td>
<td>4</td>
<td>837.5</td>
<td>0.0331*</td>
</tr>
<tr>
<td>Q16 has taught me skills that have improved other areas of my life.</td>
<td>5</td>
<td>5</td>
<td>705</td>
<td>0.5025</td>
</tr>
<tr>
<td>Q17 has helped me deal with student conflict.</td>
<td>5</td>
<td>4</td>
<td>845</td>
<td>0.0252*</td>
</tr>
<tr>
<td>Q18 has helped me become more effective when communicating with professors.</td>
<td>5</td>
<td>5</td>
<td>695</td>
<td>0.5887</td>
</tr>
<tr>
<td>Q19 has helped me become more effective when communicating with peers.</td>
<td>5</td>
<td>4</td>
<td>810</td>
<td>0.0559</td>
</tr>
<tr>
<td>Q20 has helped me become more effective when communicating with students.</td>
<td>5</td>
<td>5</td>
<td>711.5</td>
<td>0.4355</td>
</tr>
<tr>
<td>Q21 has helped me deepen my understanding of core concepts.</td>
<td>5</td>
<td>5</td>
<td>691</td>
<td>0.5751</td>
</tr>
</tbody>
</table>

* indicates significance at the $p$=<0.05 level
Discussion and Conclusion

In response to each question, a majority (sometimes an overwhelming majority) of SI Leaders reported that they either agree or strongly agree that their experiences as SI Leaders positively impacted their communication and leadership skills (Q13, Q18, Q19, Q20, and Q14). We found that almost all participants in the study felt a positive influence on communication skills (Q13), and a large majority felt an improvement in leadership skills (Q14) and other skills (Q16). These results confirm those of Malm, et al. (2012). However, in contrast to that study, our study also found that a slight majority felt that leading an SI workshop impacted their career choice (Q12). Furthermore, participants felt an overall increase in effectiveness in communication skills with professors (Q18) and peers (Q19) and in effectively handling student conflict (Q17).

When comparing subgroups, we found that males were more likely than females to agree that the experience of leading SI sessions helped them with their communication skills with professors and students (Q18 and Q20). We cannot speculate on the reasons why this should be the case, but future research with case studies may shed light on the reasons for this. Likewise, we will not speculate on the reasons why URM participants are more likely to agree that leading an SI workshop had a strong influence on their career choice, helped them to become aware of campus resources, and helped them to deal with student conflict.
However, these results do indicate some areas in which SI supervisors (staff and faculty) can help SI Leaders to gain more from their experience. A perennial problem on many campuses is that students are unaware of campus resources (including Supplemental Instruction). At a very large institution, like CSUF, it is unlikely that students, including SI Leaders, are aware of all of the campus resources available to them. While this study shows that a majority of SI Leaders agreed that they became more aware of campus resources, that majority is still one of the smallest (second only to Q12, influence on career choice), especially for non-URM students. Because SI supervisors work so closely with student SI Leaders, SI supervisors are in a perfect position to introduce other campus resources to the SI Leaders, who can then pass that information along to their students.

These results also indicate that SI supervisors can do more to help female SI Leaders in particular take advantage of leading an SI workshop to develop their communication skills with professors and students. The participants of our study were drawn mainly from STEM fields, where the under-representation of women is a long-standing problem (National Science Board, 2016). It is possible that the results of our study are exaggerated by the fact that a majority of participants led workshops in STEM fields, but it is encouraging to note that there were 44 women and 43 men in this study.

**Future Research**

Future research could seek to further understand the impact of leading SI workshops on the SI Leader in areas of professional and personal growth. Of special interest are the different effects felt by SI Leaders depending on gender and URM status. Future research may include qualitative research on the SI Leader; conducting a longitudinal study with incoming SI Leaders about how their attitudes change over time; conducting a longitudinal study on incoming SI Leaders’ growth in time management, organizational, and professional skills; conducting a longitudinal study on incoming SI Leaders’ personality psychology; and researching SI Leaders’ backgrounds by looking at their academic records, involvement in on- and off-campus events and organizations, and previous and current professional experiences.
References


The Impact of Online Supplemental Instruction on Academic Performance and Persistence in Undergraduate STEM Courses

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Abstract

Though demonstrated as an effective strategy for enhancing academic performance and course persistence in higher education, traditional Supplemental Instruction (SI) relies on face-to-face interaction in a classroom setting. Consequently, students who have other obligations or feel apprehensive in a group setting often cannot attend traditional SI sessions. This paper focuses on an innovative alternative to traditional SI: an online SI program currently being implemented at Texas A&M University-Corpus Christi (TAMUCC). This paper describes TAMUCC’s online SI program and discusses results from a pilot study that compared the STEM course performance and persistence of TAMUCC undergraduates (N=585) randomly assigned to SI groups (i.e., traditional SI or online SI) in the spring semester of 2015.
Keywords: Supplemental Instruction, Supplementary Education, STEM Education, Higher Education, Online Learning

Impact of Online Supplemental Instruction on Academic Performance and Persistence in Undergraduate STEM Courses

Due an increased emphasis on course persistence and institutional retention in higher education, and especially in STEM departments, many institutions are experimenting with ways to increase positive student outcomes through academic support programs. Among these programs, Supplemental Instruction (SI) continues to be one of the most popular. First developed at the University of Missouri-Kansas City in 1973, SI is a collaborative, peer-assisted model of academic assistance that employs regularly scheduled, out-of-class study sessions (Arendale, 1993). SI is non-remedial, targeting traditionally difficult courses with high rates of student attrition and/or failure rather than individual students. It is free and open to all students in these traditionally difficult classes, but is not mandatory. SI sessions give students an opportunity to discuss course material and learning strategies and are facilitated by an SI Leader, a student who has previously taken and excelled in the course. The point of SI is not to re-teach or introduce new material. Instead, the overall goal is to combine what students need to learn with how they can most effectively learn it in an open, comfortable environment.

The evidence supporting the effectiveness of traditional SI, which occurs face-to-face and in-person, is considerable (Bowles, McCoy, & Bates, 2008; Dawson, van der Meer, Skalicky, & Cowley, 2014; Malm, Bryngfors, & Mörner, 2012; Price, Lumpkin, & Seemann, 2012; Rath, Peterfreund, Bayliss, Runquist, & Simonis, 2011). However, in spite of SI’s popularity and effectiveness, it does not always fit the needs of all students. For example, nontraditional students, whose enrollment numbers at institutions of higher education have been growing steadily over the past four decades, often have financial, family, and other obligations that make it difficult for them attend face-to-face SI sessions held in campus classrooms during customary daytime instructional hours. Other students struggle in traditional SI sessions because they feel socially inhibited or

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1 In the fall of 1970, 27.8% of persons enrolled in degree-granting postsecondary institutions were at least 25 years old. By the fall of 2012, persons age 25 and older represented 40.5% of enrolled students at such institutions (U.S. Department of Education, 2014).
unable to keep pace with the Leader. However, traditional SI’s limitations are not restricted to the challenges it presents to students, as the implementation of traditional SI often forces institutions to overcome significant logistical problems such as where and when to hold sessions when available classroom space is in short supply.

To address the aforementioned challenges, TAMUCC began exploring alternatives to traditional SI and ultimately decided to investigate the feasibility and efficacy of utilizing online SI with STEM courses that have been historically difficult (meaning that typically 30% or more of enrolled students earn a grade of D or F or withdraw prior to the end of the semester) for the institution’s undergraduates. To fund this investigation, TAMUCC applied for and was awarded, in October 2014, a First in the World (FITW) grant (P116F140206) from the U.S. Department of Education.

Online SI is essentially the same as traditional SI, except that SI Leaders and participants interact through a personal computer or other hardware device instead of in a face-to-face environment (Boggs, Heaney, Kramer, & Williams, 2011). SI Leaders ask questions and share content such as study guides, exercises, videos, PowerPoint presentations, and other documents on the virtual whiteboard. SI Leaders and participants communicate with one another by using a microphone and headset or by typing, which allows participants to receive feedback and communicate with the SI Leader without being constrained to a particular location. Moreover, because online SI sessions are recorded, students can view them anytime and as many times as they wish.

Although a relatively recent phenomenon and not nearly as well studied as traditional SI, online SI models have been shown to have certain advantages over traditional sessions. Painter, Bailey, Gilbert, and Prior (2006) note that online SI allows students access to supplemental materials anytime, anywhere. Students who are anxious about speaking or solving problems in front of others may find online SI appealing because they are not surrounded by other students. The online format allows for easy distribution of additional

FITW (CFDA#84.116F) is “designed to support the development, replication, and dissemination of innovative solutions and evidence for what works in addressing persistent and widespread challenges in postsecondary education for students who are at risk for not persisting in and completing postsecondary programs, including, but not limited to, adult learners, working students, part-time students, students from low-income backgrounds, students of color, students with disabilities, and first-generation students” (U.S. Department of Education, 2015).
resources, as well as quizzes and surveys that provide immediate feedback to students. Online SI sessions can be recorded and viewed multiple times for students who missed a session or need additional support. Hurley, Patterson, and Wilcox (2006) argue that this “time to think” facilitates the deepest level of learning and helps students “formulate questions like those modeled by their facilitator, make observations, and consider solutions.”

Still, online SI is not without its disadvantages (Painter et al., 2006). The cost of software and related equipment, as well as technical support, often makes online SI prohibitively expensive for some support programs. Similarly, some software companies set limits on the number of users at one time and therefore the number of students that can be served, making their online portals inadequate for conducting SI sessions. Moreover, even when the hardware, software, and technical support are suitable, students sometimes lack the requisite computer-literacy skills or technology (e.g., microphones and cameras) to fully engage in online SI sessions. Finally, in the online environment, SI Leaders may encounter difficulties managing students that would not occur in a traditional SI setting. For example, maintaining student attention can be challenging due to the students’ ability to easily leave and reenter the discussion. In addition, SI Leaders may encounter communication issues with subjects such as math and chemistry because these disciplines utilize unique symbols that can be difficult to use in a digital format.

Although ascertaining the effectiveness of online SI has not received the same level of scholarly attention as its traditional SI counterpart, there is some evidence suggesting that participation in online SI positively impacts students’ academic achievement and persistence.

