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Supplemental Instruction in First-Year Chemistry Courses: Efficacy and Gender Balance

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A dissertation

presented to

the faculty of the Department of Educational Leadership and Policy Analysis

East Tennessee State University

In partial fulfillment

of the requirements for the degree

Doctor of Education in Educational Leadership

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by

Deidre Johnson

May 2020

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Keywords: Supplemental Instruction, Gender Balance, Academic Support, Learning Center,

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## ABSTRACT

Supplemental Instruction in First-Year Chemistry Courses: Efficacy and Gender Balance

by

Deidre Johnson

Increasing student success and retention rates are top goals for many higher education institutions. Supplemental Instruction (SI) is a widely used academic support program designed to increase students' academic performance and provide students the learning skills they need to persist to graduation. Unfortunately, a lack of time, personnel, and resources often prevent in-depth, meaningful analysis on the effectiveness of SI programs. This study examined the relationship of attending SI sessions for first-year chemistry courses to student grade outcomes and retention rates for attendees. The gender of SI leaders and SI participants was also assessed to determine if leader and participant gender were related to SI attendance, final course grades, or retention.

The results indicated that students who attended SI earned significantly higher final course grades and were retained at significantly higher rates after one and two terms. A positive correlation was discovered between the number of SI sessions attended and final course grades. Significant differences in final grades were demonstrated between students who attended SI and those who did not at all levels of composite ACT scores. Both male and female students showed a preference for gender-matching with their SI leader, but students who attended SI sessions with both male and female SI leaders earned higher final course grades than students who gender-matched with their SI leader and students who only attended SI sessions with an SI leader whose gender differed from their own. No significant differences were found between male and female students for final course grades or retention outcomes.

## DEDICATION

This study is dedicated to my daughter, Isabella. I aspire to serve as a source of support, love, and inspiration for her just as she has for me.

## ACKNOWLEDGEMENTS

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## CHAPTER 1

### INTRODUCTION

The current climate in higher education demands colleges and universities focus increasingly on student success and retention as a means of encouraging students to persist to graduation and reduce the costs of losing and recruiting new students. With endowments shrinking and higher education institutions becoming increasingly reliant on tuition dollars to support operations, it is more important than ever for administrators to focus on how to keep students enrolling each semester and persisting towards graduation. To balance the university's need to retain and support students through graduation with the obligation to maintain rigor and ensure meaningful learning experiences, faculty and staff must work together on creative solutions to accomplish these shared goals.

Traditional academic support programs can be problematic for addressing the large-scale issues of student success and retention. Typical learning center programs such as tutoring and academic coaching tend to operate on a voluntary, drop-in basis offering services geared toward highly specialized content assistance and areas of need associated with high-risk students such as developing time management or study skills. Unfortunately, these learning center programs serve small numbers of students at a high cost per student served. The need for students to self-identify as struggling and seek out help from someone they do not know further decreases the likelihood that the students who most need help will seek it out. Additionally, students tend to use these programs in less effective, reactive ways, e.g. seeking tutors late in the semester only after they have earned failing grades on multiple exams. A more proactive, preventative, and accessible approach is needed to address these issues.

To combat the challenges faced by traditional academic support models, a new type of academic support program, Supplemental Instruction (SI), was developed in the 1970s at the University of Missouri-Kansas City. The SI program was designed to improve student success and retention rates by providing targeted support in historically difficult courses (Martin & Blanc, 1981). Focused on targeting high-risk courses instead of high-risk students, SI offers a cost-effective option for providing intensive assistance where it is needed most. Combining multiple best practices including peer-led instruction, collaborative learning strategies, embedded assistance, and applied learning skills, the model is internationally recognized to increase student academic performance and retention. The SI model is currently employed at thousands of colleges and universities across the world with numerous studies touting its effectiveness at increasing student grades, lowering failure and withdrawal rates, and improving rates of retention and graduation (Dawson, van der Meer, Skalicky, & Cowley, 2014; Martin & Arendale, 1990). While SI is widely considered a wise investment for supporting student success, evaluation of the program's responsiveness to ever-changing student populations has been understudied.

The robust nature of the SI approach comes from the inclusion of multiple best practices in learning. The program aligns with Seidman's (2005) renowned theory of student success in that SI provides an early, intensive, and continuous academic intervention. Having peer leaders attend lectures with students increases the visibility and accessibility of support options and contributes to the sense of community within a classroom as emphasized by Tinto (1997). Peer-assisted learning can benefit students in multiple ways such as creating an environment where students feel more comfortable asking questions, presenting material in a slower pace with less jargon, and establishing a more collaborative and social learning environment than traditional lecture classrooms (Huynh, Jacho-Chavez & Self, 2012; Kieran & O'Neill, 2009; Rayner &

Papakonstantinou, 2018; Topping, 2005). Another component of SI, teaching study skills through the direct application to course content has been shown to be more effective than teaching study skills independently (Arendale, 1994; Burmeister & Martin, 1996; Hurley, Jacobs, & Gilbert, 2006; Martin & Blanc, 1981). Furthermore, the SI approach encourages students to study and review material in deeper, more meaningful ways than they might on their own and encourages student autonomy (Hurley et al., 2006; Brown, Roediger, & McDaniel, 2014; Martin & Arendale, 1990). Participating in SI helps students master challenging course content while strengthening their learning skills.

Most SI programs are subject to some manner of assessment to justify their cost and effectiveness, oftentimes this assessment merely compares the final grades of students who participate in the program to students who do not participate. Few SI programs possess the time, staff, and access to the data required to perform more in-depth analyses. Although several studies have been done to assess the effectiveness of SI for unique populations in a variety of subject areas (such as those of Blanc, DeBuhr, & Martin, 1983; Caldarello, 2017; Hardin, 2012, Martin & Arendale, 1990; Ning & Downing, 2010; and Oja, 2012), modern research into SI has not explored new areas. Additionally, although improved retention rates are touted as a leading outcome of SI participation, few studies assess the long-term impact of SI attendance on retention.

A related yet largely unexplored trend is the disparity between males and females in higher education in terms of overall gender distribution, gender differences in performance, and disparate levels of engagement and motivation. While college was once a strictly male endeavor, changes in American society such as birth control and family planning, later age of marriage, the evolution of family size and motherhood, and more acceptance of women working outside the

home led to women attaining equal representation in college enrollment in the 1980s (Brock, 2010; Goldin, Katz, & Kuziemko, 2006). The upwards trends in female enrollment did not stop after equality was achieved. After a few more decades, women met and then exceeded their male counterparts both in terms of enrollment, academic performance, and college graduation rates (Buchanan & DiPrete, 2006; Conger & Dickson, 2017; Ewert, 2012; Goldin et al., 2006; Sax & Harper, 2007; Wimer & Levant, 2011). This modern gender gap in college pursuit and achievement poses multiple issues for university administrators regarding how to best recruit and retain men.

Many colleges and universities are shifting toward considering males a high-risk population. Some states have even launched initiatives targeted at enhancing the academic success of male students (Johnson, Williams, & Wood, 2015). Although the professoriate remains largely male, especially in the sciences, male students tend to lag behind their female counterparts' performance in the university setting. Men tend to earn lower grades, demonstrate lower levels of motivation and engagement, and earn degrees at lower rates than females (Brock, 2010; Spinath, Eckert, & Steinmayr, 2014). Furthermore, men are less likely to participate in academic support programs that might help improve their academic performance (Wimer & Levant, 2011). Skill gaps between men and women do not magically appear in college; these deficits are often noted at the K-12 level and persist into higher education. However, with a significant portion of institutional funding being based on students' performance, colleges and universities must endeavor to find creative ways to engage and advance their male populations.

Developing robust academic support programs that are effective and appealing to all students is no easy task. A key component of the SI model is that the presence of SI leaders in the classroom serves to promote, normalize, and engage students with the program. With females

comprising the majority of the student body, it can be challenging for such programs to secure qualified and motivated male candidates for roles such as that of the SI leader. This lack of male representation may make it less likely that male students will take advantage of programs such as SI (Good & Wood, 1995). It is unclear if the gender of the SI leader plays a role students' decisions to attend SI sessions. Gender-based stereotypes make it less likely that males will seek help, and the same stereotypes make it difficult for females to be seen as effective SI leaders (Breakwell, Vignoles, & Robertson, 2003; Coder, & Spiller, 2013; Ewert, 2010; Good & Wood, 1995). Furthermore, students may find it easier to develop rapport with a peer of their own gender (Thwaites, 2017). Exploring these notions is critical for mitigating the challenge of encouraging all students to participate in support programs.

In addition to prompting students' decisions to attend SI sessions, little research exists on how the gender of participants and SI leaders influences student academic outcomes such as course grades and retention. At the time of this research, there are no known studies that take into consideration the interaction between the gender of the SI leader and the gender of the student. The present study assesses the relationship of SI attendance to final course grades and retention outcomes in two general chemistry courses at a four-year public university in the Southeastern United States. The relationship of SI leader gender to student attendance at SI sessions and participants' final grades and retention will also be examined.

### **Statement of the Problem**

Increasing student success and retention rates are often touted as top goals for many higher education institutions. Supplemental Instruction is a widely used academic support program designed to increase students' academic performance and provide students the learning skills they need to persist to graduation. Unfortunately, a lack of time, personnel, and resources

often prevents in-depth, meaningful analysis on the effectiveness of SI programs. Additionally, little research exists related to the influence of gender on academic support program attendance and outcomes. This study seeks to assess if attending SI sessions improves student grade outcomes and increases retention rates for attendees. The gender of SI leaders and SI participants will also be examined to determine if leader and participant gender affect SI attendance, grade outcomes, or retention rates.

### **Research Questions**

The following research questions were considered for this study:

#### Research Question 1

Is there a significant difference in final course grades in first year chemistry between students who attend SI and those who did not?

#### Research Question 2

Is there a significant difference in final course grades between males and females who attended SI and males and females who did not attend SI?

#### Research Question 3

Is there a significant relationship between the number of SI sessions attended and final course grades?

#### Research Question 4

Is there a significant relationship in one and two-term retention for students who attended SI compared to those who did not?

#### Research Question 5

Is there a significant difference in one- and two-term retention for males and females who attended SI and males and females who did not attend SI?



#### Research Question 6

Is there a significant relationship between student gender and SI attendance?

#### Research Question 7

Is there a significant relationship between the gender of the SI leader and the gender of students who attended SI sessions?

#### Research Question 8

Is there a significant difference in final course grades among students who gender-matched (attended SI sessions with an SI leader of the same gender) with their SI leader, students who only attended SI sessions with a leader of a different gender, and students who attended SI sessions with both male and female SI leaders?

#### Research Question 9

Is there a significant relationship between student-SI leader gender matching and one- and two-term retention?

#### Research Question 10

Is there a significant difference in final course grades between students with low, middle, and high composite ACT scores who attended SI compared to students with low, middle, and high composite ACT scores who did not attend SI?

### **Significance of the Study**

This study is important because the population of traditionally aged college students is steadily shrinking, and many colleges and universities are struggling to maintain consistent enrollment numbers to justify the size of their operations. Student success and retention will only become more critical to keep the students who have elected to attend an institution consistently enrolling until graduation. In an era of budget cuts, it is imperative to assess the

return on investment for all initiatives to inform fiscal decisions. Additionally, analyzing the impact of SI based on the student and SI leader's gender is a new approach that might provide insight into program design and SI leader staffing to help eliminate the gender gap in academic performance.

### **Definition of Terms**

Key terms are defined so the study can be more fully understood. The following terms are defined as used in this study.

- Course grades: the final letter grade on the student's record. Letter grades were converted to numerical values for analysis using the traditional four point scale used to calculate grade point average where A = 4, A- = 3.7, B+ = 3.3, B = 3, B- = 2.7, C+ = 2.3, C = 2, C- = 1.7, D+ = 1.3, D = 1, F = 0, and W = 0.
- Gender: the category self-reported by the student when applying to the university, either male or female. Because this information was provided by the student, it may or may not align with biological sex. As in Ecklund, Lincoln, and Tansey (2012), because this study is not concerned with differences based on biology, the term gender was used instead of sex throughout this study
- Gender matching: when the gender of the student matches the gender of the teacher, professor, or in the case of the present study, the SI leader (Dee, 2007).
- Retention: whether students re-enrolled in at least one course at the university of study following the semester in which the student was enrolled in the SI-supported course. One-term retention refers to the student re-enrolling one semester after the SI-supported course, e.g., if a student was enrolled in SI-supported general chemistry in fall 2017 and re-enrolled for at least one course at the university during spring 2018. Two-term

retention refers to a student re-enrolling at the university of study two semesters after their participation in an SI-supported course, e.g., if a student was enrolled in general chemistry during the spring 2018 semester, two-term retention would be the student re-enrolling at the university for at least one course during the spring 2019 semester.

- Supplemental Instruction (SI): academic support program developed at UMKC by Deanna Martin which involves a peer leader attending all lectures and conducting study and review sessions every week centered on collaborative learning strategies and helping students develop their study skills by applying learning strategies instruction to course content (Martin & Arendale, 1990). The SI model may be referred to in some studies as Peer Assisted Learning (PAL), Peer Assisted Study Sessions (PASS), or Peer Led Learning (PLL), but these programs may involve some alterations to the traditional SI model (Topping, 2005).

### **Limitations and Delimitations**

The theoretical framework for this study is assumed to be accurate and applicable. It was assumed that students who did not enroll in subsequent semesters left higher education completely, but it is possible these students transferred to another institution. It is also assumed that the methodology adequately addressed the research questions. Additionally, it is assumed that the statistical tests were appropriate and powerful enough to detect differences in the variables if differences were present. Finally, it was assumed that students in the sampling frame were representative of other cohorts at the university being studied.

The present study was delimited to undergraduate college students enrolled in first year chemistry I and II at a public university in the Southeastern United States with both an ACT score and gender on file. Students in these courses without both pieces of information were

excluded from this study. This study is further delimited by the theoretical framework that was selected for the research, as well as the use of letter grades and one- and two-term retention to measure student success. Results from this study may not be generalizable to other settings or populations.

### **Overview of the Study**

Chapter 1 included an introduction to the study, statement of the problem, research questions, significance of the study, and limitations and delimitations. Chapter 2 contains a thorough review of relevant literature. Chapter 3 includes a detailed description of the research methodology. Chapter 4 presents the results of the study. Chapter 5 concludes with a summary and discussion of findings, conclusions, and recommendations for practice and further research.

## CHAPTER 2

### REVIEW OF LITERATURE

Studies from a variety of fields were reviewed in preparation for the present study. Research into supplemental instruction, gender, leadership, and education was conducted, and a variety of historically significant and relevant modern studies were selected for inclusion in this literature review.