Sargent, Borthick, and Lederberg (2013) studied the effect of video-recorded supplementary tutorials on student performance in an introductory accounting course. These tutorials were similar to an SI presentation in that core concepts were explained and applied to individual problems, strategies and processes for problem solving were delineated, and students were encouraged to solve problems for themselves. Each tutorial contained informal comments from the facilitator underscoring common mistakes and misperceptions. These tutorials were then loaded onto a WebCT platform. The resulting pass rate for low-achieving students who accessed the tutorials was significantly higher than the pass rate of the control group, and the tutorial users’
exam scores were increased by a half a letter grade. Sargent et al. (2013) also found that tutorial users reenrolled in subsequent semesters at a significantly higher rate than did non-users. Similarly, data from an online SI program at the University of Wyoming found that student use of online SI corresponded to improved course performance compared to those who did not participate in any SI sessions (Boggs et al., 2011). Finally, Ndahi, Charturvedi, Akan, and Pickering (2007) found that a web-based, interactive SI model led to an average gain of 14.05% on exam scores in an introductory engineering class.

Student perceptions of online SI have also been generally positive. Schaffer and Schwebach (2015) studied the use of Livescribe pencasts, which are interactive versions of notes and audio, as supplementary instruction tools for undergraduate students studying cell biology. Students reported that the pencasts helped them learn and retain the material, irrespective of their prior academic performance levels. Use of the pencasts increased dramatically before exams, suggesting that students viewed it as an important study tool. Freeman and Field (2004) found that more than 90% of industrial technology students in an occupational safety course at Iowa State University indicated that online notes and quizzes provided through a WebCT platform helped them prepare better for class. Likewise, 89% of students indicated that the WebCT component improved their learning experience, and 92% said that they were satisfied with the WebCT experience. Ninety-six percent indicated that they preferred to have a class with the WebCT component.

The focus of the pilot study that TAMUCC conducted from January to May 2015 was a randomized control trial to compare the relative effectiveness of online SI with that of traditional SI. The goal of the study was to collect evidence that might be useful in ascertaining whether online SI might be a viable alternative to traditional SI for colleges and universities that wish to enhance the STEM course performance and persistence of their students despite experiencing severe resource (e.g., available classrooms) constraints. Thus, the study focused on the following research question: do students assigned to online SI perform as well or better than students assigned to traditional SI in terms of their persistence and grade earned in the STEM course with which the SI is associated?
Method

Participants

In late January 2015, 644 students in select sections of four STEM courses (Biology 2421, Chemistry 1412, Engineering 2322, and Mathematics 1442) were randomly assigned to either online SI (the treatment group) or traditional SI (the comparison group), with an equal number of students within each course section randomly assigned to one group or the other.

From this initial sample, 17 students were removed because they were enrolled in more than one of the four aforementioned STEM courses, 10 students were removed because they dropped their SI-associated course prior to the first day of instruction, and 32 students were removed because they opted-out of the SI group to which they were assigned. However, as shown in Table 1, these removals did not appear to diminish the baseline equivalence of the two groups to any significant degree, as an independent samples, two-tailed, t-test of the analytic sample \((N=585)\) revealed no statistically or practically significant difference, \(t(583)=0.10, p=0.92, g=0.00\), between the pre-intervention cumulative GPA of the treatment group \((n_t=277, M_t=2.82, SD_t=0.63)\) and the comparison group \((n_c=308, M_c=2.82, SD_c=0.58)\). Moreover, as shown in Table 2, the groups remained equivalent in terms of socioeconomic status, as there was not any statistically or practically significant difference in the Pell-grant-eligibility status of the groups, \(\chi^2(1)=0.66, p=0.42, V=0.03\), with 41.2% of the treatment group and 44.5% of the comparison group being Pell-eligible.

In terms of demographic characteristics, 52.0% of analytic sample members were Hispanic; 62.9% were female; and 42.9% were low-income individuals (as indicated by Pell-grant eligibility). The results of baseline-equivalence analyses for select subgroups in the sample are shown in Tables 1 and 2.

Materials

Members of the treatment group (online SI) and comparison group (traditional SI) were provided the same materials throughout the Spring 2015 semester. The only difference between the SI sessions was the medium through which the two groups received the materials and interacted with their SI Leaders. Members of the comparison group attended SI sessions in a traditional classroom on prescheduled days at prescheduled times, occupied the same physical space as their SI Leaders and other session attendees, and received
hardcopy versions of all materials. Members of the treatment group also attended SI sessions on prescheduled days at prescheduled times, but they did so through an online platform called WebEx video conferencing, occupying a completely separate physical space from their SI Leaders and other session attendees and receiving electronic versions of all materials. Moreover, online SI sessions were recorded and then available to treatment group members who either could not attend at the time of broadcast or who wished to watch the sessions multiple times.

WebEx video conferencing permits users to view multiple video feeds at once or side-by-side with a screen sharing mode. During online sessions, SI Leaders can easily redirect questions, facilitate discussions, share content, administer quizzes, and track attendance, just as they would in traditional SI sessions. Users can share content from their own device, collectively annotate documents, and share ideas on a virtual whiteboard from any device with an internet connection. TAMUCC’s use of this platform ensured that the treatment group’s SI experience closely resembled that of the comparison group while also permitting the treatment group to capitalize on online SI’s inherent advantages: the ability to receive instruction irrespective of location and view recorded sessions anywhere at any time.

**Design and Procedure**

After students were randomly assigned to either the treatment or comparison group in January 2015, an equal number of online SI and traditional SI sessions were then conducted weekly (repeated three times on different days at different times) through the end of the semester in May 2015. Students in the analytic sample had the option of attending as many or as few SI sessions as desired within their group category (i.e., online SI or traditional SI).

SI Leaders were TAMUCC students who had already completed and earned a high grade (B or higher) in the course with which their SI sessions were associated. The same SI Leader led both an online SI group and a corresponding traditional SI group for each STEM course s/he was assigned. (For example, if SI Leader #1 led an online SI group associated with Dr. X’s Mathematics 1442 class, SI Leader #1 would also lead a traditional SI group associated with that class.) SI Leaders always attended each meeting of the course with which their SI was associated and then, in accordance with guidelines established by TAMUCC’s SI program
manager, developed lessons to be delivered in the corresponding SI sessions.

Results

The principal goal of this pilot study was to investigate the extent to which online SI might be a viable alternative to traditional SI. Consequently, the research questions for the study focus on ascertaining whether students in online SI perform at least as well as those in traditional SI in the outcome domains of credit accumulation (operationally defined herein as persisting in the SI-associated course until the end of the semester) and academic achievement (operationally defined herein as grade earned for the semester in the SI-associated course).

Course Persistence

As shown in Table 3, there was no statistically significant difference between the complete analytic sample’s treatment ($n_t=277$) and comparison ($n_c=308$) groups in terms of the rates at which they persisted (92% for the treatment group vs. 90% for the comparison group) in their STEM courses to the end of the semester, $\chi^2(1)=0.58, p=0.45, \phi=0.03$. Moreover, as shown in Tables 4 and 5, there were no statistically significant differences (i.e., all $p>0.05$) between the treatment and comparison groups when just data from the females only, males only, Hispanics only, and Mathematics (MAT) 1442 students only subgroups were analyzed.

Semester Grade Earned

As shown in Table 6, an independent samples, two-tailed $t$-test revealed no statistically significant difference, $t(583)=0.36, p=0.72, g=-0.02$, between the treatment ($n_t=277, M_t=1.88, SD_t=1.28$) and comparison ($n_c=308, M_c=1.91, SD_c=1.25$) groups in the complete analytic sample in terms of semester grade earned in the STEM courses with which the SI was associated. Additionally, as shown in Tables 7 and 8, no statistically significant differences between the treatment and comparison groups were found among the females only,

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3 Subgroup analysis by course was limited to MAT 1442 students because only this course group ($N=384$) included enough members to achieve the statistical power necessary to detect small to medium effects.

4 Semester grades earned were coded as follows: A=4, B=3, C=2, D=1, F=0, and W=0.
males only, Hispanics only, and MAT 1442 students only subsamples.

**Discussion**

The results of this pilot study are very promising, as the online SI group appeared to perform as well as the traditional SI group in terms of both their persistence to the end of the STEM course and the grades they earned for the semester. Moreover, the results were similar across subgroups, suggesting that online SI is a tool that can be useful for a broad cross-section of students at institutions of higher education. Consequently, it appears that online SI may be a viable replacement (or at least valuable complement) to traditional SI in postsecondary settings. However, more research needs to be done to see if these results can be replicated with future cohorts, as well as to investigate the extent to which there are differences in performance on more distal outcomes (e.g., year-to-year retention, cumulative GPA, graduation, receipt of a STEM degree, and so on) for the cohort who participated in SI in Spring 2015. Moreover, the extent to which sample members attend SI sessions needs to be examined in future studies and factored into associated analyses so that questions of minimal and optimal treatment dosage might be effectively addressed. (In the present study, implementation data limitations restricted the analytical focus to intent-to-treat.) Finally, the findings of future studies would be enhanced by varying on a weekly basis the order in which SI Leaders utilize specific session formats. For example, if a given SI Leader facilitates his or her online SI session first and the corresponding traditional SI session second in week one, the SI Leader would do the reverse in week two, facilitating the traditional SI session first and the online SI second. The third week, in turn, would repeat the order of the first week; the fourth week, the order of the second week; the fifth week, the order of the first week; and so on.

Future research by TAMUCC will investigate the extent to which these results can be replicated and more distal outcomes might be impacted. Furthermore, TAMUCC will be taking a closer look at the relative effectiveness of online SI versus traditional SI in terms of specific STEM disciplines. To facilitate these investigations, TAMUCC will be implementing online and traditional SI and collecting data on additional cohorts in 2015-16, 2016-17, and 2017-18, as part of a comprehensive program of resources to produce definitive and consequential evidence of online SI’s utility and effectiveness.
References


in entry-level chemistry courses at a midsized public university. *Journal of Chemical Education, 89*, 449-455.