#### **Supplemental Instruction History**

Supplemental Instruction (SI) was developed in 1974 at the University of Missouri-Kansas City (UMKC) by a graduate student in education, Martin, who was tasked with finding a cost-effective method to improve the university's low retention rate (Martin & Blanc, 1981). Through a review of the literature and benchmarking with learning center directors across the country, Martin identified several barriers that prevented traditional student support programs from effectively improving student performance. Trends that emerged included the fact that regularly scheduled remedial or developmental courses maintained high DFW rates, were often viewed as an unnecessary addition to heavy course loads, and little evidence was available to suggest that students were successfully transferring the skills from these courses into their regular courses (Arendale, 1994). Additionally, students who needed assistance the most often avoided asking for help, especially in a timely fashion, due to the fear of being stigmatized (Arendale, 1994). Traditional student support such as tutoring, which offers more intensive individual assistance, was expensive, impossible to scale, challenging to evaluate, and many students who sought out tutoring failed to attend regularly.

This research led to the creation of SI center's around a key insight—"skills instruction is best accomplished if applied to specific content" (Widmar, 1994, p. 5). Through that lens Martin

designed a program that combined multiple best practices in academic support including peer-led instruction, the promotion of independent learning, a focus on reducing attrition without relaxing standards or inflating grades, avoided the need for self-identification of seeking help, reduced stigma because there was no remedial association for students, and required little extra effort from faculty members (Martin & Arendale, 1990). Martin's model was also more cost-effective than other programs and provided a more straightforward evaluation model than other support services.

The pilot program for SI began in the School of Dentistry at UMKC and produced positive results (Martin & Blanc, 1981). The program soon received an award from the Health Careers Opportunities Program that allowed SI to be expanded into UMKC's colleges of Medicine and Pharmacy (Martin & Blanc, 1981). Additional grants helped SI continue its expansion across the campus. Almost a decade later, the SI program won certification by the US Department of Education as an *Exemplary Education Program*; this allocated funding that allowed UMKC staff to help implement the SI model at other college and universities (Martin & Arendale, 1990). To date SI is practiced in more than 400 higher education institutions in 30 countries across four continents (UMKC, 2019). The International Center for Supplemental Instruction at UMKC continues to train hundreds of higher education professionals each year to supervise SI programs at higher education institutions around the globe.

### **Program Model**

The SI model centers on using peer leaders to provide targeted academic assistance using collaborative learning strategies. The program is typically used to support "historically difficult" courses where 30% or more of students earn final grades of D, F, or W (Arendale, 1994). The program involves having trained peer leaders attend all lectures of a course section and conduct

regularly scheduled, outside-of-class study and review sessions. These sessions are planned using collaborative, active learning strategies to help students engage with, process, and discuss course content. Embedded learning skills instruction is a fundamental aspect as students learn more effective ways to approach material within the context of the course.

A key component of SI is the focus on high-risk courses instead of high-risk students. This helps eliminate the stigma associated with other types of academic assistance in that it is not remedial and does not require students to seek out help on their own. High-risk, historically difficult courses often share other characteristics including infrequent examinations that focus on higher levels of learning, significant amounts of challenging reading, homework, and studying needed per week, and having high enrollment per section where each student has little opportunity to ask questions or interact with other students (Widmar, 1994). Attaching SI to challenging courses eliminates the need for students to seek out help, makes it clear that many students find the course difficult, and encourages students to take advantage of the convenient assistance provided.

The SI model is also proactive. Because SI is offered beginning the first week of classes, help is available during the important first few weeks of class before the first examination when the rate for dropping the course is highest (Arendale, 1994). Embedding SI leaders in the course helps increase students' awareness of assistance and encourages students to participate before they encounter academic difficulty. This is beneficial because many students do not seek tutoring until after they have demonstrated poor performance, and most early alert programs are not triggered until a student has earned a D or F on an examination, which may not take place until a third or more of the term has passed (Widmar, 1994). Encouraging students to implement strong studying strategies from the beginning of the semester is critical to student success.

Having SI leaders attend all course lectures is another critical part of the SI model. The presence of the SI leader in the lecture serves multiple purposes; it helps students put a name and face to the SI leader, which increases students' familiarity and comfort level, making it more likely that students will seek out the leader's help. It also allows the SI leader to hear the lecture verbatim, so all SI sessions will be tailored specifically to the instructor's approach, style, and wording. The presence of the SI leader in the class allows for more communication with faculty; leaders can inquire about which concepts have been difficult for past students, how the faculty typically structures exam questions, and the leader can also serve as a student-faculty liaison to let the faculty know what students are finding to be confusing. The interaction with faculty not only builds trust with the instructor, but also with students as they feel more confident in the SI leader's ability to provide meaningful assistance.

The structure of SI sessions is also central to the program's success. The majority of SI-supported courses are high-enrollment, lecture-heavy courses, resulting in students often having little opportunity to engage with the material, ask questions, or interact with other students in the course. Because sessions are designed around collaborative learning strategies, SI promotes a high degree of interaction and student support.

### **Supplemental Instruction Efficacy**

Research into the efficacy of SI goes back to the program's creation in the 1970s. A study by Blanc et al. (1983) helped call nationwide attention to the positive effects of the program. To assess SI's impact on student performance and retention, the authors analyzed a sample of 746 undergraduate students in seven high-risk arts and sciences courses. Using past performance and students' self-reported interest in attending SI as motivational controls, the authors observed that students who attended SI earned higher grades, dropped fewer courses, and reenrolled at higher



rates than students who did not attend SI. Blanc et al.'s findings established a precedent for SI program evaluation, and although this study took place several decades ago, their processes are often replicated in current research.

Proponents of SI tout the program's effectiveness at improving grade outcomes and retention. While generally positive, research into the efficacy of SI shows varying levels of success across different types of institutions, subjects, and students. Vorozhbit (2012) examined the effectiveness of SI at a large public research university. Using a sample of almost 12,000 students enrolled in entry-level biology, chemistry, and mathematics between 2006 and 2010, Vorozhbit revealed that SI participants earned higher final course grades in all three courses than non-participants. Additionally, the final course grade was positively correlated with the number of SI sessions attended. Furthermore, SI participants were shown to have a lower mean ACT score than non-participants. Although the author did not examine retention, Vorozhbit's findings align with expectations that participation in SI helps students achieve better grade outcomes, despite having lower entering ACT scores.

A common criticism of many academic support models is that only motivated students seek out assistance, and those motivated students would have likely done better in the course, even without help, than the unmotivated students who did not seek out assistance. Terrion and Daoust (2011) assessed the impact of SI on the academic performance and retention of students after controlling for motivation. The authors distributed the Academic Motivation Scale to first-year residential students enrolled in SI-supported courses. Using attendance data from the SI sessions, the authors created comparison groups between the students who attended SI and those who did not. Terrion and Daoust found that participation in SI did not improve final course grades compared to non-participants, but SI participants were more likely to persist in their

studies. Terrion and Daoust suggested that even if no measurable grade gains occur, SI might function as a form of social support for students, increasingly the likelihood that they will persist beyond the first year.

To further explore the idea that self-selection is a key reason why students who elect to attend SI demonstrate positive outcomes, Paloyo, Rogan, and Siminski (2016) studied the effect of financial incentives offered to students for participating in SI. Because the majority of research into SI is observational instead of experimental, the researchers followed a random encouragement design where a randomly selected group of students in first-year SI-supported courses in Australia was offered money to participate in SI. The financial incentive was shown to increase SI attendance, especially for disadvantaged students. Paloyo et al.'s results indicated students who attended SI consistently earned higher final grades, but the specific effects varied widely, with the most significant increases occurring among students in their first semester. The authors also speculated that this effect might be because SI provides support beyond the classroom such as helping new students make friends.

A similar criticism of academic support programs is that they are more likely to attract higher-performing students than lesser-prepared students who would most benefit from academic support. Furthermore, SI program evaluations most often compare students who attend SI to those who do not attend SI, and other factors which might contribute to student success are not considered. Shaya, Petty, and Petty (1993) examined the effect of supplemental instruction on at-risk biology students. Focusing on a population of students with low high school GPAs, low ACT scores, and other high-risk demographic factors, the researchers uncovered that at-risk students who attended SI earned higher final grades than at-risk students who did not attend SI and successfully completed the course at higher rates than non-attendees (90% versus 32%).

Shaya et al. also concluded that student self-selection did not account for the performance difference between those who elected to attend SI and those who did not.

A more recent study aligns with the purpose of Shaya et al.'s study (1993). Harding (2013) tested if participation in SI for a nursing course enhanced the academic success of at-risk students in nursing. Harding saw that SI had an immediate impact on student grade outcomes, and students who participated in SI were far more likely to be retained and successfully complete the nursing program. Furthermore, Harding noted that course evaluations completed by students who participated in SI were more favorable than those completed by students who did not participate in SI. Although the SI model reviewed in this report did not adhere strictly to the model developed at UMKC, the author emphasizes the importance of identifying high-risk students early and making academic support readily available for them.

One component of SI that is rarely studied is the program's ability to improve students' learning skills. Ning and Downing (2010) investigated how participating SI affected students' academic performance and learning skills. The authors administered the Learning and Study Strategies Inventory to a sample of 430 freshmen business students at the beginning of an SI-supported course. At the end of the course, all students took the inventory again to establish a pre- and post- comparison. Ning and Downing found that students who attended SI sessions demonstrated positive gains in both final course grades and enhanced learning competency. This study provided strong support for the claim that SI enhances both academic performance and learning skills. The researchers' controls for pre-scores and past academic achievement help attribute the gains to the SI intervention instead of selectivity bias.

Science courses are often some of the most challenging courses students will experience in college. Succeeding in first-year science courses is particularly important for students in

many majors because they serve as gateways to continue in a program of study. Lockie, Van Lanen, and McGannon (2013) sought to examine how several predictors of student success affected students' performance on the National Council Licensure Examination-Registered Nurses (NCLEX-RN). The authors assessed the impact of students' learning styles, success in first-year chemistry, and supplemental instruction participation on NCLEX pass/fail rates. Lockie et al. found that while SI attendance had a positive effect on students' chemistry grades, it was not significantly related to higher rates of passing the NCLEX. However, chemistry grades, learning styles, and race emerged as strong predictors of NCLEX performance. While Lockie et al.'s findings supported the idea that SI attendance enhances course performance, the grade gains in the course do not seem to be related to standardized examination performance. Lockie et al.'s study calls in to question the ability of SI to produce long-term effects and the ability of knowledge gained during SI to translate to other environments and conditions. Additional research and replication are needed to understand the longitudinal effects of SI participation.

Oja (2012) sought to examine if SI participation helped students earn higher course grades and made students more likely to persist at the university during the term following their SI support. Assessing a sample of 2005 students enrolled in SI-supported courses for one spring semester including accounting, biology, chemistry, English, geography, history, math, physics, and radiology, the author documented that SI attendance was highly predictive of course grades, with students attending SI performing better in all their courses than students who did not attend. However, Oja's results on retention differ from several studies in that students who attended SI were no more likely to return to the university the next semester than students who did not attend. Despite the lack of support for an influence on persistence, Oja argued that SI remains a valuable support program due to its ability to increase student performance for students of all

ability levels. Further research into the effect of SI participation on attendance is needed, especially in the diverse subject areas represented in this study.

The effectiveness of SI has been assessed in multiple subjects, but the program has been demonstrated to be especially effective in challenging STEM courses. Caldarello (2017) assessed SI's relationship to final course grades in an introductory biology course when considering ACT/SAT scores, high school GPA, and student gender. Caldarello found a statistically significant correlation between final course grades and ACT or SAT scores and HS GPA, a smaller significant increase in final course grades based on the number of SI sessions a student attended, and no statistical significance in performance based on student gender. Caldarello proposed that while SI did seem to increase student performance, the academic preparation indicators were stronger predictors of student success. Additionally, the fact that gender was not shown to influence final course grades is contrary to several studies that indicate the existence of a gender gap in academic achievement.

While SI has been documented to be effective in several conceptual subjects, the effectiveness of the model in problem-solving courses like chemistry is less often examined. Rath, Peterfreund, Bayliss, Runquist, and Simonis (2011) examined the impact of SI on final grades in four chemistry courses: General Chemistry I, General Chemistry II, Organic Chemistry I, and Organic Chemistry II. The authors compared final course grades among groups who attended and did not attend SI with similar academic success predictors including high school GPA and SAT scores. Rath et al.'s results indicated that SI was more effective in General Chemistry I and II than Organic Chemistry I and II. The findings from their study supported the idea that SI might be the most beneficial in introductory-level courses where students have the least experience with material.

## **Reasons for Participating in Supplemental Instruction**

Understanding the reasons students elect to participate in voluntary academic support programs is vital for ensuring programs are communicated and marketed in the most effective way possible. Encouraging participation by the greatest number of students helps more students receive the benefits associated with participation and guarantees the cost effectiveness of SI. Goldstein, Sauer, and O'Donnell (2014) investigated the factors leading to participation in SI in introductory accounting courses. The researchers administered a survey at the beginning of the course based on the Theory of Planned Behavior to assess students' perceptions of attending SI and their behavioral intentions. Goldstein et al. found that students' attitudes toward SI affect their intentions to participate, students' attitudes were influenced by their perceptions that sessions could help them in concrete ways, and influential people could sway students' intent to attend SI. Students with lower expected grades demonstrated stronger helpful attitudes about SI and stronger intentions to participate.

## **Influence of Gender**

Although a great deal of attention and support has been directed towards first year, first generation, and underrepresented student populations, the gender of students is highly predictive of student success. Trends in higher education indicate that females are pursuing education at higher rate than males, and females are more likely to be academically successful than their male peers (Spinath & Steinmayr, 2014; Vianello, Schnabel, Sriram, & Nosek, 2013; Wright, 2003). Additionally, females are more likely to seek out assistance than males, and they are more likely to apply for helping positions such as tutors and SI leaders (Good & Wood, 1995; Nelson, Biernat, & Manis, 1990; Vianello et al., 2013; Wright, 2003). The disproportionate number of

females compared to males reduces the representation of good male role models and may result in males being less inclined to take advantage of academic support (Spinath & Steinmayr, 2014).

Sociological and psychological research has consistently encountered that gender indoctrination plays a role in this phenomenon where females are taught from a young age to gravitate towards more quiet, care-providing activities where males are expected to take more active, loud, and assertive roles (Ellis & Bentler, 1973; Löckenhoff et al., 2014; Vianello et al., 2013). Traits associated with femininity such as patience, attention to detail, and organization all contribute to academic success, whereas traits associated with masculinity such as dominance, strength, and decisiveness are less associated with academic success (Ewert, 2012; Löckenhoff et al., 2014; Palomino & Peyrache, 2010; Vianello et al., 2013; Wright, 2003). Gender role expectations influence not only traits, personality, and career choice, but also behaviors in higher education.