Table 1

<table>
<thead>
<tr>
<th>Group</th>
<th>N</th>
<th>n₁</th>
<th>M₁</th>
<th>SD₁</th>
<th>n₂</th>
<th>M₂</th>
<th>SD₂</th>
<th>t</th>
<th>df</th>
<th>p</th>
<th>g</th>
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<tbody>
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<td>585</td>
<td>277</td>
<td>2.82</td>
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<td>308</td>
<td>2.82</td>
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<td>0.10</td>
<td>583</td>
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<tr>
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<td>168</td>
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<td>-0.17</td>
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<td>2.77</td>
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<td>0.49</td>
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<td>Mathematics (MAT) 1442 students only</td>
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<td>0.61</td>
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<td>2.74</td>
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<td>0.07</td>
<td>382</td>
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*As measured by pre-intervention, cumulative GPA
Table 2

Baseline equivalence of student socioeconomic status* for analytic sample

<table>
<thead>
<tr>
<th>Group</th>
<th>N</th>
<th>$n_t$</th>
<th>$n_{t}(\text{Pell-eligible})$</th>
<th>$n_c$</th>
<th>$n_{c}(\text{Pell-eligible})$</th>
<th>$\chi^2$</th>
<th>df</th>
<th>p</th>
<th>$V$</th>
<th>OR</th>
</tr>
</thead>
<tbody>
<tr>
<td>All sample members</td>
<td>585</td>
<td>277</td>
<td>114</td>
<td>308</td>
<td>137</td>
<td>0.66</td>
<td>1</td>
<td>0.42</td>
<td>0.03</td>
<td>0.87</td>
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<tr>
<td>Females only</td>
<td>368</td>
<td>168</td>
<td>80</td>
<td>200</td>
<td>101</td>
<td>0.30</td>
<td>1</td>
<td>0.58</td>
<td>0.03</td>
<td>0.87</td>
</tr>
<tr>
<td>Males only</td>
<td>217</td>
<td>109</td>
<td>34</td>
<td>108</td>
<td>36</td>
<td>0.11</td>
<td>1</td>
<td>0.74</td>
<td>0.02</td>
<td>0.91</td>
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<td>304</td>
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<td>69</td>
<td>162</td>
<td>88</td>
<td>1.00</td>
<td>1</td>
<td>0.32</td>
<td>0.06</td>
<td>0.79</td>
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<tr>
<td>MAT 1442 only</td>
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<td>185</td>
<td>89</td>
<td>199</td>
<td>95</td>
<td>0.01</td>
<td>1</td>
<td>0.94</td>
<td>0.00</td>
<td>1.01</td>
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</table>

*As measured by Pell-grant eligibility status

Table 3

STEM course persistence of analytic sample

<table>
<thead>
<tr>
<th>Group</th>
<th>N</th>
<th>$n_t$</th>
<th>$n_{t}(\text{Persisting})$</th>
<th>$n_c$</th>
<th>$n_{c}(\text{Persisting})$</th>
<th>$\chi^2$</th>
<th>df</th>
<th>p</th>
<th>$V$</th>
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<td>All sample members</td>
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<td>277</td>
<td>255</td>
<td>308</td>
<td>278</td>
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<td>1</td>
<td>0.45</td>
<td>0.03</td>
<td>1.25</td>
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</tbody>
</table>

Table 4

STEM course persistence by select subgroups (Females only, Males only, and Hispanics only) of analytic sample in STEM courses

<table>
<thead>
<tr>
<th>Group</th>
<th>N</th>
<th>$n_t$</th>
<th>$n_{t}(\text{Persisting})$</th>
<th>$n_c$</th>
<th>$n_{c}(\text{Persisting})$</th>
<th>Wald*</th>
<th>df*</th>
<th>p*</th>
<th>Exp(B)*</th>
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<tr>
<td>Females only</td>
<td>368</td>
<td>168</td>
<td>155</td>
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<td>182</td>
<td>0.10</td>
<td>1</td>
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<td>100</td>
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<td>1</td>
<td>0.41</td>
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<tr>
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<td>142</td>
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<td>162</td>
<td>144</td>
<td>1.56</td>
<td>1</td>
<td>0.21</td>
<td>0.60</td>
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</tbody>
</table>

*Treatment (i.e., online SI vs. traditional SI) variable results from a binary logistic regression utilized to provide statistical control because baseline equivalence in cumulative GPA (cf., Table 1) is insufficient (i.e., effect size difference between groups at baseline is not $\leq 0.05$)
Table 5

STEM course persistence by select subgroups (MATH 1442 students only) of analytic sample in STEM courses

<table>
<thead>
<tr>
<th>Group</th>
<th>N</th>
<th>(n_t)</th>
<th>(n_{t(Persisting)})</th>
<th>(n_c)</th>
<th>(n_{c(Persisting)})</th>
<th>(\chi^2)</th>
<th>df</th>
<th>p</th>
<th>V</th>
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<td>1</td>
<td>0.21</td>
<td>0.06</td>
<td>1.61</td>
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</table>

Table 6

Semester grades earned by overall analytic sample in STEM courses

<table>
<thead>
<tr>
<th>Group</th>
<th>N</th>
<th>(n_t)</th>
<th>(M_t)</th>
<th>(SD_t)</th>
<th>(n_c)</th>
<th>(M_c)</th>
<th>(SD_c)</th>
<th>t</th>
<th>df</th>
<th>p</th>
<th>g</th>
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<td>308</td>
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<td>1.25</td>
<td>0.36</td>
<td>583</td>
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<td>-0.02</td>
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Table 7

Semester grades earned by select subgroups (Females only, Males only, and Hispanics only) of analytic sample in STEM courses

*Means adjusted via ANCOVA procedure with pre-treatment cumulative GPA as covariate. This ANCOVA procedure was selected because baseline equivalence in pre-treatment cumulative GPA (cf., Table 1) was initially insufficient for these subgroups.

<table>
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<tr>
<th>Group</th>
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<th>(n_t)</th>
<th>(M_t)</th>
<th>(SD_t)</th>
<th>(M_{t*})</th>
<th>(n_c)</th>
<th>(M_c)</th>
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<td>168</td>
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<td>162</td>
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<td>1.40</td>
<td>1</td>
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Table 8

Semester grades earned by select subgroups (MATH 1442 students only) of analytic sample in STEM courses

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<th>SD_t</th>
<th>n_c</th>
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<td>384</td>
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<td>1.80</td>
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<td>0.11</td>
<td>382</td>
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</tbody>
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**Application of Supplemental Instruction in an Undergraduate Anatomy and Physiology Course for Allied Health Students**

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**Abstract**

Anatomy and physiology is a field of science essential to the studies of all healthcare professionals. However, quite often, such subject matter, particularly when taken by less experienced students, results in poor performance and high failure rates. The current study investigates the incorporation of Supplementary Instruction (SI) as an academic assistance program which utilizes peer-led study sessions in order to improve student grades, rates of success, and learning experiences. The results indicate that students who participated in SI sessions consistently outperformed non-SI students. There was a positive linear relationship between the numbers of SI sessions attended and the higher final grade earned. In addition, an end of term survey indicated that the SI addition was well-liked by the students and helped them to better prepare themselves for the challenges of the course. This study demonstrates that students who routinely participate in SI sessions improve their final grades and success rates in an anatomy and physiology course. The current report confirms that the SI academic support model enables students to develop and incorporate effective learning techniques and problem solving skills which ultimately translate into higher student success rates and enhanced learning experiences.

*Key Words:* Supplemental Instruction, anatomy, physiology, allied health education
Introduction

Understanding human anatomy and physiology is essential in promoting higher-level learning among students with an interest in healthcare related fields. However, quite often, such rigorous and demanding entry-level subjects become high-risk courses, particularly among less experienced students, wherein student failure and withdrawals exceed 30 percent of course registrants (Blanc, 1983; Blanc, Robert & Martin, 1994. One such course at Kent State University at Ashtabula (KSUA) is Anatomy and Physiology for Allied Health (APAH), which is required to be taken by students prior to their admission into their field of interest in allied health sciences (Nursing, Physical Therapy, Occupational Therapy, Respiratory Therapy, and Radiological Technology). APAH is offered in two semesters (BSCI 11010 and BSCI 11020). The current study was conducted among students who were taking the second half of the course, BSCI 11020. BSCI 11020 consists of both lecture and laboratory components, but final grades for the course were assigned cumulatively and combined according to the course syllabus. The success rate for BSCI 11020 was only 71% in spring 2013. Such a low success rate prompted the faculty and Academic Services (AS) coordinator at KSUA to join forces to tackle the problem.

Previous studies have shown that incorporating student-centered activities into a course will positively influence student learning experiences and retention among undergraduate student populations (Astin, 1995; Bonsangue & Drew, 1995; Barr & Tagg, 1995; Beichner, Saul, Abbott, Morse, Deardorff, Allain, & Risley, 2007. After extensive research and discussion, the faculty and AS coordinator agreed upon using a reputable academic support model known as Supplemental Instruction (SI) in order to improve students’ success rates in the course. The reasoning for the decision to choose SI as the academic support model was multifaceted. First, the interest was in using a student-centered approach since previous experience with this format proved effective with our student population (Nasr, 2012). Moreover, there is a plethora of evidence that active involvement of students in their own education is an effective tactic for improving students’ performance and success rates in science courses (Allen, Duch, & Groh, 1996; Duch, Groh, & Allen, 2001; Haney & McArthur, 2002). SI sessions are primarily based on peer-led group discussion in which students become actively involved in the learning process; this model is well-fitted into the framework considered a practical model for
our student population. Second, SI participation not only allows the students to learn and develop problem-solving skills through facilitated dialogue, but it also sets the groundwork for developing confidence in using alternative study habits and learning strategies that may be unfamiliar to students.

For successful implementation of an SI program, it is critical to recognize the unique needs of each student population and develop the plans accordingly (Forester, Thomas, & McWhorter, 2004; Higgins-Opitz & Tufts, 2014). A large number of KSUA students are non-traditional students who are either new to college or returning after several years of absence from academia. Since the SI model places great emphasis on information processing skills and comprehension of material rather than memorization, its application provides an excellent opportunity to promote and reinforce good study habits and learning skills for less experienced students and will likely have a positive impact on students’ overall academic performance. Third, the SI model is designed to promote the concept of scaffolding in which complex concepts are broken into their smaller components; then, through peer-led group discussions and practice exercises, students acquire a more comprehensive view of the original concept by discovering the interactions among the basic components, and, in the process, gain a higher level of comprehension of the subject matter. Fourth, the SI model creates an opportunity to train SI Leaders to be future teachers. With an ever increasing need for qualified teachers in the health sciences (Darling-Hammond & Youngs, 2002), the SI program provides SI Leaders the opportunity to gain experience in effective teaching practices and problem solving skills; this allows the student leaders to grow academically and to develop their leadership skills (Jacobs, Hurley, & Unite, 2008). For the above reasons, the faculty and AS coordinator at KSUA decided to utilize the SI model as an academic support mode to improve the student success rates and learning experiences in BSCI 11020.

SI is an educational approach based on a series of behavioral, cognitive, and social concepts in which students build new knowledge in collaboration with peers (Stone & Jacobs, 2006). The SI model was first developed by Deanna Martin at the University of Missouri-Kansas City in 1973; she developed this model to increase students’ performance and retention in high-risk courses (Martin, 1977; Martin & Ardendale, 1990). Since its conception, SI has evolved with time, adapted to various technological advances, and has been utilized in various academic fields ranging from natural sciences to business administration and history (Blanc,
Supplemental Instruction Journal, Volume 2, Issue 1

1983; Stone & Jacobs, 2006). SI is fundamentally different from other academic support programs since it targets high-risk courses instead of high-risk students (Zaritsky, 2006). In the current model, SI participation is voluntary and open to all students in the course free of charge. The general format of SI sessions used in this study included group discussion, problem solving skills and practice exercises which were all moderated by an SI Leader. The SI Leader is trained to focus on how to help students break complex tasks into subcomponents and use the subcomponents to discover the intricate mechanisms generating a complex function; in the process, this enables students to reach a higher level of comprehension.

In summary, an increasing body of evidence accumulated over forty years demonstrates, when administered properly, the SI model is a positive addition to high-risk courses and has the potential of improving student performance and learning experiences. However, relatively few studies have incorporated the SI academic support model into undergraduate high-risk courses, such as anatomy and physiology in healthcare related fields (Hughes, 2011). The purpose of this study was to evaluate the efficacy of incorporating SI into BSCI 11020 in relation to improving students’ grades and success rates.

Methods

A total of 134 undergraduate students at KSUA were included in the current study in three consecutive terms (Spring 2014, n = 64; Summer 2014, n = 22; Fall 2014, n = 48). The SI academic support model was incorporated into BSCI 11020, which is offered in the second semester of an anatomy and physiology course sequence for allied health. All students who were enrolled in the course had successfully completed the first half of the course; however, SI was not offered to students in the first portion of the course. The faculty, SI Supervisor, and SI Leader remained the same throughout the entire study. BSCI 11020 is designed to explore the anatomy and physiology of the circulatory, digestive, urinary, nervous, endocrine, and reproductive systems. This course consists of both lecture and laboratory components. The laboratory section of the course was held in two laboratory spaces: a dry laboratory and a cadaver laboratory. All SI sessions were held in the dry laboratory which was separated from the cadaver laboratory by a narrow hallway; however, if needed, the SI Leader accompanied the student for a practical session in the cadaver laboratory. In the dry laboratory, students used microscopes and histological slides as well as anatomical models. SI sessions were facilitated by
the SI Leader who had access to a multimedia station and a projector for presentations. Participation was voluntary and students were allowed to join or leave each session as their schedule permitted.

Using a standard four-point scale grading system, the final grades were quantified as follows: A= 4, A-= 3.7, B+= 3.3, B= 3.0, B-= 2.7, C+=2.3, C=2.0, C-=1.7, D+=1.3, D=1.0, F=0. A grade of C or higher is required for successful completion of the course. The final grade was determined based on four lecture exams, 10 weekly quizzes, and four practical laboratory exams. The data from students who stopped attending the course but failed to withdraw was not included in the average final grade calculation to avoid skewing the non-SI average grade. Three criteria were used to identify a candidate to serve as the SI Leader for this study: 1) completion of the course earning an A within one year prior to the start of project; 2) interest in teaching career; and 3) the ability to communicate effectively in large groups. Based on the interviews and qualifications, one student leader was invited to join the study for one year (Spring, Summer, and Fall 2014).

The student leader was introduced to the SI model and trained in various teaching practices and study strategies. The Leader attended all the course lectures and laboratories through the entire project and met regularly with the course director and SI Supervisor to coordinate project plans. The SI Leader consistently kept pace with the course schedule in determining the main theme for each SI session. In the current variation of the SI model, great emphasis was placed on peer-led discussion. In the early phases of the sessions, the students were discouraged from drawing any conclusions before the initial discussions. The format of discussion was open forum and loosely structured, and the SI Leader assumed the role of facilitator, rather than lecturer, occasionally guiding the discussion by emphasizing the value of available clues or resorting to other techniques such as concept maps, flow charts, and multimedia technology. Mock written and practical examinations were also routinely utilized in the sessions. In consultation with the faculty, the SI Leader designed and proctored all mock written and practical exams. In the practical mock exams, the students identified unknown histological slides, models, and cadaver-related structures. However, even in such cases, rather than emphasis being placed on memorization, the emphasis was placed on analyzing the available information in order to draw conclusions.
SI sessions were offered at least 3.5 hours per week, divided into two 1-hour sessions and one 1.5-hour session. The longer session was routinely used as a review of the week’s material. The academic performance of students within the two cohorts (SI and non-SI populations) was quantified based on the series of quizzes and exams described above. The exam and quiz questions with similar levels of difficulty were randomly selected from a test bank each term and were used to assess student performance in the course. The differences between SI and non-SI student performance groups were analyzed and compared using an unpaired student t-test. The relationship between the treatment groups (SI and non-SI) and final grades was investigated by comparison of the final grade within each group using the numerical correlation between two variables (SI or non-SI versus the final grade). All statistical analysis was performed in Microsoft Excel. For all statistical tests performed, all values were expressed as mean ± Standard Error of Mean (SEM.), and a probability level of p<.05 was considered statistically significant. In addition, at the end of each term, a questionnaire consisting of multiple choices, rating scale questions, and a comment box was administered to all students to assess the students’ perceptions regarding the usefulness of the SI program. A copy of the end of term survey is provided in Figure 1.

Results

Study Parameters

A total of 134 freshmen and sophomore students were included in this study; 81 students participated in SI, and 55 students did not. The definition of SI attendance was considered to be any students who attended more than one SI session. The average number of sessions attended by SI participants was eight sessions per term; however, there was a wide variation in number of sessions attended by each student. The average number of students per session was 10 during the spring and fall terms, and four during the summer term. The student data, contact hours, number of sessions, and final grades are shown in Table 1.

Performance Outcomes

Following the completion of each semester, students’ final grades were determined as previously described. In this study, the final course grades were assigned based on a standard four-point grading scale, and the mean average grade for each group was calculated. The data was utilized to compare the performance
of SI versus non-SI groups. The average grade for the SI group was 2.91 ± 0.26, while the average for the non-SI group was 1.81 ± 0.49 (Figure 2A). Based on the grading scale, the SI group had an average grade difference of 1.1 points higher than did the non-SI group. When SI and non-SI groups were compared in each term, the SI group consistently outperformed the non-SI group, as was measured by comparing the percent of students who successfully (% success) completed the course each term (Figure 2B). When results for the three terms were averaged, 84.4% of total SI participants and 41.38% of non-SI participants successfully completed the course (Figure 2C, SI 84.4 ± 9.4 and non-SI 41.38 ± 15.7, p<.05). Moreover, only 14.28% of SI participants in three terms withdrew from the course, while the withdrawal percentage for the non-SI group was 21.53% (Figure 2D, SI 14.28 ± 3.54 and non-SI 21.53 ± 0.43, p<.05).

Grade Distribution and Success Rate

The data indicates that participation in SI was associated with a significant increase in course final grade (A and B versus D and F). When the average final grade for each group was calculated, the results show that the SI group consistently outperformed non-SI group by earning higher grades (Figure 2A; p<.05). There was a correlation between SI participation and higher final grade point average in the course (Figure 3B; r=0.92), while in the non-SI group, a lower percentage of student grades belonged to A and B categories and a higher percentage was associated with grades C, D, and F (Figure 3C, r=.68).

End of Term Survey Results

The students’ opinions regarding SI incorporation into the course were overwhelmingly positive and supportive. The average of student satisfaction with the SI team leader was 4.8 ± 0.33 (1= Low, 5= High) over three terms. Among non-SI group respondents, 80% indicated they had wished to participate in SI sessions but could not for various reasons, among which the most cited reason was conflict with other classes. A copy of the survey is provided in Figure 1.

Discussion

Problem solving and critical thinking skills are essential to any profession. In healthcare-related fields, as in many other fields, certain facts must be learned; however, it is not the knowledge of facts alone which make a successful student, but it is the application of acquired knowledge to real life situations. For those
interested in allied health sciences, understanding human anatomy and physiology is an essential component of a well-rounded curriculum. BSCI 11020 is the second part of an anatomy and physiology course for allied health pre-professionals and traditionally considered a challenging course with high rates of failure (grades of D and F) or withdrawal.

Since learning abilities among college students vary, it is critical for faculty and staff to recognize the unique needs of each student population in order to implement intervention plans to improve students’ rates of success in challenging courses such as BSCI 11020. At KSUA, a large portion of the population consists of non-traditional students attending college for the first time or returning after a long absence. A non-traditional student may, among many other narratives, be an individual who is a single parent, a veteran, employed full-time, or a laid-off worker returning school to earn a degree in a field offering new employment opportunities. This population of students, although resilient and mature, often fall trap to the rigorous demands of the college curriculum, mostly due to lack of time management skills and/or effective study habits (Bamber & Tett, 2010; Laing & Robinson, 2003). Moreover, institutional data confirms a national trend in the United States indicating the majority of freshmen attending college directly out of high school are not academically ready for post-secondary studies (Attewell, Lavin, & Domina, 2006). Whatever the reason may be, the gap between college eligibility and college readiness creates a major academic impediment for an increasing number of students and must be addressed.

Often, among our student populations, the initial response to a highly demanding course such as BSCI 11020 is characterized by emphasis on memorization of a series of disconnected facts without any in-depth understanding of the interactions among those facts. Indeed, enabling students to reach their academic potential regardless of their backgrounds and personal lives is a difficult task; thus, when faculty and staff at KSUA recognized the challenges facing students in BSCI 11020, they decided to incorporate SI into the curriculum in order to improve students’ success rates and learning experiences in the course. SI is a respectable model that has evolved over the last four decades into various forms (Martin, 1977; Martin & Arsendale, 1990; Arendale, 1994; Zaritsky, 2006). However, the general theme of SI has remained the same: SI creates a peer-led environment in which students can be exposed to new study skills and learn how to solve
problems and work out solutions through group discussions and interactions with other peers. Such an approach facilitates the development of critical thinking skills and may ultimately result in developing confidence in defining, analyzing, and problem solving skills, which we would anticipate to translate into higher rates of success and enhanced learning experiences for the students.

Prior to the implementation of the SI model, during Spring 2013, the student success rate in BSCI 11020 was 71%. In the current study, SI participants had 84.4% success rate, while only 41% of non-SI were able to successfully complete the course. Although it is difficult to draw any specific conclusions based on the available data, at its face value, the outcomes suggest a positive effect of SI on student success rates. A similar trend for a positive influence of SI on student success rates was present in all three semesters in which data was analyzed; however, the rates of success each term varied considerably. In the summer term, the average final grade difference was the lowest among the three terms, but all SI participants were able to successfully complete the course. The impact of SI participation on average final grades was narrower than other terms as measured by the average difference in final grade (spring=1.41, fall=1.70 and summer=0.47). During the same term, the success rate for non-SI students was 66.7%. Considering the subtle variances among attending students and a smaller total enrollment for summer, the reduced impact of the SI model in the summer term could be attributed to several factors. First, non-SI participants often take lighter course loads during the summer, which allows this population to allocate more time to prepare for the course material in summer, in turn improving the non-SI students’ performance in the course and resulting in an overall higher final grade. Second, the summer term is an eight-week session and does not provide a similar number of SI contact hours (106 hours for summer compared to 308 hours in fall and 296 hours in spring). The lesser course load and the limited number of SI contacts hours during summer may be contributing factors for the narrower impact of SI on students’ grades. Lastly, a smaller class size in the summer term provides the faculty an opportunity to allocate more time to each individual student, and, in the process, troubleshoot and actively engage the students in the subject matter.