Gender role expectations not only influence individuals' decisions and behavior, but also their perceptions of others. The male advantage in leadership is an oft studied phenomenon that regardless of leadership skills, males are often perceived to be more effective leaders while females are rated unfavorably when they display the strong leadership traits. Previous research has shown people are more likely to seek help from someone of the same gender as themselves (Dee, 2007; Ozogul, Johnson, Atkinson, & Reisslein, 2013; Paredes, 2014). Combined with males being less likely to seek assistance, the predominance of females filling more assistance roles poses challenges for filling SI leader roles with males as well as having female SI leaders being perceived less favorably by their students (Eagly & Karau, 2002; Nelson et al., 1990; Palomino & Peyrache, 2010; Wright, 2003).

## **Gender Gaps in Academic Achievement**

The underperformance of males in an academic setting is not a new trend. However, the exact cause for the gender gap in academic achievement remains unknown. Some researchers point to constraints resulting from gender role stereotypes as the culprit, while others focus their attention on aspects of the educational system. Understanding why males tend to achieve at lower levels may provide guidance into how they can best be supported in collegiate academics.

While colleges and universities often strive for diversity in their student body, most higher education institutions are seeing higher rates of female applications, enrollments, and graduations. Conger and Dickson (2017) explored the causes and potential consequences of gender imbalance in higher education. Using a novel approach of empirically testing gender sensitive admissions practices at a public university in the U.S., the authors uncovered no preference was given to applicants based on their gender. However, a state policy that requires the university to automatically admit students in the top 10% of their graduating class did affect the gender balance of university admissions because 58% of students in the top 10% of their class were female. The gender difference in admissions for minority populations was even more pronounced than the imbalance between white males and females. Conger and Dickson's findings have implications for university administrators, especially related to the legal context of gender-sensitive admissions policies. Given the challenges faced by affirmative action policies, lower admissions standards for males, a historically privileged population, would likely be quite controversial.

Citing the higher rate at which women attain college degrees when compared to men, Buchanan and DiPrete (2006) sought to assess the broad causes of the gender gap in college completion. Comparing trends in 39 years of data from the Current Population Survey, the



authors determined that the standard of living and insurance against poverty returns for higher education attainment for women have steadily risen faster than those for men. Buchanan and DiPrete proposed that economic factors relative to gender-based changes in the value of higher education contribute to women earning more college degrees than men. Their findings are particularly interesting because the researchers do not assess pre-college and college-related factors to explain the gender gap in higher education, but instead focus on the differences in what is gained by attaining a college degree. Men may see less value in persisting to graduation when they can leave college and achieve similar economic returns without investing additional time, effort, and financial resources into higher education. The value of higher education has risen more quickly for women, so females may consider college a worthwhile investment, which increases their motivation to perform well and graduate. While Buchanan and DiPrete looked at the gender gap in higher education achievement from a novel angle, further research is needed to determine if men and women are cognizant of these economic factors when making decisions related to higher education.

Multiple factors contribute to students' perception of and motivation towards academic endeavors. Morris (2008) expanded the research on the educational gender gap by focusing on perceptions of education in rural environments. The author's study consisted of participant observation, student interviews, and a review of school records and related documents at two high schools in Ohio. One school was located in a rural area, and the other was in a more urban location. Following a thorough immersion into each context, Morris discovered an exaggerated gender gap with girls outperforming boys on almost all academic outcomes in the rural location. Investigation into this gap showed boys' underperformance was closely connected with boys' commitment to hegemonic masculinity which considers the act of putting forth effort in school to

be an undesirable, feminine activity. Additionally, the rural context, with high levels of poverty and a lack of diversity, appeared to enhance students' adherence to traditionally masculine ideas such as males preference towards manual labor, patriarchal family roles, and the consideration of stereotypical male traits such as nonchalance and toughness to be superior to academic inclination and goal orientation. Morris's findings support the idea that hegemonic masculinity may be exacerbated in rural locations, further hindering males' academic performance.

To design effective support strategies, a better understanding of the gender gap in college achievement must be attained. Sax and Harper (2006) explored whether gender differences in college students were in place before college or developed during students' time in higher education. Survey data were gathered from 17,637 men and women in 204 colleges and universities upon college enrollment, then participants were surveyed again 4 years later. Of the 19 outcomes assessed, 5 arose from pre-college variables, 2 were attributed to pre-college and college variables, and 12 produced significant gender gaps. Particularly relevant to this study is the fact that men reported higher scores for self-rated mathematical ability, time spent exercising, competitiveness, SAT scores, belief in traditional roles for married women, status orientation, and confidence in leadership abilities. Female participants reported higher rates of attending college for education reasons, feeling overwhelmed, involvement in volunteer work, commitment to social activism, and higher grades. Sax and Harper's findings indicated that many gender differences are present before college, but college experiences may strengthen these inclinations. The scope of this study lends to the credibility of its results, but more research is needed to enhance the understanding of how to better support both men and women in higher education.

Another factor that contributes to disparate levels of success in higher education between men and women is that individuals can take many different pathways through college. Some students take the traditional pathway that leads them straight to college immediately after high school where they enroll as a full time student, live on campus, and graduate in four years. However, many students' pathways diverge from the traditional pathway; individuals may elect to take time off, transfer between institutions, work a full-time job while maintaining a reduced course load, enroll only part-time, or return to college later in life as a non-traditional student. Ewert (2010) assessed gender differences in students who pursued discontinuous and part-time pathways at four-year colleges. Analyzing a large national sample of data from the National Education Longitudinal Study by the National Center for Education Statistics, Ewing extracted significant differences between men and women in three categories. Women were more likely to maintain continuous full-time enrollment, while men were more likely than women to attend part-time or experience a pathway that was disrupted multiple times. Women entered college with higher high school GPAs, while men were found to have higher combined SAT scores. The author posited that academic preparation, as measured by high school GPA, is a significant contributor to the gender gap in college academic performance. Ewing also noted that first-year GPA gaps contribute to students' likelihood to follow a non-traditional pathway, which is likely related to males' under-preparation for college coursework. The findings from Ewert's study are important because they point to the prior academic performance as a reason why men tend to be less successful in college than their female counterparts. Although dated, Ewing's findings suggested colleges must find ways to bridge the gap between males' academic preparation and college expectations.

One explanation for the gender gap in academic achievement is that school is considered, either explicitly or implicitly, to be a feminine endeavor. Heyder and Kessels (2013) examined implicit gender stereotyping of school and how this association affected boys' achievement. The authors administered questionnaires to 122 ninth graders to assess their gender role self-concept, grades in math (a traditionally masculine subject), and grades in language (a traditionally feminine subject). Heyder and Kessels detected that school was only considered feminine by girls, but the stronger the feminine-school association was for boys, the lower their grades in language were. Additionally, the more masculine traits boys assigned to themselves, the lower their grades were in language, but not math. No associations were found between girls' grades, gender self-concept, and school stereotyping. These results support the idea that students who adhere closely to traditional gender roles may struggle in subjects that are often associated with the other gender.

Although women are achieving more equality, disparities still exist in certain types of positions, especially in certain fields. Science largely remains a male-dominated domain, and little research exists into how gender role attitudes affect science education. Breakwell et al. (2003) sought to address this concern by comparing high school students' sex, liking of science, and gender stereotyped traits. Findings indicated that students who liked science rated themselves more positively on feminine and gender non-specific traits. Girls who liked science rated lower on feminine traits, but boys who like science were rated higher in feminine traits. Breakwell et al. recommended that students may view science as a gender neutral field, but enjoying science in school is more closely associated with traditionally feminine traits. Breakwell et al.'s study is relevant because it supports the concept of enjoying learning as a largely female pursuit.

The gender-imbalance in science persists beyond the student level, with faculty and researchers in most fields of science being predominantly male. Despite females entering traditionally masculine fields at increasing rates, equality has not yet been achieved. Ecklund et al. (2012) sought to explore the perceptions of scientists themselves about the underlying causes for gender disparity in the sciences. Using a large sample of survey data collected from 30 high-ranking graduate programs in biology and physics in the United States, the authors revealed that gender was more prominent than the field of study among the reasons participants provided. Both male and participants indicated they preferred to enter a discipline where they felt comfortable and represented. The importance of the availability of good mentors was also a significant contributor to participants' decisions to enter their particular field of study. Physics was more male-dominated than biology, and participants noted the emotional application of biological research aligned more with feminine interests, suggesting a general perception that biology was a better fit for females than physics where research traditionally has fewer emotional implications. Women were also more likely to report experiencing discrimination, and around half of the participants felt females were discouraged from pursuing physics. Ecklund et al.'s findings indicated that women still face barriers in their pursuit of traditionally male endeavors and emphasize the importance of gender representation for reducing this gender segregation.

A contributing factor to academic success is students' self-efficacy. With many university professors shifting toward more technology-driven instructional strategies, students' confidence in navigating technology is especially important. Huffman, Whetten, and Huffman (2013) examined the relationship between technology self-efficacy and gender roles by distributing a survey to 750 undergraduate students at a public university in the U.S. The authors noted that while males reported higher levels of perceived technological ability than females, masculine

gender roles were a stronger predictor of technology self-efficacy than biological sex. Huffman et al.'s study delved into the general notion that males do not perform as well as females in higher education by assessing gender role beliefs, and the findings suggest that males and females might demonstrate higher levels of academic success in technology-heavy courses and fields if they adhere to masculine gender role expectations.

### **Leadership and Gender**

The interaction between leadership and gender is an important factor of consideration for this study. With females composing the majority of the student body at most colleges and universities and males generally being considered a high-risk group, academic support programs must be mindful of how the gender of SI leaders might influence students' willingness to receive assistance. Furthermore, the professoriate remains largely male, especially in the sciences, and female faculty tend to earn less and face more barriers in promotion (Renzulli, Reynolds, Kelly, & Grant, 2013). The complex interaction of leadership and gender in the higher education setting, combined with the fact that female students are more likely to apply for helping/support positions such as that of the SI leader further enhances the need to examine this relationship.

### **Sex and Gender Stereotypes**

In the United States, sex and gender role stereotypes have been slowly evolving for decades. Despite the gradual expansion of traditional sex role standards, sex and gender stereotypes persist. Ellis and Bentler (1973) conducted a study to assess the perseverance of traditional sex role standards and sex stereotypes. Using a sample of 152 college students, the researchers evaluated whether males and females accepted or rejected sex role standards, and then compared the findings with the participants' perceptions of males, females, and themselves. results indicated that female subjects' who rejected traditional sex-role standards perceived

similarity between males and females, perceived themselves as similar to males, and perceived themselves as intelligent. For both males and females, disapproval of traditional sex role standards was related to liberalism, extra legality, and lack of religious association. Additionally, females displayed the largest difference between self-ratings and ratings of other females. The study displayed high internal consistency, but a larger and more diverse sample would have enhanced the generalizability of the findings. Ellis and Bentler's study confirmed the persistence of sex stereotypes and provides a historical basis against which to compare more recent research.

Heilman (1997), a prominent researcher on gender inequality in the workplace, explored sex discrimination in employment settings. The author proposed that organizational practices support and perpetuate sex bias in the workplace, and weighs the pros and cons of introducing affirmative action to address unequal gender representation in top leadership positions. Citing decades of research, Heilman noted that stereotypes are stronger in sex-typed employment fields, settings with ambiguous performance enhance stereotypes, unstructured decision making may result in stereotypes influencing decisions, and stereotypes are emphasized when performance cannot be attributed to the individual. Although no original research was conducted, the author provided a well-supported argument that connects sex stereotypes with workplace discrimination and discusses how affirmative action presents its own set of problems instead of a perfect solution.

Heilman (2012) discussed the influence of gender stereotypes in the workplace. The author differentiates between descriptive and prescriptive stereotypes. Descriptive stereotypes "designate what women and men *are* like," and prescriptive stereotypes "designate what women and men *should be* like" (Heilman, 2012, p.113). The author stated that gender stereotypes

promote gender bias and discrimination due to the perceived lack of fit between feminine gender roles and attributes required to succeed in male-typed employment domains. Heilman also argued that gender stereotypes affect performance expectations and contributes to poor evaluations for women when they either fail to adhere to gender role expectations and when they are perceived to exhibit traditionally masculine characteristics. These factors contribute to the underrepresentation of women in leadership roles, but can also be harmful for men who exhibit traditionally feminine characteristics. Heilman suggested that men may actually receive workplace benefits for entering a female gender-typed career, but may endure attacks to their masculinity as a result. Overall, Heilman adequately supported her position by integrating research from numerous fields, while also highlighting inconsistencies and conflicts about the effects of gender stereotypes in the workplace.

Women enter leadership positions at rates lower than their male counterparts.

Shahtalebia and Yarmohammadian (2012) conducted a qualitative study to explore the barriers women encounter on their rise to top leadership positions. Participants were seven female higher education administrators in Iran. Extensive interviews were conducted with each participant, and three general areas of barriers arose including organizational elements, social elements, and individual elements. Organizational elements was concerned with supervisors' outlook, negative conditions, unfavorable situations, and university policies and procedures. Social elements involved general social problems and a negative societal outlook on female leaders.

Individual Elements encompassed personal problems, family problems, and job problems.

Shahtalebia and Yarmohammadian discovered that participants struggled more with organizational and social elements than individual elements, suggesting the barriers to women's success were largely out of their control. The findings of Shahtalebia and Yarmohammadian's



study are not generalizable, but they do illuminate the challenges encountered by the participants.

With much research indicating that males are preferred in leadership position over females, one might wonder whether this has more to do with sex or gender roles. Sczesny, Spreemann, and Stahlberg (2006) studied the impact of sex and physical appearance on the attribution of leadership skills. In the first study, participants were asked to evaluate the leadership competence of individuals based on photographs and written background information. Results indicated that stimulus people with a masculine appearance were rated higher on leadership qualities than stimulus people with a feminine appearance, regardless of the sex indicated in the description. The second experiment consisted of a recognition test that asked participants to quickly memorize and recall as many characteristics as possible of the person descriptions used in the first experiment. Participants had the option to select additional sex-typed characteristics that were not included in the descriptions. Consistent with the findings from the first experiment, participants ascribed false leadership characteristics more often to stimuli with a masculine appearance than to stimuli with a feminine appearance. Sczesny et al.'s (2006) research was reinforced by the multi-study design, pre-tests, manipulation checks, and indirect measurement to avoid the social desirability bias. However, limitations include small and uniform samples for each experiment that reduce application to other populations. Sczesny et al.'s novel approach of mixing sex and gender role information suggests gender role information may be more important than the sex of the leader, which conflicts with the gender role congruity theory of Eagly and Karau (2002).