The most noticeable effect of SI participation was seen in the grade distribution throughout each term. On average, the SI participants consistently earned higher final grades in the course (Figure 3A). The data
indicates a strong correlation between SI participation and higher average final grades (Figure 3B). A moderate correlation exists between the non-SI group and the final grade; there was a higher population of non-SI students who earned grades in the C, D, and F range (Figure 3C). This finding is of significant importance since it provides evidence that not only does SI participation allow students to improve their success rates, but SI participation also correlates with a higher final grade. When analyzed, the data did not indicate a correlation between the number of sessions attended and the final grade earned in the class (data not shown). This finding may be due to the varied backgrounds of students in the subject matter and/or the voluntary nature of the SI model. Although some students may require extensive academic support to successfully complete the course, not every student needs support to the same extent. The voluntary nature of SI allows the students to attend SI sessions as they deem necessary, which may explain the lack of correlation between the number of sessions attended and the final grade earned in the course.

The current study is in agreement with previous reports that demonstrated the efficacy of SI support programs in promoting higher cognitive reasoning and meaningful problem solving skills (Blanc & Martin, 1994; Congos & Schoep, 1998; Martin & Arndale, 1990). In the SI model, by placing the students in decision-making positions in a group discussion setting, students are encouraged to analyze the situation in greater depth in order to rationalize their decisions before reaching any conclusions. During the discussions, the SI Leader took the role of facilitator and moderator, rather than an instructor, occasionally guiding the discussion by emphasizing the value of previously learned information. Students were discouraged from drawing a conclusion without the initial discussion. After the initial allocated time, the SI Leader described the concept at hand by emphasizing the significance of the previously learned information. This approach fosters active participation of students in their own education by giving students a chance to acquire knowledge through an interactive, peer-assisted discussion and to use the newly gained knowledge to build upon and construct more complex concepts. In addition, SI participation not only enables students to develop problem-solving skills through facilitated dialogue, but it also sets the ground for developing confidence and problem solving skills in a group setting. This is an invaluable experience for students in allied health sciences and allows the students to analyze the situation, evaluate the available information, resolve conflict, and draw
appropriate conclusions, both individually and as a team. These traits are essential characteristics of well-educated healthcare professionals. More importantly, learning through group discussions encourages the students to also be active listeners and incorporate their classmates’ ideas into their own before reaching any conclusions. Furthermore, this approach is a student-centered activity that is highly interactive, giving students a chance to formulate their knowledge through an interactive discussion with their classmates. In our experience, the SI model fosters active participation of students in their own education which is both effective and practical for our student population. The voluntary nature of the SI model provided an opportunity for students who sought additional resources to enhance their learning experiences as their schedules allowed. The students’ responses to the end-of-term survey also indicated a large number of students who did not attend SI failed to do so because of conflicts with other classes. Therefore, it is prudent to plan SI sessions in a manner that allows the maximum number of students to attend. This goal may be accomplished by a simple survey in the beginning of each term to determine the schedule for SI sessions that best serves the students.

In summary, the current study confirms that a prudent augmentation of the SI model into an anatomy and physiology course is an effective strategy in helping undergraduate students to overcome the academic challenges created by highly demanding courses like BSCI 11020. This approach encourages the active participation of students and is well-regarded by the majority of them. The rapidly changing nature of healthcare professionals’ educational needs substantiates the application of such a simple but effective academic support model in academic curricula.

References


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**Appendix A: Tables and Figures**

**Table 1. Student performance and attendance over three terms.** Spring and Fall terms were 16 weeks long, while the Summer term was eight weeks. The number of contact hours for the course remained the same for every term; however, the SI contact hours were significantly less during the summer as compared to other terms.

**Figure 1. End-of-term student survey.**

**Figure 2A-D. Student Performance.** A) On average, students who participated in SI sessions consistently earned higher final grades compared to non-SI participants; B) SI participants consistently outperformed non-SI students in percent success rates for each term ($p<.05$); C) When data from three terms were combined, SI participation significantly increased the successful completion of the course as compared to non-SI students over three terms (SI $84.4 \pm 9.4$ and non-SI $41.38 \pm 15.7$, $p<.05$); D) Students who participated in SI had significantly lower number of withdrawals from the course as compared to the non-SI group (SI $14.28 \pm 3.54$ and non-SI $21.53 \pm 0.43$, $p<.05$).

**Figure 3A-C. Grade Distribution.** A) When averaged for the total number of participants, SI participants earned a higher portion of grades A and B than the non-SI group. The asterisk indicates the results that differ significantly from corresponding non-SI students for each grade scale ($p<.05$); B) There was a strong correlation between SI participation and higher final grades in the course (Figure 2B, $r=.92$); C) on average, the non-SI group consistently earned a lower final graded when compared to the SI group. There was a moderate correlation between lower grades and the non-SI group (Figure C, $r=.68$).
### Table 1

**Student performance and attendance over three terms**

<table>
<thead>
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<th>Grade</th>
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<td></td>
<td>SI</td>
<td>Non-SI</td>
<td>SI</td>
</tr>
<tr>
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<td>1</td>
<td>2</td>
</tr>
<tr>
<td>B</td>
<td>12</td>
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<td>7</td>
</tr>
<tr>
<td>C</td>
<td>5</td>
<td>7</td>
<td>4</td>
</tr>
<tr>
<td>D</td>
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<td>4</td>
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</tr>
<tr>
<td>F</td>
<td>3</td>
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<tr>
<td>Average</td>
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<tr>
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</tr>
<tr>
<td>Number of</td>
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</tr>
<tr>
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</tr>
<tr>
<td>Mean Sessions</td>
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<td>7</td>
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</tr>
<tr>
<td>Total Enrollment</td>
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<td>22</td>
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</table>
End-of-Term Supplemental Instruction Survey

This information is for research purposes only, and will in no way influence your final grade.

Your Name: ________________________________________________________
Course Name: ________________________________________________________ Term: ____________

Please fill out only the side of this questionnaire that applies to you.

If you attended even one SI session, please fill out this side.

1. How helpful were the sessions to you?
   □ 1  □ 2  □ 3  □ 4  □ 5

   not helpful  very helpful

2. What grade do you expect to earn in this course?
   □ A  □ B  □ C  □ D  □ F

3. How many sessions did you attend?
   □ 1  □ 2-5  □ 6-10  □ more than 10

4. If you have any comments on the sessions and/or suggestions for improving future sessions we would appreciate them. Please use the back of the page if needed.

5. If you are interested in becoming an SI leader for this or other courses please provide us with the following information:

   Name: ____________________________________________________________
   Address: __________________________________________________________
   Phone: _____________________________________________________________
   Course(s): __________________________________________________________

If you did not attend any SI sessions, please fill out this side.

1. Please indicate the reason(s) you did not attend any sessions.
   □ I wanted to attend but couldn’t. The session schedule conflicted with work or other classes.
   □ I didn’t feel it was necessary.
   □ I have been to similar kinds of study sessions for other courses and did not find them helpful.
   □ I have been to SI sessions for other courses and did not find them helpful.
   □ I intended to, but couldn’t find the time.
   □ Other, please explain using the back of the page if needed.

2. What grade do you expect to earn in this course?
   □ A  □ B  □ C  □ D  □ F

3. Did you fill out the time schedule questionnaire for SI sessions at the beginning of the term?
   □ Yes □ No □ Can’t Remember

Comments: __________________________________________________________________________
___________________________________________________________________________________
___________________________________________________________________________________
___________________________________________________________________________________
(If you have an anonymous comment you would like to make, please turn it in on a separate sheet of paper.)

Figure 1. End-of-Semester Survey
Figure 2A. Comparison of average final grades each term

Figure 2B. Percent success rate each term
Figure 2C. Combined success rate over three terms

Figure 2D. Combined withdrawal rate over three terms
Figure 3A. Grade distribution

\[ \% \text{SI} \]

\[ \% \text{non-SI} \]
Figure 3B. SI participation vs. distribution

Figure 3C. Non-SI vs. average final grade
Implementing Supplemental Instruction (SI) Online to Create Success in High-Stakes Coursework for Pre-Doctoral Dental Students

Carrie Carter-Hanson, Johnson County Community College
Cynthia Gadbury-Amyot, University of Missouri-Kansas City

Abstract

There is a critical shortage of culturally diverse dental practitioners in the United States. In addition, many underrepresented minority (URM) and disadvantaged students have difficulty with the course material needed to pursue a dental degree. One strategy for helping students achieve higher grades and persist in difficult course work is the implementation of Supplemental Instruction (SI). The purpose of this study was to describe the outcomes of using SI online for the first time as part of the University of Missouri-Kansas City, School of Dentistry’s (UMKC-SOD) Admissions Enhancement Program (AEP). The AEP program was designed to provide URM and disadvantaged pre-dental students with increased academic skills training in Biology, Chemistry, Organic Chemistry, and Math via online modules. Students met with their SI Leader three times per week at a specified time in a synchronous format to review course material, problem solve, and work collaboratively with fellow classmates. Twelve URM and disadvantaged students participated in the AEP from 2011 to 2014 for a total of 48. Success in the AEP was measured by an increase the student’s Dental Admission Test (DAT) score and admission to dental school. At the end of each year’s program, students completed a survey regarding all aspects of the AEP. The study found that AEP students who were admitted to dental school had a significantly higher DAT score than those students who were not admitted. Students also reported that the required time for SI sessions and test taking instruction helped them prepare for the DAT. Over 72% of students responded favorably that SI contributed to their success in the AEP and to taking the DAT. Students reported that attending the SI sessions helped them work through problems in the course material. This study found evidence that SI is a viable strategy for helping URM and disadvantaged students be successful in high stakes courses needed to move forward and pursue health profession degrees.
Introduction

For a number of years, leaders in dental education have been calling for an increase in the enrollment, retention, and graduation of underrepresented minority and underserved students in U.S. dental schools (Haden, 2003; Sullivan, 2010). This critical shortage of culturally diverse dental practitioners is troublesome most notably due to the impending shift in the nation’s demographics over the next twenty years (Meyers, 2007; Sullivan Commission, 2004; Sullivan, 2010). In other words, it is important that institutions of higher education admit and graduate a more diverse class of dental practitioners to meet the changing demographic landscape.