## Leadership Stereotypes

A variety of research has indicated that successful leaders are perceived to possess traditionally masculine characteristics. Sczesny (2003) sought to explore this gender stereotype-based view of leadership, termed the *think manager, think male* phenomenon, by examining general sex stereotypes and leadership-specific gender stereotypes, then comparing those against self-perception and how male and female leaders are perceived by others. Descriptive and prescriptive stereotypes were studied in a leadership context in a sample of 215 undergraduate students. Results showed a stereotypical impact on male and female perception of leadership, but there was little difference found between the participants' ranking of leadership characteristics importance. On the self-perception of leadership characteristics, females reported they possessed less task-oriented skills and more person-oriented skills than males. Sczesny's study purports that males and females are in agreement regarding the traits and skills they feel are essential to leadership, but there are discrepancies between the self-reported leadership skills. Sczesny's study does not allow for reasoning behind the ratings; females may have felt more pressure to reduce their own ratings in an effort to appear more feminine.

Bosak and Sczesny (2011) evaluated gender discrimination in leader selection. The researchers asked 107 undergraduate business students in Germany to decide whether or not to hire an imaginary applicant for a managerial position. The applicants were described as being either male or female and currently holding either a leader or non-leader role. The study compared social role theory and gender bias, and a trend emerged that the applicants who currently held a leadership position were hired more often than those who did not currently possess a leadership position regardless of gender. However, when participants were not provided social role information, male applicants were hired more often than female applicants,

but only by male participants. The study followed a strong factorial design that helped ensure homogeneity among participant groups. Manipulation checks confirmed participants were making the desired inferences from the provided applicant information, and the methodology replicated the hiring process well. However, the lack of diversity among participants, small sample size, and limited cultural context of the study reduces its overall generalizability. Bosak and Sczesny suggested that women may experience difficulty entering leadership roles, especially if they are being assessed by a male.

Prior research has indicated that women who attain leadership positions tend to be evaluated more harshly than males. Exploring this idea, Pratch and Jacobowitz (1996) gauged the effect of leader gender, coping ability, and motivation on followers' evaluations of leadership efficacy. Results indicated significant differences existed in ratings of motivation; men were rated as showing higher levels of agentic motivation and women were rated as showing more social motivation. Women who exhibited high levels of agentic traits were negatively perceived as leaders, but there was no difference between men who exhibited social and agentic qualities. Overall, traits demonstrated more often by males were rates as being more effective for leadership. Pratch and Jacobowitz's article contained multiple strengths: an in-depth literature review, a diverse theoretical foundation, and detailed write-ups of methodology and limitations. Limitations for each aspect of the study were identified by the authors and addressed. The findings of their study are in line with expectations as males tended to be evaluated as better leaders no matter what type of qualities they exhibited, but females were rated lower if they displayed masculine leadership qualities. Pratch and Jacobowitz's study is consistent with expectations about gender-based leader evaluations, but the findings suggest that gendered leadership behavior may be more flexible for males than females.

Martell and DeSmet (2001) also examined how leaders of different sexes were perceived as they sought to evaluate beliefs about men and women's leadership abilities from a novel perspective by using a diagnostic-ratio measurement strategy. A sample of 151 managers judged the effectiveness of their superiors' leadership behaviors across 14 categories. Ratings for leader behavior varied depending on the sex of the leader and the behavior being rated. A same-gender rating bias was exhibited by participants as males tended to rate males better and females tended to rate females better. When provided with explicit evidence demonstrating manager success, participants' ratings were only varied slightly from the general trends, suggesting stereotypes may play a significant role in determining evaluations. The study's findings are in line with previous research, logic, and expectations. Measuring real-life perceptions of leaders in their natural environment, novel measurement instrument, and well-presented data are strengths of this article. Weaknesses include unequal proportions of male and female participants and studying the phenomenon only inside the university setting. The study was unable to account for differences among leaders such as style, gender role congruent behaviors, and many other factors. Martell and DeSmet's study highlighted novel effects in followers' perceptions of leader behavior as the results showed a same-sex rating bias, demonstrating a need to further investigate the relationship between leader sex and follower sex.

Given the historical association between leadership and males, one might wonder how females who enter leadership roles are perceived, and if the ideas about female managers are consistent among men, women, employees, and students. Balgiu (2013) explored the way female managers are perceived by employees and non-employees. The author administered a measure of attitudes towards women as managers to three samples: 46 employees in a multinational company, 116 management students, and 131 students studying fields other than

management. Results indicated that males from all samples displayed less acceptance for female managers. Female management students exhibited the highest degree of favorability towards female managers. Balgiu's study implied that males may adhere more to traditional gender and leadership stereotypes that are unfavorable to women. Females from this study were generally more accepting of women in management positions, but this research only measured explicit attitudes. It is possible that a higher degree of bias would be exhibited towards female managers due to the desire of respondents to be politically correct. Additionally, the participants' explicit attitudes may vary from implicit attitudes and behaviors. Despite the applicability issues, the study was strengthened by its comparison of multiple diverse samples. Balgiu's research provided a foundation upon which other researchers can build and expand by comparing different types of attitudes and behaviors, as well as replication with other measures and populations.

With the majority of leadership research being conducted in the business-oriented organizational environment, one might wonder if different leadership environments were more accepting of female leaders. Madden (2011) conducted an extensive literature review to assess if gender stereotypes influenced leadership in higher education. Research from multiple fields was examined including social psychology, organizational development, gender stereotypes, leadership styles, and leadership efficacy. Madden experienced that dichotomous stereotypes of leadership, including friendliness versus competence and agentic style versus communal style, contribute towards negative stereotypes and prejudice towards female leaders who tend to be perceived as friendly and more communal than their male counterparts. The author reported that research on leadership in higher education was similar to that of other fields. Although Madden did not contribute an original study, the novel comparison of multiple areas of expertise

indicated that gender stereotypes shape how people processed information, which affects whether or not the same behavior will be perceived as effective. Madden's review of literature relating to gender and leadership in higher education resulted in findings that were comparable to those conducted in the business sector, suggesting that gender bias is an issue in multiple employment fields. Further studies conducted in other employment domains would help confirm these findings, especially in traditionally sex-typed fields like education, nursing, and the military.

With the strong connection established between gender and leadership, Braun et al. (2012) sought to test how leader gender, attraction, and style affected follower trust and loyalty. The study involved 253 undergraduate students who were randomly assigned to one of eight experimental conditions in a between-subjects research design. Photographs presented in each imaginary leader's curriculum vitae manipulated gender and attractiveness, and vignettes manipulated dimensions of transformational and transactional leadership styles, as well as communication style. Results indicated no negative effects for males, but attractiveness resulted in negative effects for female leaders with a transformational leadership style. Braun et al.'s study provided a comprehensive literature review and clear hypotheses. Extensive pre-tests enhanced the validity and reliability of the measures employed by the researchers. A detailed account of the methodology guarantees ease of replication, and multiple cross-checks validated the authors' constructs. Limitations of the study primarily center on the lack of diversity among participants and the cultural context of the study. Replication with varied populations and photographs of participants is necessary to improve generalizability. Braun et al.'s findings are in line with the propositions of the gender role congruency theory and research that suggests physical attraction is a negative asset for females attempting to secure a leadership position.

Research into gender inequality in the workplace has for decades supported the concept of a “glass ceiling,” an invisible barrier that prevents females in male-dominated fields from attaining high level leadership roles. Furthermore, in 1992, Williams coined the term “glass escalator” to refer to advantages males receive in traditionally female-dominated fields where males ride an invisible escalator to top roles despite the majority of individuals in the field being female. An example of the glass escalator phenomenon would be that although the vast majority of elementary school teachers are female, a significantly higher proportion of principals are male. Williams (2013) revisited her notion of the “glass escalator” two decades later to determine if the concept still applies in today’s rapidly changing workplaces. Citing the modern lack of stability in employment compared to past generations, the dissolution of traditional career ladders, and diminishing support for public institutions, Williams analyzed trends in the oil/gas and retail industries. The author’s findings advised that the previous research into the “glass escalator” failed to account for intersectionality. Williams emphasized the importance of researchers considering the influence of race, sexuality, and social class, noting that those in a minority group or facing additional disadvantages or discrimination did not experience the gender-based benefits proposed by the “glass escalator” theory.

### **Gender Role Congruency**

With traditional gender roles being prevalent and persistent, how well people match the expected roles for their gender is likely to impact how others perceive them. Eagly and Karau (2002) proposed the role congruity theory, that stated females who do not conform to traditional feminine stereotypes will experience prejudice. In leadership roles, this prejudice will result in women being perceived less favorably than men as applicants for leadership roles. Additionally, evaluative behavior performed by women will be received in a less positive manner than

evaluative behavior performed by men. The role congruity theory describes why attitudes towards female leaders, it is more difficult for females to become leaders, and why females have a more difficult time achieving success in leadership roles. Eagly and Karau (2002) condensed information and evidence from a wide variety of fields to create a unified theory to explain multiple phenomenon. The authors' novel assertion is consistent with the leadership evaluation findings of Bosak and Sczesny (2011), Madden (2011), and Pratch and Jacobowitz (1996). The congruency of individuals with their gender role expectations provides a potential explanation for why females continue to be underrepresented in leadership roles and proceed to encounter difficulties once a leadership position is obtained.

Although the number of women in leadership positions has increased, the majority of leadership positions, especially upper leadership positions and those in male dominated employment fields, are filled by males. One possible explanation for this disparity is the way women are evaluated in leadership positions. Hoyt and Burnette (2013) examined gender bias in the evaluation of leaders by applying a combination of role congruity theory and implicit theory. The goal of the researchers' two studies was to establish a more complex understanding of factors that contribute to female leadership biases, especially in terms of leader evaluations. The authors surveyed 147 undergraduate students and measured the participants' implicit person theories and attitudes towards female authority figures before they evaluated two political candidates, one male and one female. Results indicated that participants who supported traditionally feminine gender roles demonstrated biased evaluations of the female political candidate. The authors replicated their methodology with new participants and received similar findings. This study contained several strong points: strong theoretical foundation, use of established measures, and well-designed methodology. However, the use of college students



limits the generalizability of results as groups of different ages and experiences may have vastly differing attitudes. Hoyt and Burnette's (2013) findings are in line with gender role congruity theory of Eagly and Karau (2002), and the authors' additional assessment of gender role attitudes provided a solid connection between beliefs and evaluative behavior of the participants.

Most studies that assess how followers evaluate leaders focus solely on traits and behaviors associated with effective leadership. Rojahn and Willemsen (1994) went a step further as they sought to examine if leaders would be rated as more likeable and effective if they behaved in gender-role congruent ways. A large sample of Dutch undergraduate students was asked to read a scenario where a leader emerged among a small group. Participants received one of four scenarios that manipulated the gender of the leader and leadership style used as either task-oriented or socio-emotional. Findings indicated that female participants exhibited no bias, and male participants judged gender-role incongruent leaders as less effective than gender-role congruent leaders. Strengths of the study include a strong experimental design, adequate sample size, and manipulation checks to ensure validity; however, the lack of diversity in the sample and cultural context of the study reduce the applicability of the findings to other populations. Rojahn and Willemsen's (1994) results showed similar elements to those of Martell and DeSmet (2001) in terms of males exhibiting more gender bias than females, except in this study no significant bias was exhibited by female participants. Male participants in this study also demonstrated the gender role congruity bias like the results of Hoyt and Burnette (2013) and Eagly and Karau (2002). Current research exhibits mixed findings about whether or not female followers reliably demonstrate gender role congruity bias in their evaluations of leaders.

Goktepe and Schneier (1989) examined how sex, gender role characteristics, and attractiveness worked together to predict emergent leaders. Participants included 122 college

students who were divided into 28 sexually heterogeneous groups with between 3 and 7 people. The groups worked together for either 6 or 15 weeks depending on course length, and every group performed the same set of sex neutral tasks. Results showed no significant difference in the number of men and women who emerged as leaders through group election. However, group members who exhibited masculine gender role characteristics became emergent leaders more often than those who exhibited feminine characteristics, regardless of sex. Leaders additionally received significantly higher attractiveness ratings than non-leaders. This study's methodology was unique because it allowed groups to select their own leaders without outside influence, but groups were not consistent in terms of males, females, or size, which likely reduces the reliability and validity of findings. Another concern is that students were allowed to create their own groups. Goktepe and Schneier supported the idea that adherence to masculine gender role characteristics is more important than a person's sex when determining leadership potential, which fits well with gender bias ideas, but not the gender role congruity theory. Their study demonstrated that all leaders, regardless of gender, were more physically attractive than non-leaders, and this clashes with Braun et al.'s findings that attraction is harmful for females in leadership roles.

### **Female Punishment for Success**

Not only have females experienced challenges attaining leadership roles, they often encounter obstacles once reaching a leadership position. It has been proposed that women not only face disadvantages in leadership, but also that females are actively punished for entering the leadership domain. Heilman, Wallen, Fuchs, and Tamkins (2004) sought to explore reactions to males and females leaders in a male gender-typed job when the leader's performance was either ambiguous or clearly successful. The researchers conducted three separate studies with a total of

242 participants where each participant rated a male and female leader with varying performance levels. Results indicated that when the female leaders' performance was successful, the female was less liked and personally derogated more frequently. Heilman et al. (2004) emphasized that this female punishment occurs to higher degrees in male gender-typed domains, and the negative consequences can lead to biased evaluations and unfair recommendations and resource allocation. This study emphasized the importance of dispelling stereotypical ideas of males and females, and supports the idea that females may encounter additional bias after they enter leadership roles.

Research has long documented disparities between the pay, perceptions, and performance evaluations of male and female leaders, with females of comparable qualifications and experience levels earning less than their male counterparts and females facing harsher evaluations for exhibiting the same leadership traits for which males were praised. One proposed explanation for this disparity is that women might be less reliable and committed employees due to their potential to bear children, resulting in work being or becoming less of a priority than their family. Additionally, gender role stereotypes promote the idea of women as being kind, understanding, and nurturing, and women who exhibit the traditionally masculine traits associated with leadership (such as decisiveness, strength, and assertiveness) face harsher evaluations due to their failure to adhere to feminine gender role stereotypes. Benard and Correll (2010) explored the idea that workplace evaluators discriminate against successful mothers by rating them more negatively than non-mothers who exhibit the same traits. The researchers asked 260 participants to evaluate the files of two applicants for a midlevel marketing position. The applicant files presented to the participants varied the candidates' gender, parental status, and past performance ambiguity. Benard and Correll observed that overall, mothers were found to be

less competent and committed to their work than fathers or male and female candidates without children. Additionally, successful mothers faced the harshest evaluations, particularly from female evaluators. This penalty for mothers, likely a consequence of the sense of female-female competition due to the perceived likelihood of limited opportunities of success among women, makes it even more difficult for females to maintain success once it has been achieved.

### **Leadership Context**

Much research has centered on the preference for male leaders, but Ryan et al. (2010) argued that leadership preferences may vary based on the leadership context. Based on the think manager-think male stereotype, Ryan et al. studied the glass cliff phenomenon, described as the idea that “women are more likely than men to be appointed as leaders in time of poor company performance” (p. 470). The first study found that characteristics of successful company managers were associated with masculine stereotypes. The second study indicated that ideal managers of unsuccessful companies were associated with female stereotypes. The third study detailed that women were preferential for periods of poor company performance, not for their skills to remedy the situation, but instead due to their perceived ability to handle people and willingness to receive the blame for failure. Ryan et al.’s findings were reinforced by their multi-study design, but the online methodology and self-report measures weaken the validity and generalizability of the results. Additional research is needed to determine if leadership context affects gender-based leader preferences.

The military is another sex-typed employment field where the majority of members are males. Recent innovations have led to a larger number of females attaining leadership positions in the military, but once females attain such leadership they often encounter other challenges. Looney, Robinson-Kurpius, and Lucart (2004) examined military leadership evaluations to

explore the relationship between the sex of the leader and the sex of the evaluator in terms of leadership evaluations used for promotions to lieutenant. Participants included 108 mid-ranking naval leaders who completed measures about their attitudes towards women and masculinity, then read a fitness report about either a male or female candidate. The fitness reports were the same except for gender and names. Participants were asked to rate the candidate for promotion and leadership skills. Results indicated that male candidates were rated as having fewer leadership characteristics related to emotion, but overall, recommendation for promotion were based on positive leadership characteristics. Looney et al.'s (2004) study indicated that evaluators exhibited stereotypical characterizations of male and female candidates' leadership skills, but no bias was shown in the subsequent promotion recommendations. A methodological flaw in this study was that the fitness reports described traditionally masculine-associated leadership traits such as firmness, commitment, conscientiousness, and determination. The traits appeared to be the focus of the evaluations, not the sex of the leader. The confounding interaction of sex, leadership traits, and role expectations makes it difficult to determine the meaningfulness of the results. Further replication is needed with varying leadership traits to assess the relationship between sex and leadership evaluations.

### **Gender Role Congruity**

Eagly and Karau (2002) proposed a theory of prejudice toward female leaders based on their congruity to traditional gender role expectations. According to the authors, gender roles are a social construct that encompass beliefs about the attributes of men and women; furthermore, these social expectations describe qualities that are desirable for each sex. The behaviors and traits assigned to form stereotypes for both men and women, with expectations for women centering on being nurturing, sensitive, and kind, and expectations for men encompassing

assertiveness, decisiveness, and resiliency. Qualities of good leaders most closely align with traditionally masculine traits. Eagly and Karau put forward the notion that adherence to gender role expectations causes women to be perceived less favorably as potential leaders and causes women who demonstrate strong leadership traits to be evaluated less favorably because those behaviors do not align with feminine gender role expectations. This theory remains a cornerstone in the study of the influence of gender role expectation in leadership.

Trickey (2011) explored role congruity theory and its application to leader performance evaluations in community college settings. Trickey conducted a mixed-methods study to investigate the relationships between evaluator attitudes, gender role biases, evaluation practices, perceptions of leader efficacy and success, and leader persistence at two community colleges. The findings supported the idea that females face prejudice in leadership roles due to gender role expectations negatively affecting the evaluation, advancement opportunities, and persistence of female community college leaders. The author suggested that despite possessing identical competencies and achievements, men were attributed with greater social significance and higher competence levels than women, and that women who exhibited successful leadership traits experienced biases in the evaluation of their leadership abilities. Although more research is needed in more diverse settings and regions, this study suggests that leadership remains a problematic area for females. It is unclear exactly how the SI leader role is viewed by students considering it is a complex blend of leadership, teaching, and support; however, the notion of potential prejudice against female leaders might affect the number of students who are willing to voluntarily attend an SI session led by a female.

## **Gender and Help-Seeking**

Traditional gender roles can affect both males and females in a negative manner. While women may have difficulty attaining status and power usually attributed to males, men may experience social punishment and psychological discomfort for displaying behaviors and traits typically ascribed to females. One such example of this phenomenon is the unwillingness of men to seek help. While jokes abound about men's aversion to asking for directions, the real-life consequences of avoiding seeking help can be severe.

Rigid gender role expectations can be restrictive and harmful for both men and women. Seeking to test the hypothesis that college men experience higher levels of gender role conflict, Good and Wood (1995) proposed that college males would experience increased instances of depression and more negative attitudes towards seeking counseling services. A sample of 397 traditionally aged male college students was obtained from a large, public university in the midwestern United States. Participants were administered the Gender Role Conflict Scale, Center for Epidemiological Studies Depression Scale, and the Attitudes Toward Seeking Professional Psychological Help Scale. Good and Wood documented that male gender role conflict was strongly related to men's attitudes toward seeking counseling help and their experiences of depression. The vigorous measurements using tested scales speaks to the validity of the authors' findings, but more current studies with diverse populations would clarify if Good and Wood's findings remain a significant issue with modern college students.

Citing the prevalence of mental issues and serious consequences of failing to seek help, Wendt and Shafer (2015) examined the connection between gender and help-seeking attitudes. Using data from the 2006 General Social Survey, responses from 927 men and women on the mental health module of the survey were assessed. Wendt and Shafer found that men and

women were equally likely to endorse help seeking from informal sources such as family, friends, or religion for the two issues examined, schizophrenia and depression. However, men were less likely to support formal help seeking from a mental health professional, psychologist, or physician for people with depression. The results supported the notion that men display lower likelihood of seeking professional help, especially for what they perceive to be an invisible, easily cured, or less serious issue. Wendt and Shafer's findings emphasize the importance of men's perception of issues in relation to their attitude about seeking help. Extending this notion to the field of higher education might help reduce the barriers to men's help seeking.

One proposed explanation for men's avoidance of help arises when traditional gender role beliefs conflict with what a person wants or needs. This gender role conflict involves cognitive and emotional discomfort that arise when one's desires conflict with what is traditionally expected of one's gender. Yousaf, Popat, and Hunter (2015) explored the connection between masculinity attitudes, gender, and attitudes toward psychology help-seeking. The authors distributed the Male Role Norms Inventory and Inventory of Attitudes Toward Seeking Mental Health Services to a sample of 124 diverse participants who were voluntarily recruited from the London area. Results indicated that the stronger participants' beliefs in traditionally masculine gender roles, the more likely they were to avoid psychology help seeking. Furthermore, men adhered more strongly to traditional gender stereotypes than women, and younger participants reported lower levels of psychological help-seeking than older participants. Yousaf et al.'s findings support the notion that gender, particularly a commitment to traditional gender role adherence, reduces the likelihood of psychological help seeking due to the pressure for men to tolerate pain, solve their own problems, and avoid expressing emotions. These factors likely contribute to male students' disinclination to seek academic support. Furthermore, the



notion that younger people are less likely to seek help than older people, while surprising, is relevant to this study because the younger participants' beliefs likely align most closely with the beliefs held by traditionally college-aged students. The authors postulated that older individuals may have more experience with and exposure to mental health issues as well as an increased awareness of the value of help-seeking. Further research in the academic sector, especially with students of many ages, is needed for a more informed view of the phenomenon.

One area that can be negatively affected by avoiding help is academics. Wimer and Levant (2011) examined the relationship between men's adherence to traditional masculine ideologies and their willingness to seek help in college courses. Using a sample of 178 men enrolled in psychology courses, the researchers assessed the participants' conformity to masculine norms and their attitudes toward receiving academic assistance. Wimer and Levant detected that the higher men scored on measures of masculinity, the higher their scores were on avoiding help. Two measures of masculinity, self-reliance and dominance, were shown to strongly associate with the avoidance of help-seeking. The findings from this study align with other research that suggests traditional gender role adherence can contribute to the lack of willingness among men to seek assistance. Given that dominance was identified as one of the factors with the strongest association to avoiding help, it follows that men may be even less likely to receive help from a female, especially if that female is viewed as a subordinate.

Miller (2017) sought to explore how college students' multiple identities, such as gender identity, socioeconomic status, race, and ethnicity affected help-seeking behaviors. For Miller's study, help-seeking behavior was defined as using counseling services when needed. Drawing upon data from the 2010 University of California Undergraduate Experience Survey, a diverse sample of 17,801 students from multiple institutions in California was selected. The most

notable finding from Miller's study that as income level dropped, so did students' usage of the counseling center. This held true across all genders and races/ethnicities. Students with moderate to low income were also more likely to demonstrate need for counseling services as well. Miller also showed that males, particularly minority males, were slightly less likely to self-report using counseling services. Strengths of this study included the large sample size and consideration of multiple factors that contribute to an individual's identity. Similar studies conducted across different locations would be helpful for determining the generalizability of the findings.

Wright (2003) examined the attitudes of male undergraduate students in developmental mathematics toward peer tutoring. The researcher conducted interviews with 15 male participants including undergraduate math tutors, students enrolled in developmental math who attended tutoring, and students enrolled in developmental math who did not attend tutoring. Multiple significant trends emerged from Wright's interview data including male students not wanting to ask for help because it damaged their pride, males demonstrating a general lack of engagement, energy, and motivation for course work, males self-handicapping themselves (described by participants as laziness), and males perceiving attending tutoring as a loss of status. Additionally, male tutors strongly preferred working with female clients due to their experience with females coming more prepared and being more willing to ask questions. However, opinions were mixed about whether male students preferred male or female tutors. Some respondents indicated no preference about the gender of their tutor, but slightly more students preferred male tutors. Male students who preferred male tutors noted that they felt males were more relatable, more laid back, and more trustworthy than female tutors. Male students who preferred female tutors indicated that they were more comfortable getting help from a female due to the alleged

lack of dominance/power struggle during tutoring. Wright's research supports the idea that males are less likely to seek academic assistance than females and suggests that the majority of males might be more comfortable getting help from other males. Additional research is needed to determine the prevalence of these trends in other contexts.

The specific context and population for gender research can affect research outcomes as expectations and beliefs can vary widely among different groups and locations. Johnson, Harris, and Peters (2013) investigated how student athletes used tutoring services. Analyzing a sample of 1,297 individuals over a three-year period, the authors uncovered that overall females participated in more hours of tutoring than males. Additionally, females were more likely to meet with fewer tutors but met with those tutors more regularly. Males sought out tutoring less often, and they met with the same tutors less consistently. Johnson et al.'s findings support the idea that females are more likely to seek out help than males. Additionally, females might prefer to develop deeper relationships with their tutors whereas males view tutoring as more functional in nature and care less about receiving help from a specific person.

### **Gender Matching**

Gender matching is the idea that people tend to prefer or benefit from interacting with someone of the same gender in some contexts. Research into gender matching occurs in a variety of fields for many purposes, and little agreement in the literature exists about whether gender matching is beneficial. Despite a lack of consistent evidence into the efficacy of gender matching, gender does appear to factor into people's preferences and decision-making processes.

### **Student-Teacher Gender Matching**

One factor thought to contribute to the gender differences in educational outcomes is how interactions with teachers affect students' academic performance. Dee (2007) examined how

being assigned to a teacher with the same gender influenced student academic achievement, teacher perception of student performance, and student engagement. Using data from the National Education Longitudinal Study, Dee experienced that students with a same-gender teacher exhibited significant improvements in achievement, and teachers' perception of student performance and engagement increased. Results suggest that gender matching positively influences classroom dynamics with student expectations aligning more closely with teacher expectations. This study followed participants during the 8<sup>th</sup> and 9<sup>th</sup> grades, so it is unclear how these findings might apply to college-age students.

Education is a common field for gender matching research, especially in primary school where the majority of educators are female and young males tend to underperform compared to their female peers. Cho (2012) examined the influence of teacher-student gender matching on academic achievement. Using data from an international study on trends in mathematics and science achievement in 15 countries, observations of more than 200,000 early high school students were assessed. Although some achievement differences were noted, 11 out of 15 countries saw no significant benefit in achievement when the teacher-student gender was matched. Cho's findings indicated there is little universal benefit for gender matching students and teachers, but the study notes that cultural beliefs and variations in teacher content mastery, teaching experience, skill, and personality are difficult to assess and control in the research environment.

Women outnumber men in K-12 teaching roles. While gender equality advocates note the lower status and pay levels of primary school teachers, critics question how this feminization of school and the lack of male role models affects young male students. Driessen (2009) sought to determine whether teacher gender influences student achievement, attitudes, and behavior.

Using longitudinal data from a large cohort study, the interactions of more than 6000 teachers and 5000 students were assessed. Although Driessen hypothesized that the feminization of schools would negatively affect male students, results of the analyses indicated that teacher sex had no significant impact on the achievement, attitude, or behavior of students. A weakness in Driessen's study is that it relied on data that was more than a decade old at the time of publication, and the study's location, the Netherlands, may be difficult to generalize to American populations. Regardless, Driessen's outcomes conflict with the findings of Dee (2007) but align with those of Cho (2012). Further research is needed into the benefits or drawbacks of gender-matching to understand what factors may play a role in the interaction between teacher and student gender.

Although little agreement exists between studies, the notion persists that gender matching between students and teachers results in increased achievement for students. Paredes (2013) assessed the impact of gender-matching on 119,489 eighth grade students in Chile using national education evaluation data. Results indicated that having a female teacher had a significant, positive effect for girls, but having a male teacher did not result in achievement gains for boys. Paredes further examined possible mechanisms for this performance difference including teacher bias, self-selection, and role model influences, and determined that role model influences were the most probably cause because the effect was only significant in subjects with lower proportions of female teacher and there was no achievement change in those subjects for girls whose mothers had attained higher levels of education. This study highlights that gender representation may be significant in subjects that are dominated by teachers with a different gender than their student.