Students from underrepresented minority and disadvantaged backgrounds seeking to enter the health professions have continually been met with barriers due to some of the difficult coursework needed to attain professional degrees. These students often lack the study skills and learning strategies necessary to navigate the college experience. Additionally, they may have had exposure to less rigorous college prep coursework, may have internalized stereotypes which affect their ability to succeed in college, and may have experienced difficulty developing academic skills in college (Massey, 2002; Sullivan Commission, 2004).

A number of solutions have been recommended by national associations and educators to remedy the lack of diversity in the healthcare workforce (Haden, 2003; Sullivan, 2004; Sullivan, 2011). Recommendations formulated by the Sullivan Commission include: (1) Increasing diversity in the health professions, citing the importance of this change at the educational level; (2) Exploring nontraditional paths for education and training of a health professional; and (3) adhering to change within institutional leadership to support diversity (Sullivan, 2004). Likewise, the American Dental Education Association’s (ADEA) Commission reviewed the roles and responsibilities of the academic institution in educating a more diverse student population and set forth a landmark call for change “to improve the oral health care of all Americans” (Haden et al., 2003).

In response to the many calls for change and proposed initiatives, newly developed dental enrichment programs have been implemented across the country for the past several years. The main purpose of these programs has been identified by several authors with a common theme of developing the URM students’ academic and professional skills so that they can be competitive in the dental school application process.
Supplemental Instruction Journal, Volume 2, Issue 1

(Alexander & Mitchell, 2010; Carreon, Davidson, & Andersen, 2009; Gravely, McCann, Brooks, Harman, & Schneiderman, 2004; Johnson, Woolfolk, May, & Inglehart, 2013; McClain, Jones, McClain, & Curd, 2013; Pendleton & Graham, 2010). The development of these programs was an outgrowth of the efforts of the American Dental Education Association (ADEA) Commission President’s report on the roles and responsibilities of academic dental institutions (Haden et al., 2003).

In 2011, the UMKC-SOD launched its inaugural program to increase the diversity of the student body by implementing a new summer program called the Admission Enhancement Program (AEP). The AEP is a 10 week hybrid program designed to advance the foundational knowledge and professional development of culturally diverse candidates for the competitive dental school admission pool.

One strategy at UMKC for helping all students be successful in their educational programs is the utilization of Supplemental Instruction (SI). SI’s main purpose is threefold: (1) to increase retention within targeted historically difficult courses; (2) to improve students’ grades in targeted historically difficulty courses; and (3) to increase the graduation rates of students (UMKC, 2008; Ardendale, 1997; International Center for SI, 2015).

SI was developed in 1973 at UMKC by Dr. Deanna Martin. The UMKC campus is now home to the International Center for Supplemental Instruction (http://www.umkc.edu/si). The results of Dr. Martin’s work with SI were so innovative and effective that in 1981, the U.S. Department of Education recognized SI as an “Exemplary Education Program” (Ardendale, 1997; University of Missouri-Kansas City, 2008). Today, SI is known internationally with over 1,800 U.S. institutions and 27 countries utilizing SI on their campuses (University of Missouri-Kansas City, 2008). A key feature of SI is that the student is an active participant in the SI sessions. SI encourages participants to become independent critical thinkers through peer collaboration and the use of effective learning skills. These key concepts help increase student connection to campus culture and increase retention (Hurley, Jacobs, & Gilbert, 2006).

SI utilizes peer leaders who have previously completed these courses with competency, thereby enabling them to lead and conduct group sessions that include study strategies and collaborative learning in a nonthreatening environment (Latino & Unite, 2012; University of Missouri-Kansas City, 2008). To allow for
most students to attend SI, it is recommended that SI sessions be held three times per week. The SI Leaders
guide students to learn various study strategies that can serve them even as they move on to other course work
in their educational studies. These strategies include how to appropriately develop skills in note taking,
graphic organization, questioning techniques, vocabulary skills, and test preparation (Hurley, Jacobs, &
Gilbert, 2006). As noted on the International Center’s website, SI does not involve a fee for students; rather, it
is offered free of charge to all students in targeted courses. It is also important to note that SI is not a remedial
approach to learning. Instead, high-risk courses are targeted as opposed to high-risk students. All students are
welcome to attend, and attendance is completely voluntary.

SI has been studied in a variety of courses, including Chemistry, Biology, and Math, and has resulted in
improved outcomes, such as students earning higher grades (Haak, HilleRisLambers, Pitre, & Freeman, 2011;
Rath, Peterfreund, Bayliss, Runquist, & Simonis, 2011; Rath et al., 2007; Shaya, Petty, & Petty, 1993; Rath,
Peterfreund, Xenos, Bayliss, & Carnal, 2007) and improved overall performance (Paideya, 2014; Rath et al.,
2011) when compared to those students who did not participate in SI. While most of the literature suggests
that SI benefits all ethnic/racial groups equally, some studies have found SI to benefit URM groups even more
(Rath, Peterfreund, Bayliss, Runquist, & Simonis, 2011). However, SI has mainly been studied in
undergraduate students as opposed to students in professional school. High-impact courses such as Chemistry,
Biology, and Math are courses that are needed to enter a health profession school, and the knowledge learned
in these courses serves as a base for taking standardized entrance exams such as the DAT. Therefore, utilizing
SI with pre-doctoral students could be very helpful in students gaining admission to health professions schools.

Because SI has previously demonstrated effectiveness in student performance, higher grades, and
increased use of critical thinking and problem solving, the UMKC-SOD sought to implement the SI model in
an online environment in the AEP. When approaching the staff at the International Center for SI (ICSI), the
desire to use SI in four modules and the critical nature of delivering SI through online and distance technology
was thoroughly explained.
Methods

The purpose of this study was to describe the outcomes of using SI online for the first time as part of the UMKC SOD’s AEP. The following research questions were addressed: (1) Is there a significant difference between the pre/post DAT scores among students attending the pre-dental summer AEP? (2) What percentage of students gain admission to dental school after attending the AEP? (3) Did SI have an impact on the student’s ability to perform better academically?

This study was accepted as exempt by the UMKC Social Sciences Institutional Review Board. Forty-eight (48) students from either URM and/or disadvantaged backgrounds who completed the AEP from years 2011 to 2014 participated in the study. The term URM in dentistry and for this study was defined as being from an African American, Hispanic, or American Indian group (Sullivan Commission, 2004). For this study, the term disadvantaged was defined as being from an environment that has inhibited the individual from obtaining the knowledge, skills, and abilities required to enroll in and graduate from a health professions school or a program providing education or training in an allied health profession; the term disadvantaged also referred to a student whose family had an annual income below a level based on low-income thresholds according to family size as set by the U.S. Bureau of Census, adjusted annually for changes in the Consumer Price Index and adjusted by the Secretary of Health and Human Services for use in health professions and nursing programs (U.S. Census Bureau, 2011; U.S. Department of Health & Human Services, 2009).

Researchers agree that when using the term disadvantaged to describe students, this implies that these students have not had access to or completed the more challenging college preparatory coursework. Rather, they often take lower-level math, science, and reading courses (Green, 2006; Twigg, 2005; Wimberly & Noeth, 2005). Additional criteria for admission to the AEP program included: a minimum GPA of 2.5, completion of at least 90 hours of undergraduate coursework, and from either a URM or disadvantaged group. Each year, approximately 40 students applied to the AEP and 12 students were chosen each year based on above-stated criteria.

The AEP provided academic skills enhancement training to pre-doctoral dental students through online module instruction in Biology, Chemistry, Organic Chemistry, and Quantitative Analysis (math). These
courses are core topics on the DAT, so providing academic skills review in these areas was crucial in helping students attain a successful score. Additionally, these courses are often deemed difficult or “high-stakes” by SI standards (Arendale, 2002) and considered gatekeeper courses needed to proceed to any school of health professions. Therefore, it was a natural fit to provide SI support through the online platform. In collaboration with the ICSI and UMKC’s campus SI program, SI was incorporated as part of the online module structure of the AEP and represented the first foray for UMKC’s campus SI program into online education.

SI sessions were conducted using Blackboard Collaborate, a synchronous two-way audio-video platform allowing online users to “meet” in real time. Prior to starting the online modules, students and SI Leaders completed an online training session for navigating the Blackboard Collaborate interface. Upon completion of the training sessions, students were given access to the module material 24/7. Students had two weeks to complete the material for each individual module. While traditional SI sessions are voluntary, this study instituted mandatory online sessions. The online sessions were three days per week, at a pre-set time, for two hours each. While traditional SI sessions are held three times per week to allow most students to attend (University of Missouri-Kansas City, 2008), in this online setting, the sessions were mandatory, ensuring all students in the AEP were attending. Students met with their classmates and an SI Leader in synchronous sessions. Each module was designed for mastery of material for the purpose of enhancing their foundational knowledge and academic skills in each of the four course areas prior to taking the DAT. This innovative SI online format allowed students an opportunity to ask questions, be redirected by the SI Leader, work through any material they might be struggling with and check for final understanding, just as they would in a face-to-face SI sessions (Arendale, 1997; Rath, Peterfreund, Xenos, Bayliss, & Carnal, 2007; University of Missouri-Kansas City, 2008).

As with traditional SI, all of the Leaders had previously taken the same courses or similar courses in the field they were assigned to and did well in those courses. The SI Leaders met with the AEP course instructors to go over the material and items to review in SI online sessions prior to the beginning of the modules. Additionally, SI Leaders had the added feature of using tablet technology as a way of enhancing students’ learning of the material. Tablet technology allowed students to process steps and arrive at solutions,
an essential part of SI (Hurley, Jacobs, & Gilbert, 2006). It also provided an environment of collaboration for the students where problem solving could be accomplished in a step-by-step fashion. Connecting in a synchronous online format during their SI sessions allowed students to ask real-time questions, use break out rooms, and work collaboratively with their peers and the SI Leader.

In order to assess and describe the outcomes of incorporating SI in the four online modules, students were asked to complete a survey at the completion of the AEP. The survey was anonymous and sent via a link to Survey Monkey®. Questions were asked regarding the quality of SI for each online module and how the modules helped students prepare for the DAT. The questions were formulated in a Likert scale of 5 = Outstanding to 1 = Far below average. The survey also addressed required time with SI Leaders and how the SI sessions helped students with the specific course content. (Appendix A). Other data collected included pre- and post- DAT scores, GPA, and admission outcomes to dental school. Student demographic information was also collected in order to characterize the population.