## **Gender Matching and Learner Choice**

Most naturally occurring learning environments do not permit students to have a choice in whether they are educated by a male or female. Ozogul et al. (2013) explored whether learners would demonstrate a preference for gender matching with animated pedagogical agents in a computer-based environment while learning about electrical circuitry. The authors also assessed whether differences in learning outcomes and perceptions would be obtained based on learner choice. Overall, students significantly preferred an agent that matched their own gender. The researchers also found that female students rated programs higher when the agent matched their gender, and male students rated programs higher when the pedagogical agent did not match their gender. Additionally, when learners were given a choice of agent, they earned higher grades and rated the programs higher than did students who were randomly assigned an agent. Ozogul et al.'s findings aligned with those of Dee (2007) and Parades (2013) in finding that females benefit from a female pedagogical agent in the scientific environment. However, males' higher ratings for female agents may be reflective of the majority of their K-12 teachers being female, resulting in males being more comfortable with a female teaching dynamic. A noteworthy finding is that when students were given a choice of agent, they were more satisfied and performed better regardless of the gender of their agent. Simply having a choice between a male and female educator appears to result in students being more motivated and engaged with the educator.

## CHAPTER 3

### RESEARCH METHOD

The nature of inquiry for this study was quantitative because it was the best fit for the study's topic, purpose, and research questions. Quantitative methodology allowed for an objective evaluation of the connections between the variables of interest. This study's research questions are concerned with measurable grade, retention, and attendance variables, so quantitative methods were a logical choice. The existing literature related to the field of interest also relies primarily on quantitative methods to establish relationships between variables. A quantitative approach will allow a test of the theoretical expectations about performance, retention, and expected attendance outcomes.

#### **Research Questions**

This study explored the following research questions and their corresponding null hypotheses:

Research Question 1: Is there a significant difference in final course grades in first year chemistry between students who attend SI and those who did not?

Ho1: There is no difference in the final course grades for first year chemistry students who attended SI and those who did not.

Research Question 2: Is there a significant difference in final course grades between males and females who attended SI and males and females who did not attend SI?

Ho2<sub>1</sub>: There is no significant difference in final course grades between males and females who attended SI.

Ho2<sub>2</sub>: There is no significant difference in final course grades between males and females who did not attend SI.

Research Question 3: Is there a significant relationship between the number of SI sessions attended and final course grades?

Ho3: There is no significant relationship between the number of SI sessions attended and final course grades.

Research Question 4: Is there a significant relationship in one and two-term retention for students who attended SI compared to those who did not?

Ho4<sub>1</sub>: There is no significant relationship in one-term retention for students who attended SI and those who did not.

Ho4<sub>2</sub>: There is no significant relationship in two-term retention for students who attended SI and those who did not.

Research Question 5: Is there a significant difference in one and two-term retention rates for males and females who attended SI and those who did not?

Ho5<sub>1</sub>: There is no significant difference in one-term retention rates for females who attended SI and those who did not.

Ho5<sub>2</sub>: There is no significant difference in two-term retention rates for females who attended SI and those who did not.

Ho5<sub>3</sub>: There is no significant difference in one-term retention for males who attended SI and those who did not.

Ho5<sub>4</sub>: There is no significant difference in two-term retention for males who attended SI and those who did not.

Research Question 6: Is there a significant relationship between student gender and SI attendance?

Ho6: There is no significant relationship between student gender and SI attendance.



Research Question 7: Is there a significant relationship between the gender of the SI leader and the gender of students who attended SI sessions?

Ho7: There is no significant relationship between the gender of the SI leader and the gender of the students who attended SI sessions.

Research Question 8: Is there a significant difference in final course grades among students who gender-matched (attended SI sessions with an SI leader of the same gender) with their SI leader, students who only attended SI sessions with a leader of a different gender, and students who attended SI sessions with both male and female SI leaders?

Ho8: There is no significant difference in final course grades among students who gender-matched with their SI leader, students who only attended SI sessions with a leader of a different gender, and students who attended SI sessions with both male and female SI leaders.

Research Question 9: Is there a significant relationship between student-SI leader gender matching and one- and two-term retention?

Ho9<sub>1</sub>: There is no significant relationship between student-SI leader gender matching and one-term retention.

Ho9<sub>2</sub>: There is no significant relationship between student-SI leader gender matching and two-term retention.

Research Question 10: Is there a significant difference in final course grades between students with low, middle, and high composite ACT scores who attended SI compared to students with low, middle, and high composite ACT scores who did not attend SI?

Ho10<sub>1</sub>: There is no significant difference in final course grades between students with low composite ACT scores who attended SI and students with low composite ACT scores who did not attend SI.

Ho10<sub>2</sub>: There is no significant difference in final course grades between students with middle composite ACT scores who attended SI and students with middle composite ACT scores who did not attend SI.

Ho10<sub>3</sub>: There is no significant difference in final course grades between students with high composite ACT scores who attended SI and students with high composite ACT scores who did not attend SI.

### **Population and Sample**

The population for this study was undergraduate students at a mid-sized public university in the Southeastern United States who were enrolled in first year chemistry courses, General Chemistry I and General Chemistry II, during the fall 2017, spring 2018, fall 2018, and spring 2019 semesters. The sample included all students in the selected courses during the indicated time period who had a gender, ACT score, and final course grade on file with the university (n = 1704). Appendix A shows the distribution of composite ACT scores for students in the sample. Students taking these courses were primarily majoring in biology, chemistry, or health sciences. Most students in these areas of study have intentions of pursuing graduate or professional school. The mean age of participants was 20 with a range of 17 - 45 years. The majority of students in these courses were in their first or second year of study at the college level.

### **Data Collection**

Archival data from two sources were used for the present study. Student information including gender, composite ACT score, one-term and two-term retention, and final course

grades was provided by the university's Office of Institutional Research. Gender was self-reported by students on their application to the university. Information about SI attendance and SI leader gender was provided by the university's learning center that houses, funds, staffs, and manages the SI program. Data about attendance at SI sessions were collected via paper sign-in sheets distributed at every SI session. Attendance data were entered onto a central attendance record all SI-supported courses by learning center staff. Participants were coded by the SI coordinator to indicate whether they attended SI sessions with a male SI leader, female SI leader, or both male and female SI leaders during each semester they were enrolled in an SI-supported course. All identifying data were removed by the Office of Institutional Research prior to the researcher accessing and analyzing the data. Data were secured on a password protected spreadsheet and kept in a locked desk drawer in the researcher's home office.

### **Data Analysis**

Parametric statistical methods were used to analyze the research questions. All statistical analyses were conducted using IBM-SPSS version 26. For Research Question 1, an independent samples t test was used. Research Question 2 employed two independent samples t tests to assess the difference in final course grades for students between (1) males and females who attended SI and (2) males and females who did not attend SI. A Pearson's correlation coefficient was used for Research Question 3 to explore the relationship between the number of SI sessions attended and final course grades. A chi-square test using crosstabs was conducted for Research Question 4 to determine if differences existed in one and two-term retention for students that attended SI compared to students who did not. For Research Question 5, chi square tests using crosstabs were used to assess if a significant difference arose in one and two-term retention rates for males and females that attended SI and those that did not. Research Question 6 relied upon a

chi-square test using crosstabs to assess the relationship between student gender and attendance at SI sessions. Research Question 7 engaged a chi square test using crosstabs to evaluate the relationship between the gender of SI leaders and gender of SI attendees. A one-way analysis of variance (ANOVA) was conducted for Research Question 8 to explore the relationship between student-SI leader gender matching and final course grades. Research Question 9 relied on a chi-square test using crosstabs to evaluate the relationship between student-SI leader gender matching and one- and two-term retention. Independent samples t tests were used for Research Question 10 to compare the difference in final course grades for students who attended SI and those who did not for groups of students with low, middle, and high composite ACT scores.

## CHAPTER 4

### RESULTS

The purpose of this study was to evaluate the relationship between attendance at SI sessions and final course grades for students enrolled in general chemistry courses at a mid-sized public four-year university in the Southeastern United States. The relationship between SI session attendance and one- and two-term retention was also assessed. In addition, the connection between student gender, SI leader gender, final course grade, and one- and two-term retention was examined. The study explored nine research questions. This chapter presents the research questions, corresponding null hypotheses, data analyses, and results.

The sample consisted of 1,704 undergraduate students enrolled in general chemistry I or general chemistry II during the fall 2017, spring 2018, fall 2018, and spring 2019 semesters who had an ACT score on file with the university. There were 988 female students (58%) enrolled in the selected courses during this period and 716 male students (42%). The range of composite ACT scores was 13 to 36. Supplemental Instruction (SI) was offered for each course section, with a variety of session times for students to attend. Attendance at SI sessions was voluntary, and students received no incentives for attending. Sessions were offered on a consistent schedule each semester, and equal numbers of SI sessions were offered by male and female SI leaders. Students were considered “SI attendees” if they attended three or more sessions per semester, and 654 students (38%) met that attendance criteria, with the remaining 1,050 students (62%) attending fewer than two SI sessions.

#### **Research Question 1**

Is there a significant difference in final course grades in first year chemistry between students who attended SI and those who did not?

Ho1: There is no difference in the final course grades for first year chemistry students who attended SI and those who did not.

An independent samples t test was conducted to evaluate Ho1. The independent variable, SI attendance, included two levels: students who attended three or more SI sessions during the semester were included in the SI group, and students who attended two or fewer sessions formed the non-SI group. The dependent variable was final course grade where letter grades were converted to numerical values using a four point scale to calculate GPA where A = 4, A- = 3.7, B+ = 3.3, B = 3, B- = 2.7, C+ = 2.3, C = 2, C- = 1.7, D+ = 1.3, D = 1, F = 0, and W = 0. Levene's test for equality of variances was significant  $F(2, 1,702) = 234.04, p < .001$ , so equal variance was not assumed. The test was significant  $t(1694) = -26.56, p < .001$ , therefore Ho1 was rejected. Students who attended SI ( $M = 2.84, SD = .88$ ) earned higher final grades than students who did not attend SI ( $M = 1.42, SD 1.31$ ). The 95% confidence interval for the difference in means with equal variances not assumed was -1.52 to -1.31. Figure 1 displays the boxplots for each group.

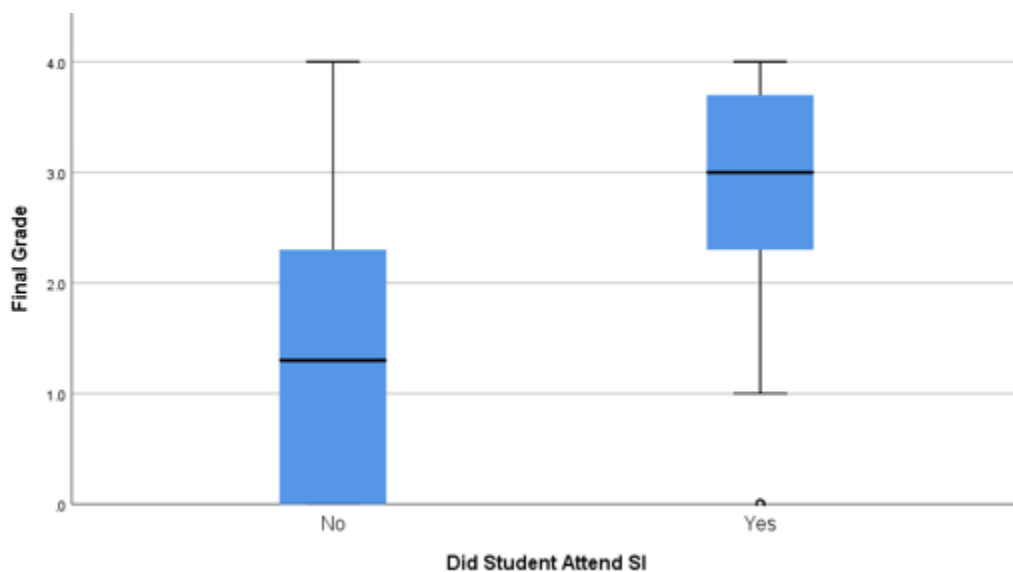


Figure 1. Boxplots of final course grades for SI attendees and non-SI attendees

## Research Question 2

Is there a significant difference in final course grades between males and females who attended SI and males and females who did not attend SI?

Ho<sub>21</sub>: There is no significant difference in final course grades between males and females who attended SI.

Ho<sub>22</sub>: There is no significant difference in final course grades between males and females who did not attend SI.

An independent samples t test was conducted to evaluate Ho<sub>21</sub>. The independent variable, student gender, included two levels (male, female), and the dependent variable was final course grade where letter grades were converted to numerical values using the four-point scale used to calculate GPA as indicated in RQ1. SI attendance (yes, no) was used a grouping variable. Levene's test for equality of variances was not significant  $F(2, 652) = 2.06, p = .151$ , so equal variance was assumed. The test was not significant  $t(652) = .50, p = .618$ , therefore Ho<sub>21</sub> was not rejected. Little difference was exhibited between the final course grades of males and females who attended SI.

A second independent samples t test was conducted to evaluate Ho<sub>22</sub> to examine if significant differences exist between the final grades of male and female students who did not attend SI. Levene's test for equality of variances was not significant  $F(2, 1,048) = .16, p = .694$ , so equal variance was assumed. The test was not significant  $t(1,048) = -.21, p = .837$ , therefore Ho<sub>22</sub> was not rejected. Little difference was depicted between the final course grades of males and females who did not attend SI. Table 1 shows the mean final course grades for males and females who attended SI and those who did not.

Table 1.

*Mean Final Course Grades by Gender and SI Attendance*

SI Attendance	Female		Male	
	<u>M</u>	<u>SD</u>	<u>M</u>	<u>SD</u>
Attended SI	2.85	.87	2.81	.89
Did Not Attend SI	1.42	1.31	1.43	1.31

### **Research Question 3**

Is there a significant relationship between the number of SI sessions attended and final course grades?

Ho3: There is no significant relationship between the number of SI sessions attended and final course grades.

A Pearson correlation coefficient was calculated to assess the relationship between the number of SI sessions attended and final course grades. The independent variable, number of SI sessions attended, represented the total number of SI sessions a student attended during one semester. The dependent variable, final course grade, involved the numerical equivalent of final letter grades as described in research question one. The results were significant ( $N = 1,700$ ,  $r = .41$ ,  $p < .001$ ), therefore Ho3 was rejected. The mean number of SI sessions attended among students who attended SI was 6.28 with a range of 3 to 35 sessions and standard deviation of 4.30. The mean final course grade for SI attendees was 2.83 with a standard deviation of .88. A moderate, positive correlation was found between the two variables, indicating that the more SI sessions students attended the higher their final course grade was likely to be.

### **Research Question 4**

Is there a significant relationship in one and two-term retention for students who attended SI compared to those who did not?



Ho4<sub>1</sub>: There is no significant difference in one-term retention for students who attended SI and those who did not.

Ho4<sub>2</sub>: There is no significant difference in two-term retention for students who attended SI and those who did not.