Results

All 48 students completed the AEP outcome survey through Survey Monkey®. The demographic data is summarized in Table 1. The mean age of the participants was 24.3 ($SD=4.5$) years of age; the overall GPA was 3.32 ($SD=.327$), and the mean science GPA was 3.27 ($SD=.299$). The GPA is the one each student had upon entrance into the AEP and was verified by an official transcript. Ethnicity and race were derived from the U.S. Census data. The largest percentage of students were Black/African American (29%), White (29%) from rural or underserved areas of the region, and female (66.7%).
An important piece of evidence in admission committees’ selection process for dental schools is the student’s DAT score. Therefore, this study looked at an increase in the DAT score after completion of the program as a measure of success. The t-test was used to look at significant differences between mean pre- and post-DAT scores. The mean academic average (AA) of the pre-DAT scores was 16.00 and the mean AA of the post-DAT scores was 17.84. Post-DAT scores were found to have significantly increased when compared to the pre-DAT scores, t(18) = -7.18, p<.01. This is an important finding in that the national academic average for the DAT is 18.1 (Garrison, McAllister, Anderson, & Valachovic, 2013).

Secondly, while improved DAT scores are an important part of the admissions process, actual admission to dental school is the crowning achievement for the AEP students. Out of 48 students that

Table 1

Demographic characteristics among participants in the AEP

<table>
<thead>
<tr>
<th>Characteristic</th>
<th>N</th>
<th>Male (%)</th>
<th>Female (%)</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age</td>
<td>48</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Gender</td>
<td>48</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Male</td>
<td>16</td>
<td>33.3</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Female</td>
<td>32</td>
<td>66.7</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Ethnicity</td>
<td>48</td>
<td>7 (14.6)</td>
<td>8 (16.7)</td>
<td>15</td>
</tr>
<tr>
<td>Hispanic/Latino</td>
<td>17</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Race:</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>African American/Black</td>
<td>6</td>
<td>12.5</td>
<td>8 (16.7)</td>
<td>14</td>
</tr>
<tr>
<td>American Indian/Alaskan Native/White</td>
<td>4</td>
<td>8.3</td>
<td>5 (10.4)</td>
<td>9</td>
</tr>
<tr>
<td>Asian</td>
<td>2</td>
<td>4.2</td>
<td>3 (5.3)</td>
<td>5</td>
</tr>
<tr>
<td>American Indian/Alaskan Native</td>
<td>2</td>
<td>4.2</td>
<td>2 (4.2)</td>
<td>4</td>
</tr>
<tr>
<td>Asian/White</td>
<td>0</td>
<td></td>
<td>1 (2.1)</td>
<td>1</td>
</tr>
<tr>
<td>American Indian/Alaska Native/Black</td>
<td>1</td>
<td>2.1</td>
<td>0</td>
<td>1</td>
</tr>
<tr>
<td>White/disadvantaged</td>
<td>1</td>
<td>2.1</td>
<td>13 (27.1)</td>
<td>14</td>
</tr>
<tr>
<td>Total</td>
<td>16</td>
<td>32</td>
<td>48</td>
<td></td>
</tr>
</tbody>
</table>
completed the AEP from 2011-2014, 32 were admitted to dental school (67%). A chi-square test was used to evaluate research question two to determine the significance of AEP students’ ability to be admitted to dental school after completing the program. Results showed a reasonably good fit between the data and the hypothesis of being admitted ($p<.021$). This outcome suggests that there was a significant difference between the AEP students who completed the program and were offered admission and those who were not offered admission, $X^2 \left(1, N=48\right) = .021, p<.05)$. It was thought that students who completed the AEP and were offered admission to dental school utilized the tools given to them, such as SI, and took advantage of all the program had to offer. Table 2 summarizes these results.

Table 2

<table>
<thead>
<tr>
<th>Results of Chi-square Test and Descriptive Statistics for Admission to Dental School</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dental School Admission</td>
</tr>
<tr>
<td>After completion of AEP</td>
</tr>
<tr>
<td>$X^2 \left(1, N=48\right) = .021, p&lt;.05$</td>
</tr>
</tbody>
</table>

The third research question addressed the impact of SI on student achievement. An independent samples $t$-test was conducted to look for differences between students who were admitted to dental school and those who were not with regard to the question about required time of the SI sessions and test taking skills. While the groups were not significantly different, of the students who were admitted to dental school, 75% strongly agreed that the required SI sessions were helpful in preparing them for the DAT. Likewise, 66% strongly agreed that the test taking skills they learned through SI helped them prepare for the DAT.

Table 3 further explores the participants’ ratings regarding SI in the AEP. Over 72.72% of students responded favorably that the SI Leaders’ assistance with the online course content contributed to their success in the AEP and taking the DAT. Students also reported that the SI sessions helped them learn to be critical thinkers and problem solvers with the course material.
Table 3

*AEP Participants’ ratings of SI*

<table>
<thead>
<tr>
<th>Question</th>
<th>Year 1</th>
<th>Year 2</th>
<th>Year 3</th>
<th>Year 4</th>
</tr>
</thead>
<tbody>
<tr>
<td>Quality of SI Math Leader (%)</td>
<td>OS (81.8)</td>
<td>OS (41.7)</td>
<td>OS (58.3)</td>
<td>OS (8.30)</td>
</tr>
<tr>
<td></td>
<td>VG (9.1)</td>
<td>VG (33.3)</td>
<td>VG (33.3)</td>
<td>VG (33.33)</td>
</tr>
<tr>
<td></td>
<td>AV (9.1)</td>
<td>AV (25.5)</td>
<td>AV (41.67)</td>
<td>AV</td>
</tr>
<tr>
<td>Totals (%)</td>
<td><strong>100%</strong></td>
<td><strong>100%</strong></td>
<td><strong>91.6%</strong></td>
<td><strong>83.30%</strong></td>
</tr>
<tr>
<td>Quality of SI Chemistry Leader (%)</td>
<td>OS (9.1)</td>
<td>OS (33.3)</td>
<td>OS (8.3)</td>
<td>OS (33.33)</td>
</tr>
<tr>
<td></td>
<td>VG (9.1)</td>
<td>VG (33.3)</td>
<td>VG (16.7)</td>
<td>VG (25.00)</td>
</tr>
<tr>
<td></td>
<td>AV (63.6)</td>
<td>AV (25.0)</td>
<td>AV (16.7)</td>
<td>AV (33.33)</td>
</tr>
<tr>
<td>Totals</td>
<td><strong>81.8%</strong></td>
<td><strong>100%</strong></td>
<td><strong>66.7%</strong></td>
<td><strong>91.66%</strong></td>
</tr>
<tr>
<td>Quality of SI Organic Chemistry Leader (%)</td>
<td>OS (36.4)</td>
<td>OS (25.5)</td>
<td>OS (8.3)</td>
<td>OS (16.67)</td>
</tr>
<tr>
<td></td>
<td>VG (18.2)</td>
<td>VG (41.7)</td>
<td>VG (16.7)</td>
<td>VG (33.33)</td>
</tr>
<tr>
<td></td>
<td>AV (45.5)</td>
<td>AV (25.5)</td>
<td>AV (58.3)</td>
<td>AV (41.67)</td>
</tr>
<tr>
<td>Totals (%)</td>
<td><strong>100%</strong></td>
<td><strong>92.7%</strong></td>
<td><strong>83.3%</strong></td>
<td><strong>91.67%</strong></td>
</tr>
<tr>
<td>Quality of SI Biology Leader (%)</td>
<td>OS (45.5)</td>
<td>OS (50.0)</td>
<td>OS (16.7)</td>
<td>OS (33.33)</td>
</tr>
<tr>
<td></td>
<td>VG (18.2)</td>
<td>VG (33.3)</td>
<td>VG (41.7)</td>
<td>VG (41.67)</td>
</tr>
<tr>
<td></td>
<td>AV (36.4)</td>
<td>AV (16.6)</td>
<td>AV (25.0)</td>
<td>AV (16.67)</td>
</tr>
<tr>
<td>Totals (%)</td>
<td><strong>100%</strong></td>
<td><strong>100%</strong></td>
<td><strong>83.4%</strong></td>
<td><strong>91.67%</strong></td>
</tr>
</tbody>
</table>

OS=Outstanding; VG=Very good; AV= Average

Students were also asked to rate the quality of the SI for all four modules: Biology, Chemistry, Organic Chemistry, and Quantitative Analysis (Math). Results showed that students were highly satisfied with the AEP and SI. A stepwise multiple regression analysis was used to evaluate the program characteristics that best predicted student satisfaction (Gravetter & Wallanu, 2013). The predictors were (1) how the AEP was able to help in current or future education, (2) learning new information and facts, (3) the quality of the SI Leader in
the math module, and (4) the quality of the DAT preparatory CE webinar. Approximately 43% of student satisfaction was attributed to the educational content received in the AEP; 8.2% was attributed to learning new information and facts; 5.4% was attributed to the quality of the SI Leader in the math module; and 4.4% was attributed to the quality of the online DAT preparatory course. Collectively, all four variables accounted for 60.3% of the variance in predicting student satisfaction in the AEP program (Table 4).

Table 4

<table>
<thead>
<tr>
<th>Model 1</th>
<th>Model 2</th>
</tr>
</thead>
<tbody>
<tr>
<td>Variable</td>
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<tr>
<td>Education</td>
<td>.472</td>
</tr>
<tr>
<td>Info/Facts</td>
<td></td>
</tr>
<tr>
<td>$R^2$</td>
<td>.436</td>
</tr>
<tr>
<td>$F$</td>
<td>33.20*</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Model 3</th>
<th>Model 4</th>
</tr>
</thead>
<tbody>
<tr>
<td>Variable</td>
<td>$B$</td>
</tr>
<tr>
<td>Education</td>
<td>.727</td>
</tr>
<tr>
<td>Info/Facts</td>
<td>-.231</td>
</tr>
<tr>
<td>DAT Web</td>
<td>-.144</td>
</tr>
<tr>
<td>SI Math</td>
<td></td>
</tr>
<tr>
<td>$R^2$</td>
<td>.580</td>
</tr>
<tr>
<td>$F$</td>
<td>18.87*</td>
</tr>
</tbody>
</table>

* $p<.01$

**Discussion & Conclusion**

There are many benefits to using Supplemental Instruction in higher education which have been demonstrated in the literature with respect to the sciences (Haak, HilleRisLambers, Pitre, & Freeman, 2011; Rath, Peterfreund, Bayliss, Runquist, & Simonis, 2011; Peterfreund, Rath, Xenos, & Bayliss, 2008; Shaya, Petty, & Petty, 1993; Rath, Peterfreund, Xenos, Bayliss, & Carnal, 2007; Webster & Hooper, 1998). These include increases in grade outcomes, understanding of critical concepts, the use of study skills, and the ability to apply learned knowledge to new information. These benefits are important when working with pre-professional URM and disadvantaged students who may lack the same academic opportunities, mentors, or
tools as other groups (Veal, Perry, Stavisky, & Herbert, 2004). Therefore, implementing SI in traditionally
difficult coursework in this study was found to be an advantage in helping pre-doctoral URM and
disadvantaged students achieve admission to dental school.