A chi-square test using crosstabs was conducted to explore Ho4<sub>1</sub> and determine whether there was a difference in one-term retention between students who attended SI and those who did not. One-term retention is defined as students who enrolled in at least one credit hour for the term following the semester in which they were enrolled in an SI-supported course, i.e. one-term retention for students in CHEM 1110 during fall 2017 would be reenrollment during spring 2018 and one-term retention for students in CHEM 1110 during spring 2018 would be reenrollment during fall 2018. SI attendance and one-term retention were shown to be significantly related, Pearson  $\chi^2(1, N = 1,704) = 66.38, p <.001$ . Therefore, Ho4<sub>1</sub> was rejected. Of the students who attended SI, 97% were retained after one term. For students who did not attend SI, 85% were retained after one term.

A chi-square test using crosstabs was conducted to explore Ho4<sub>2</sub> and determine whether there was a difference in two-term retention rates between students who attended SI and those who did not. Two-term retention is defined as students who enrolled in at least one credit hour two terms after the semester in which they were enrolled in an SI-supported course, i.e. two-term retention for students in CHEM 1110 during fall 2017 would be reenrollment during fall 2018 and two-term retention for students in CHEM 1110 during spring 2018 would be reenrollment during spring 2019. SI attendance and two-term retention were found to be significantly related, Pearson  $\chi^2(1, N = 1,353) = 118.57, p <.001$ . Therefore, Ho4<sub>2</sub> was rejected. Of the students who attended SI, 96% were retained after two terms. For students who did not attend SI, 72% were

retained after two terms. Table 2 shows the comparison between one- and two-term retention for students who attended SI and students who did not attend SI.

Table 2.

*One- and Two-Term Retention for SI Attendees and Non-Attendees*

SI Attendance	One-Term Retention		Two-Term Retention	
	<u>Retained</u>	<u>Not Retained</u>	<u>Retained</u>	<u>Not Retained</u>
Attended SI	637 (97%)	17 (3%)	501 (96%)	23 (4%)
Did not Attend SI	894 (85%)	156 (15%)	595 (72%)	234 (28%)

### **Research Question 5**

Is there a significant difference in one- and two-term retention for males and females who attended SI and males and females who did not attend SI?

Ho5<sub>1</sub>: There is no significant difference in one-term retention for females who attended SI and females who did not attend SI.

Ho5<sub>2</sub>: There is no significant difference in two-term retention for females who attended SI and females who did not attend SI.

Ho5<sub>3</sub>: There is no significant difference in one-term retention for males who attended SI and males who did not attend SI.

Ho5<sub>4</sub>: There is no significant difference in two-term retention for males who attended SI and males who did not attend SI.

A chi-square test using crosstabs was conducted to explore Ho5<sub>1</sub> and determine whether there was a difference one-term retention rates between females who attended SI and those who did not. SI attendance and one-term retention for female students were revealed to be significantly related, Pearson  $\chi^2(1, N = 988) = 42.23, p < .001$ , Cramer's V = .21, therefore Ho5<sub>1</sub>

was rejected. Overall, 91% of females who attended SI were retained after one term whereas 85% of females who did not attend SI were retained after one term.

A chi-square test using crosstabs was conducted to explore Ho5<sub>2</sub> and determine whether there was a difference two-term retention rates between females who attended SI and females who did not. SI attendance and two-term retention for female students were found to be significantly related, Pearson  $\chi^2(1, N = 988) = 73.71, p < .001$ , Cramer's V = .31. Therefore, Ho5<sub>2</sub> was rejected. Overall, 96% of females who attended SI were retained after two terms, and 72% of females who did not attend SI were retained after two terms.

A chi-square test using crosstabs was conducted to explore Ho5<sub>3</sub> and determine whether there was a difference one-term retention rates between males who attended SI and those who did not. SI attendance and one-term retention for male students were shown to be significantly related, Pearson  $\chi^2(1, N = 716) = 24.17, p < .001$ , Cramer's V = .04, therefore Ho5<sub>3</sub> was rejected. Overall, 97% of males who attended SI were retained after one term, and 85% of males who did not attend SI were retained after one term.

A chi-square test using crosstabs was conducted to explore Ho5<sub>4</sub> and determine whether there was a difference two-term retention rates between males who attended SI and those who did not. SI attendance and two-term retention for male students were discovered to be significantly related, Pearson  $\chi^2(1, N = 575) = 44.61, p < .001$ , Cramer's V = .03. Therefore, Ho5<sub>4</sub> was rejected. Overall, 95% of males who attended SI were retained after two terms, and 71% of males who did not attend SI were retained after two terms.

### **Research Question 6**

Is there a significant relationship between student gender and SI attendance?

Ho6: There is no significant relationship between student gender and SI attendance.

A chi-square test using crosstabs was conducted to determine if a relationship existed between student gender and SI attendance. The results of the test were not significant,  $\chi^2(1, N = 1,704) = 3.60, p = .058$ , therefore Ho6 was not rejected. Approximately 58% (N = 988) of the sample was female and 42% (N = 716) was male. SI attendees accounted for 38.38% (N = 654) of the sample, 61.62% (N = 1,050) of the sample did not attend SI. Overall, females were slightly more likely to attend SI than males, with 40.25% (N = 398) of females attending SI and 35.75% (N = 256) of males attending SI, but the result was not statistically significant.

### **Research Question 7**

Is there a significant relationship between the gender of the SI leader and the gender of students who attended SI sessions?

Ho7: There is no significant relationship between the gender of the SI leader and the gender of the students who attended SI sessions.

A chi-square test using crosstabs was conducted to explore the relationship between the gender of SI attendees and the gender of SI leaders. The results of the test were significant, Pearson  $\chi^2(3, N = 646) = 228.43, p < .001$ , therefore Ho7 was rejected. Of the participants who attended SI, 41% (N = 266) attended SI sessions with only a female SI leader, 30% (N = 194) attended SI sessions with only a male SI leader, and 29% (N = 185) attended SI sessions with both male and female SI leaders. Significant differences were shown between male and female SI attendees. For female SI attendees, 59% (N = 230) attended only sessions with female SI leaders, 9% (N = 35) attended only sessions with male SI leaders, and 32% (N = 127) attended sessions with both male and female SI leaders. Among male SI attendees, 14% (N = 36) attended SI sessions led only by females, 63% (N = 159) attended SI sessions led only by males, and 23%

(N = 58) attended SI sessions led by both males and females. Both male and female participants were more likely to attend sessions with an SI leader of the same gender as the participant. Males were slightly more likely than females (14% versus 9%, respectively) to attend SI sessions with an SI leader of a different gender, and females were more likely than males (32% versus 23%, respectively) to attend sessions with both male and female SI leaders.

### **Research Question 8**

Is there a significant difference in final course grades among students who gender-matched (attended SI sessions with an SI leader of the same gender) with their SI leader, students who only attended SI sessions with a leader with a different gender, and students who attended SI sessions with both male and female SI leaders?

Ho8: There is no significant difference in final course grades among students who gender-matched with their SI leader, students who only attended SI sessions with a leader with a different gender, and students who attended SI sessions with both male and female SI leaders.

A one-way analysis of variance (ANOVA) was conducted to evaluate the relationship between final course grades and SI leader gender. The independent variable, SI leader gender, included three groups: students who attended SI sessions only with an SI leader of the same gender, students who only attended sessions with an SI leader of a different gender, and students who attended SI sessions with both male and female SI leaders. The dependent variable, final grade, was the final course letter grade translated to the standard four-point scale to produce a numerical value. The ANOVA was significant,  $F(2, 645) = 7.04, p = .001$ , therefore Ho8 was rejected. The effect size, as assessed by  $\eta^2$ , was small (.02). A post-hoc Tukey HSD test was conducted to evaluate differences between groups. Significant differences were noted with the

mean final grades of students who attended SI sessions with both male and female leaders being higher than the grades of students who gender-matched with their SI leader ( $p = .044$ ) and students who only attended SI sessions with an SI leader of a different gender ( $p = .001$ ). No significant differences were noted in final course grades between students who gender matched with their SI leader and those who attended SI sessions only with a leader with a different gender than their own ( $p = .059$ ). Overall, students who attended SI sessions with both male and female SI leaders tended to earn higher final course grades than students who gender matched with their SI leader and students who did not gender match with their SI leader.

### **Research Question 9**

Is there a significant relationship between student-SI leader gender matching and one- and two-term retention?

Ho9<sub>1</sub>: There is no significant relationship between student-SI leader gender matching and one-term retention.

Ho9<sub>2</sub>: There is no significant relationship between student-SI leader gender matching and two-term retention.

A chi-square test using crosstabs was conducted to assess the relationship between student-SI leader gender matching and one- and two-term retention. For one-term retention, the results of the test were not significant,  $\chi^2(2, N = 645) = .49, p = .785$ , therefore Ho9<sub>1</sub> was rejected. The results for two-term retention were also not significant  $\chi^2(2, N = 526) = .50, p = .778$ , resulting in Ho9<sub>2</sub> not being rejected. Among those who attended SI, there was little demonstrated relationship between retention after one and two terms and the gender of the SI leader.

### Research Question 10

Is there a significant difference in final course grades between students with low, middle, and high composite ACT scores who attended SI compared to students with low, middle, and high composite ACT scores who did not attend SI?

Ho10<sub>1</sub>: There is no significant difference in final course grades between students with low composite ACT scores who attended SI and students with low composite ACT scores who did not attend SI.

Ho10<sub>2</sub>: There is no significant difference in final course grades between students with middle composite ACT scores who attended SI and students with middle composite ACT scores who did not attend SI.

Ho10<sub>3</sub>: There is no significant difference in final course grades between students with high composite ACT scores who attended SI and students with high composite ACT scores who did not attend SI.

For Ho10<sub>1</sub>, an independent samples t test was conducted to compare the difference in mean final course grades for students in the low composite ACT group who attended SI and students in the low composite ACT group who did not attend SI. The low composite ACT group (N = 177) was comprised of students who earned a composite ACT score between a 13 and 19. Levene's test for equality of variances was not significant  $F(175) = .13, p = .717$ , so equal variance was assumed. The test was significant  $t(175) = -10.32, p < .001$ , therefore Ho10<sub>1</sub> was rejected. Students in the low ACT group who attended SI (M = 1.82, SD = .83) earned significantly higher final grades than students who did not attend SI (M = .48, SD .79). The 95% confidence interval for the difference in means was -1.63 to -1.11.

For Ho10<sub>2</sub>, an independent samples t test was conducted to compare the difference in mean final course grades for students in the middle composite ACT group who attended SI and students in the middle composite ACT group who did not attend SI. The middle composite ACT group (N = 1,282) was comprised of students who earned a composite ACT score between a 20 and 29. Levene's test for equality of variances was significant  $F(1, 280) = .176.97, p < .001$ , so equal variance was not assumed. The test was significant  $t(1,280) = -23.45, p < .001$ , therefore Ho10<sub>2</sub> was rejected. Students in the middle ACT group who attended SI (N = 507, M = 2.79 SD = .81) earned significantly higher final grades than students in the same group who did not attend SI (N = 775, M = 1.34, SD = 1.22). The 95% confidence interval for the difference in means with equal variance not assumed was -1.56 to -1.33.

For Ho10<sub>3</sub>, an independent samples t test was conducted to compare the difference in mean final course grades for students in the high composite ACT group who attended SI and students in the high composite ACT group who did not attend SI. The high composite ACT group (N = 245) was comprised of students who earned a composite ACT score between 30 and 36. Levene's test for equality of variances was significant  $F(243) = .46.56, p < .001$ , so equal variance was not assumed. The test was significant  $t(175) = -10.32, p < .001$ , therefore Ho10<sub>3</sub> was rejected. Students in the high ACT group who attended SI (N = 96, M = 3.62, SD = .50) earned significantly higher final grades than students in the same group who did not attend SI (N = 149, M = 2.67, SD = 1.21). The 95% confidence interval for the difference in means with equal variance not assumed was -1.17 to -.73. Table 3 shows the differences in means for each ACT group. Appendix B shows the distribution of composite ACT scores for students who attended SI and students who did not attend SI, and Appendix C shows the mean final course grade by SI attendance and composite ACT scores.



Table 3.

*Final Course Grades for Students with Low, Middle, and High Composite ACT Scores*

SI Attendance	Low ACT		Middle ACT		High ACT	
	<u>M</u>	<u>SD</u>	<u>M</u>	<u>SD</u>	<u>M</u>	<u>SD</u>
Yes	1.82	.83	2.79	.81	3.62	.50
No	.45	.79	1.34	1.22	2.67	1.21
Mean Difference	1.37		1.45		.95	

## CHAPTER 5

### SUMMARY, CONCLUSIONS, AND RECOMMENDATIONS

Chapter five presents a summary and discussion of the results. Connections to past research are included as well as conclusions of the present study. Chapter five concludes with recommendations for practice and further research.

#### **Summary and Discussion of Results**

Several research questions for this study produced statistically significant results. For Research Question 1, an independent samples t test found significant differences in final course grades between students who attended SI and students who did not attend SI. Students who attended SI earned higher final course grades than students who did not attend SI. These findings align with the majority of research into the effectiveness of SI as an academic support program for increasing course grades as was demonstrated in the studies of Blanc et al. (2013), Caldarello (2017), Harding (2013), Ning and Downing (2010), Rath et al. (2011), Shaya et al. (1993), and Vorozhbit (2013). This finding conflicts with Terrion and Daust's 2011 study which found that SI attendance did not improve course grades, although it did improve retention and persistence. Overall, this finding is logical as it would be expected that students who seek out assistance and participate in focused study opportunities earn higher grades than students who do not.

The relationship between the number of SI sessions attended and students' final course grades was evaluated by calculating a Pearson's correlation coefficient for Research Question 3. The results were significant, indicating a positive relationship of moderate strength. These findings are reasonable in that the more SI sessions a student attended, the more likely they were to earn a high grade in the course, regardless of composite ACT score. This aligns with the findings of Arendale (1994), Blanc et al. (1983), Harding (2013), Vorozhbit (2012) and Widmar

(1994), who indicated the importance of students attending SI on a regular basis to achieve the best outcomes. The positive correlation between SI session attendance and final course grades in the present study replicates Vorozhbit's (2012) findings and supports the usefulness of SI as an academic support program.

The fourth research question sought to explore the difference in one and two-term retention rates for students who attended SI compared to those who did not. The results of the analyses indicated there was a significant relationship between SI attendance and both one- and two-term retention, with students who attended SI being more likely to be retained than students who did not attend, regardless of composite ACT score or final course grade. This finding supports the idea that attending SI has a positive relationship to student retention as found by Terrion and Daust (2012), and conflicts with the findings of Oja (2012) who documented that SI attendance improved course outcomes but not retention. Furthermore, the impact on retention demonstrated in this study was stronger after two terms than it was after one term, indicating that students who attended SI experienced more long-term success than those who did not attend.