This study also demonstrates how the use of SI online with Biology, Chemistry, Organic Chemistry
and Math modules were able to help URM and disadvantaged pre-dental students acquire the necessary study
skills for taking the DAT. After completing the AEP, students had a significant increase in performance on the
DAT, demonstrating academic achievement. Pre-DAT AA scores ranged from 14 to 18, while post-DAT AA
scores ranged from 16 to 23. This is particularly notable because the average DAT score of dental school
applicants in the United States is 18.5 (American Dental Education Association, 2014). These results are
similar to other studies in which students were able to perform better on the DAT after completing some type
of enrichment program (Johnson, Woolfolk, May, & Inglehart, 2013; Nussbaum & Steele, 2007; Markel,
Woolfolk, & Inglehart, 2008). It is also thought that the active learning exercises given by the SI Leaders in
the online sessions through the use of tablet technology most likely enhanced the learning and problem solving
skills of the students. SI played a major role in helping students to achieve and retain the material needed for
being successful on the DAT.

Another factor of success demonstrated by the program was that 32 out of 48 (67%) of the AEP
students were admitted to dental school after completion of the AEP. Many other enrichment programs have
demonstrated similar success over time and included preparation for the DAT and academic skills training
(Bailit & Formicola, 2010; Brunson et al., 2010; Carreon et al., 2009; Formicola et al., 2009; Gonzalez, 2011;
Johnson et al., 2013; Markel et al., 2008; Nivet, 2010; Price & Grant-Mills, 2010). Students reported that the
SI sessions aided in their ability to study for the DAT, perform better on the exam as a result, and gain
admission to dental school. The most distinguishing factor of the AEP that sets it apart from other summer
enrichment programs is the hybrid/online approach and incorporation of SI. This component allowed students
to study more often from their place of residence, have access to the academic materials 24/7, stay connected
to their peers, and form online study groups. Therefore, in this study, SI was a critical portion of the program.
Limitations

The current study had two main limitations. First, the population studied \((N=48)\) was the only group available to evaluate for the AEP. Although this sample size limits applicability to other populations, the strength of the findings were significant. Secondly, this study was conducted in one dental school university setting. Since there are numerous enrichment or post-baccalaureate programs in U.S. dental schools, the results cannot be generalized to all other U.S. dental schools.

Future Research

Future studies evaluating the outcomes of the AEP program should include a more representative sample of pre-dental summer enrichment students. Additionally, long-term results that follow the AEP students who were admitted to dental school should be gathered through each year of dental school. It would be interesting to include an evaluation of how students apply the use of the skills they learned in their SI sessions in dental school course work. Future studies incorporating qualitative data from focus groups of AEP students regarding the SI online sessions would perhaps enhance the quantitative outcomes of the study and help to shape and make important changes to the program.

Conclusion

Collaboration between the UMKC School of Dentistry’s AEP summer enrichment program and Supplemental Instruction to create an innovative online learning environment were linked to positive outcomes for student participants. Most notably, students improved their DAT scores, thereby putting them in a position of strength when applying to dental school. Initiatives such as the one studied here provide strategies for increasing future enrollment of underrepresented minorities and disadvantaged students in dental programs.

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Appendix A: Admission Enhancement Program Survey

**UNIVERSITY OF MISSOURI-KANSAS CITY SCHOOL OF DENTISTRY**

**“Admissions Enhancement Program (AEP)”**

Program Assessment

As part of the University of Missouri-Kansas City, School of Dentistry’s commitment to academic excellence we are conducting this survey in order to obtain feedback regarding the Admission Enhancement Program. Your feedback will then be used to revise and enhance the program for students next year. Thank you in advance for your time and effort in completing this evaluation. We truly do value your recommendations and suggestions.

1. Please rate the following questions from 1 to 5 (or zero if not applicable).

5=Strongly agree
4=Agree
3=Not Sure/Neutral
2=Disagree
1=Strongly Disagree
0=Not applicable

To what extent do you believe AEP will help you in the future?

____ (1) This program will help me when in my current or future education.

____ (2) This program will help me in my future career plans.
In this program I learned new ways of solving problems for school.

In this program I learned new skills for dental school preparation.

I learned a lot of information and facts in this program.

How did the AEP help you personally?

During this program I learned more about myself.

This program made me think more about my own ideas and feelings.

This program helped me to understand my own strengths.

How difficult was the program?

I had difficulty with the Math course work.

I had difficulty with the Chemistry course work.

I had difficulty with the Organic Chemistry course work.

I had difficulty with the Biology course work.

It was not always clear to me what I was supposed to do for this program.

The ALEKS enhanced the online module for Math

The Connect and Learn Smart enhanced the Science modules.

2. **For the following three questions 1=Yes and 2=No**

Did you enjoy participating in the *Admissions Enhancement Program*?

Would you take another hybrid program like this?

Would you recommend this program to someone else?

3. Below is a partial list of the subjects covered in this course. Please circle the appropriate response for Quality of Instruction:

5=Outstanding  4=Very Good  3=Average  2=Below Average  1=Far Below Average
Quality of Instruction

On-Site Experience 5 4 3 2 1 NA
Comments:

Math Module 5 4 3 2 1 NA
Comments:

Chemistry Module 5 4 3 2 1 NA
Comments:

Organic Chemistry Module 5 4 3 2 1 NA
Comments:

Biology Module 5 4 3 2 1 NA
Comments:

DAT – Prep Online Course 5 4 3 2 1 NA
Comments:

SI Leaders Instruction:
Math SI Leader 5 4 3 2 1 NA
Comments:

Chemistry SI Leader 5 4 3 2 1 NA
Comments:
Organic Chemistry SI Leader 5 4 3 2 1 NA
Comments:

Biology SI Leader 5 4 3 2 1 NA
Comments:

Management/Academic Skills Information (CAD) 5 4 3 2 1 NA
Comments:

Alternative Careers Exploration
(Panels for Dental Research, Education & Public Health) 5 4 3 2 1 NA
Comments:

Mentoring in Application for Dental School
(Essay and Interview review) 5 4 3 2 1 NA
Comments:

4. Please rate the following questions:

5=Outstanding  4=Very Good  3=Average  2=Below Average  1=Far Below Average

How much did the following elements contribute to your success in this program?

___(19)  PowerPoint learning modules on Blackboard.

___(20)  Required time with the SI Leaders to help with online course content.

___(21)  Discussion board threads on Blackboard.

___(22)  Interactions and facilitations from each online course instructor when needed.

___(23)  Direct e-mail contact with course instructors.
5. Please rate the following questions:

\[5\text{=Strongly Agree} \quad 4\text{=Agree} \quad 3\text{=Neutral} \quad 2\text{=Disagree} \quad 1\text{=Strongly Disagree}\]

To what extent do you feel the material prepared you for the DAT?

\[\begin{align*}
\text{\underline{28}} & \quad \text{The Math Module prepared me for the DAT} \\
\text{\underline{29}} & \quad \text{The Chemistry Module prepared me for the DAT} \\
\text{\underline{30}} & \quad \text{The Organic Chemistry Module prepared me for the DAT} \\
\text{\underline{31}} & \quad \text{The Biology Module prepared me for the DAT} \\
\text{\underline{32}} & \quad \text{The CE Webinar prepared me for the DAT} \\
\text{\underline{33}} & \quad \text{The TEST Taking Strategies prepared me for the DAT.}
\end{align*}\]

6. Please provide short answers to the following questions.

(34) Tell us how you originally were notified or found out about the *Admissions Enhancement Program*.

(35) What qualities does a student need to be successful in the *Admissions Enhancement Program*?

(36) What are two of the most positive aspects of the *Admissions Enhancement Program*?

(37) What are two of the most negative aspects of the *Admissions Enhancement Program*?

(38) Did your expectations and opinions of the program change over the semester? If so, what do you...
think most changed your opinion?

(39) How well do you believe you achieved the objectives of the program?

(40) When you were studying for your online course work and needed help, how did you get it?

(41) If you could, what changes would you make to the Admissions Enhancement Program?

(42) Did using the Blackboard and Modules in an online course format have an impact upon your opinion of this program, if any?

(43) Have you or will you be applying to the UMKC School of Dentistry?

(44) What plans do you have for using the information gained in this program for your career?

(45) Would you PAY for the AEP course? If yes, how much would you be willing to pay given all the course materials you were exposed to?
   a. $1000
   b. $1500
   c. $2000
   d. $2500

Census Data:

(46) What is your current age?

(47) What is your gender?
   a. Male
   b. Female
(48) What is your race?
   a. American Indian & Alaska Native
   b. Asian
   c. Black or African American
   d. Native Hawaiian & Other Pacific Islander.
   e. White
   f. American Indian & Alaska Native & White
   g. Asian & White
   h. American Indian & Alaskan Native & Black or African American.

(49) What is your ethnicity
   a. Hispanic or Latino
   b. Not Hispanic or Latino

Thank you for completing the evaluation! ☺️
SI Net

SI Net is the official listserv of the International Center for Supplemental Instruction.

Visit info.umkc.edu/si/si-net to sign up.

The International Center for Supplemental Instruction is excited to announce SI Program Certification

This new initiative seeks to distinguish SI programs throughout the United States who have been trained by the International Center and are operating their SI programs utilizing SI best practices.

Program Certification is underway! Visit info.umkc.edu/si to learn how to apply for certification.

Email questions to Jennifer Beatty at the International Center for SI at beattyja@umkc.edu.
SI Supervisor Trainings in Kansas City

The International Center for Supplemental Instruction offers nine SI trainings annually in Kansas City, Mo. Training covers the following topics: procedures for selecting SI courses and SI Leaders; roles of Supervisors and Leaders as well as benefits; evaluation and funding of the program; training and supervision of SI Leaders; theoretical frameworks underlying the SI model; and effective learning strategies and SI session activities. Attendees will also participate in SI simulations. Those who complete the SI training will receive reproducible SI Supervisor and SI Leader manuals and a certificate of completion.

Call 816-235-1174 for questions regarding training registration.

Additional Training Day: SI Leader Training Workshop

You must have completed the SI training outlined above before registering for this training.

SI trainings offered in Kansas City are two days. A third additional day is available for an extra fee the day following the two-day training for those attendees who would like more intensive or advanced SI training. Topics include practical applications of SI Leader training; discussion of a sample Leader training agenda; in-depth exploration of discipline specific SI skills and strategies; simulation of planning for an SI session; 'live' facilitation of an SI session; facilitation of your own SI session; troubleshooting scenarios; and innovative marketing techniques.

For registration information, call 816-235-1174.