For Research Question 5, the difference in one- and two-term retention rates for males and females who attended SI and those who did not was assessed using a series of chi-square test using crosstabs. Overall, significant differences in retention rates were found between those who attended SI and those who did not for both males and females. Again, SI attendance was shown to be the strongest predictor of retention, and no significant gender-based differences in retention were shown for either male or female students. These findings conflict with those of Buchanan and Diprete (2006), Conger and Dickson (2017), and Sav and Harper (2006) who demonstrated that females tend to outperform their male counterparts, be retained at higher rates, and earn degrees at higher rates than males.

The seventh research question explored the relationship between the gender of the SI leader and the gender of students who attended SI sessions. A chi-square test using crosstabs found significant differences in the number of students who gender-matched with their SI leader, students who attended only SI sessions with an SI leader with a different gender, and students who attended SI sessions with SI leaders of both genders. Overall, students were most likely to attend SI sessions with a female SI leader (60% of attendees). Both male and female students showed a strong preference for attending SI sessions with an SI leader who matched their gender. Females (32.4%) were more likely than males (22.8%) to attend SI sessions with both male and female SI leaders. The significance of the preference for student gender-matching with their SI leaders parallels the findings of Dee (2007), Paredes (2013), and Ozogul et al. (2013), who emphasized students' preference for gender-matching. Students' overall preference toward female SI leaders aligns with the research of Ozogul et al. who noted that females may be preferred for roles that coincide with traditionally feminine stereotypes such as education and support roles.

Research Question 8 assessed the difference in final course grades between students who gender-matched with their SI leader and those who did not using a one-way ANOVA. The ANOVA was significant, and post-hoc tests found that students who attended SI sessions with both male and female SI leaders demonstrated the highest final course grades compared to students who gender-matched with their SI leaders and students who attended SI sessions only with an SI leader with a different gender than their own. This supports the research of Cho (2012) and Driessen (2012) who noted that students did not improve their outcomes when they gender-matched with their educator. This result is particularly interesting because Research Question 7 found that students strongly preferred to gender-match with their SI leader, yet

students who attended SI sessions with multiple leaders of both genders demonstrated significantly higher final course grades. However, it should be noted that students who attended SI sessions with multiple leaders tended to attend more SI sessions overall compared to students who only attended SI sessions with leaders of one gender.

Research Question 10 involved conducting independent samples t tests to compare the final grades of students who attended SI and those who did not at different composite ACT levels. The results indicated that SI attendance produced statistically significant results for all ACT levels. These findings support the research of Caldarello (2017), Oja (2012) and Shaya et al. (1993), who experienced that SI improved outcomes for students across levels of academic preparation. This research question addressed a common criticism of many academic support programs—the idea that only strong, more prepared students take advantage of support programs. Because students who enter college with higher levels of academic preparation are more likely to be successful, some may be concerned that support programs are not effective at improving the outcomes of less prepared students. The present study’s consideration of composite ACT scores as an indicator of academic preparation is relatively novel, and the data analysis indicated that when comparing students with similar composite ACT scores, the students who attended SI earned higher final course grades than those who did not attend. The results support the efficacy of SI to improve student outcomes across preparation levels.

Three research questions from this study did not produce statistically significant results, Research Questions 2, 6, and 9, and these questions all involved gender-based differences in performance. Research Question 2 explored if there was a significant difference in final course grades for males and females who attended SI and those who did not. No significant difference was found between the final course grades of males and females. This result conflicts with the

findings of Buchanan and Diprete (2006), Conger and Dickson (2017), and Sav and Harper (2006) who observed that females tended to outperform their male counterparts in the college. Attendance at SI sessions was found to be a much stronger predictor of final course grades than was student gender, so this support may have reduced any gender-based differences in student outcomes. The fact that science has long been a male-dominated field, as noted in Breakwell et al. (2003) and Ecklund et al. (2012), may have also helped equalize academic performance between males and females.

Research Question 6 was concerned with the difference in the proportion of male and female students who attended SI compared to the proportion of males and females enrolled in the course. The results of a crosstabs chi-square test indicated that females were slightly more likely to attend SI, but the test statistic was not significant. Similar to the findings of Buchanan and Diprete (2006), Conger and Dickson (2017), and Sav and Harper (2006), more females than males were enrolled in general chemistry courses than males, and females were slightly more likely to attend SI than males. This is comparable to the findings of Good and Wood (1995), Johnson et al. (2013), Wendt and Shafer (2015), Wimer and Levant (2011), Wright (2003), and Yousaf et al. (2015) who presented that males were less likely to take advantage of support than females. However, the lack of statistical significance suggested this gender imbalance may be less of an issue than previously expected. Furthermore, the availability of male SI leaders may have encouraged more males to attend SI sessions, helping to close the anticipated gap in male participation. Given that the results from this study were close to being statistically significant at the .05 level ( $p = .058$ ), additional research with more populations is needed to better understand how pervasive this issue might be across different subject areas.

The ninth research question examined the relationship between student-SI leader gender matching and one- and two-term retention. A crosstabulation chi-square test of these variables was not significant, indicating that little difference in retention was found based on whether students gender-matched with their SI leader or not. This aligns with the findings of Cho (2012) and Driessen (2012) who reported no significant benefits for students who gender-matched with their teacher. Despite the difference shown in Research Question 8 related to students who attended SI sessions with both male and female SI leaders earning significantly higher final course grades, this benefit does not seem to carry over to retention as no significant differences were found in this analysis. However, this may mean that students who attended SI with any SI leader received the translatable learning skills needed to impact retention rates.

### **Conclusions**

Overall, this study aligns with much of the research on SI. The present study showed a strong relationship between SI attendance and final course grades, with students who attended SI earning final course grades that were significantly higher than students who did not attend SI across a range of composite ACT scores. Furthermore, students who attended SI were more likely to be retained one and two terms after the semester in which they attended SI, and the retention benefits of attending SI were stronger two terms after attending SI than they were one term after attending the SI-supported course. The majority of the findings from this study coincide with the existing body of literature that promotes SI as an effective academic support program for enhancing student performance in challenging courses and improving retention rates.

The present study's inclusion of gender as a factor for study illuminates a new area of exploration in both SI and gender studies literature. There were little to no differences in

outcomes between males and females in the course as students who attended SI performed better academically and were retained longer than students who did not attend SI, regardless of gender. However, when taking the gender of the SI leader into consideration, a few statistically significant differences emerged. Students were more likely to attend SI sessions with an SI leader that matched their own gender. Relatively few students attended only SI sessions with an SI leader whose gender differed from their own. Interestingly, students who attended SI sessions with both male and female SI leaders, regardless of their own gender, tended to earn higher final course grades than students who gender matched with their SI leader and students who attended SI sessions with an SI leader with a different gender. Students who attended sessions with multiple SI leaders were likely exposed to a variety of perspectives and instructional styles, and this may have increased their understanding and comprehension of course content.

### **Recommendations for Practice**

This study paves the way for several practice recommendations for practice at higher education institutions. Administrators, faculty, and staff should strive to make evidence-based practice decisions, and the findings from this study support several suggestions for best practices.

Institutions without SI should consider piloting the program for historically difficult courses with high failure or withdraw rates. The majority of research into SI, including this study, supports the effectiveness of SI programs for improving student outcomes. With most schools having student success and retention as top institutional goals, SI is likely a worthwhile investment. Robust SI programs provide an integrated peer-led academic success initiative that encourages more students to take advantage of assistance, and these types of programs also create leadership and professional development opportunities for the students who serve as SI leaders.



A second recommendation for practice is for college and universities with SI programs to devote time for an in-depth analysis and assessment of their SI programs. With budgets tightening at many institutions, it is critical that support programs justify their existence and demonstrate their value. Program administrators must look beyond simple grade comparisons and show who SI is helping and how. Longitudinal studies that emphasize the long-term impact of SI attendance may be helpful, and partnering with faculty can be useful for establishing pre- and post-tests to measure student gains in other areas such as study skills and increases in content knowledge. It is also vital that programs find ways to tell their data-driven story in a manner that appeals to faculty and administrators.

A third recommendation for practice is for faculty and staff to work together on marketing SI to students and encouraging participation. As this study demonstrated a positive correlation between the number of SI sessions attended and final course grade, getting students to attend more SI sessions would likely be more beneficial to the students' success. Furthermore, students are more likely to take advantage of SI assistance if their instructor frequently mentions the assistance and clearly supports attendance. Partnerships between SI administrators and faculty are invaluable for developing the trust and working relationships that lead to better student outcomes.

While this study found little gender-based difference in student performance, students did appear to prefer to attend SI sessions with a leader of the same gender. The final recommendation for practice related to this study is that administrators should strive to recruit and hire SI leaders that are representative of the student population. Gender appears to be one salient factor, but other institutional demographics should be considered. Having a variety of SI leaders to choose from, with each having unique characteristics and instructional styles, will

likely appeal to the diverse student population and help students feel like their SI leaders are representative and relatable.

### **Recommendations for Further Research**

This study concludes with several recommendations for further research. The findings of this study highlight the need for additional research into both the efficacy of SI as an academic support program and the influence of gender on the program's success.

Additional research into the efficacy of SI should examine additional variables. More predictors of academic preparation such as high school GPA for first semester students, college GPA for students who have completed at least one semester, SAT scores, or even college-level placement tests would be beneficial. The more indicators of preparation used, the better the comparisons that could be made between students who elect to attend SI and those who do not. Additionally, examining retention over a longer period of time, up to and including graduation, would make a stronger argument for the long-term impact of SI attendance.

Measurement of additional factors could further explain the differences in outcomes between SI attendees and non-attendees. For example, student motivation is a variable that may not be fully accounted for by assessing student preparation for college. Assessing student motivation at the beginning of a course might provide insight into differences in student performance among students with similar levels of academic preparation. Knowing a student's entering experience, competence, and confidence in the course subject matter would also assist with making more meaningful comparisons in student outcomes. Pre- and post-tests might also be helpful to gauge student improvement between students who attend SI and those who do not. The significance of intersectionality highlights the need for future examination of the complex factors which can influence student success such as social class, knowing whether or not the

student was the first in their family to attend college, availability of a mentor, socioeconomic status, race, ethnicity, and knowing whether or not the student was from a rural or urban location may provide new insights about student success as it relates to academic support programs.

Further study into modern gender differences in college performance are also needed. The majority of gender research has been conducted in the k-12 education setting, so exploring how male and female college students perform, particularly in subject areas that have traditionally been associated with one gender or another, would help researchers determine if the gender performance gap in education dissipates in higher education. It is possible that many students who conform to traditional gender role expectations choose not to attend college, so assessing students' gender role beliefs and their connection to academic performance may also be enlightening. Additionally, knowing why students attended SI sessions with particular SI leaders would help determine how important the gender of their SI leader was for their decision. Student availability and SI leader session times undoubtedly factor into these choices, but much could be learned from students who were available to attend sessions with multiple SI leaders but elected to attend sessions with a specific leader. Because this study found that students who attended more SI sessions with both male and female SI leaders had the best final course grades, figuring out how to encourage students to replicate that behavior would likely improve student outcomes.

Future research should incorporate other factors that might contribute to student performance and retention. The true equation for student success is unknown, if such an equation even exists, but a variety of factors such as campus involvement, family support, student work positions, living on campus, and having friends to study with should be reviewed. Investigating the factors that contribute to successful students can provide a road map for faculty

and administrators to promote, incentivize, and embed into the college experience and curriculum.

Conversely, the experiences of students who did not attend SI should be investigated. While some might assume students who do not attend SI are unmotivated or uncaring, there are many factors which contribute to the decision to not attend SI sessions. Students facing barriers and juggling multiple priorities are less likely to be able to attend SI sessions due to their need to work outside of campus to pay their bills, leave campus to care for their children, or cope with personal medical issues. Exploring innovative strategies for making SI available and convenient for diverse student populations will help more students benefit from SI programs.

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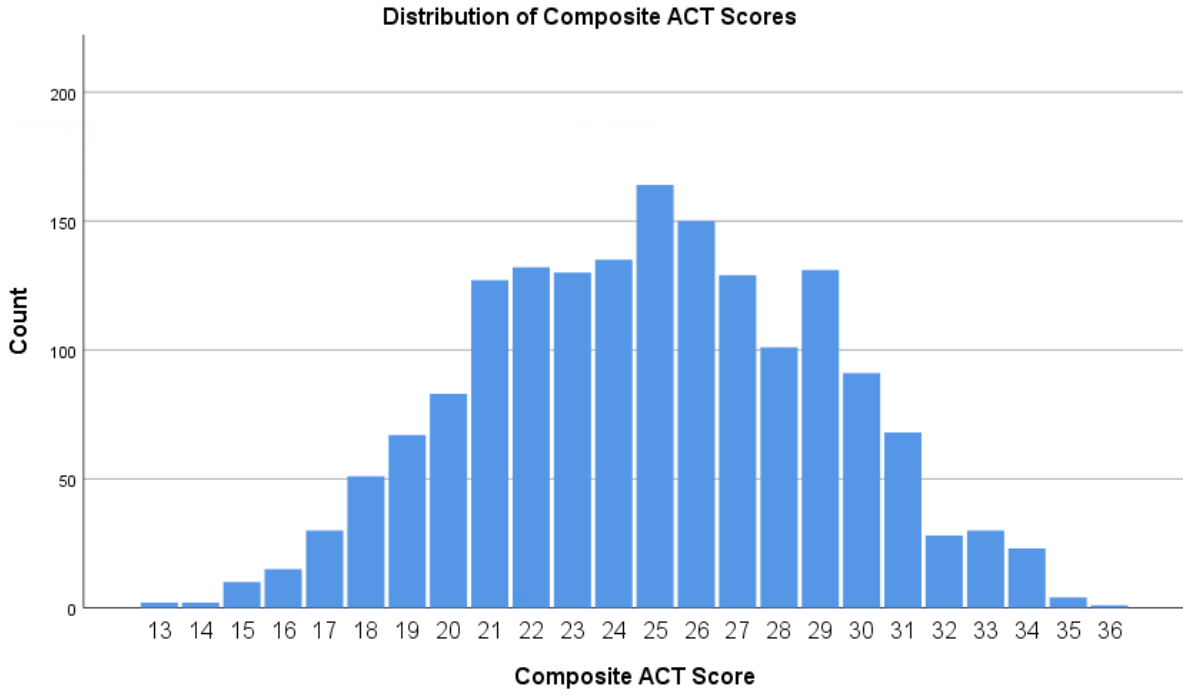
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APPENDICES

Appendix A

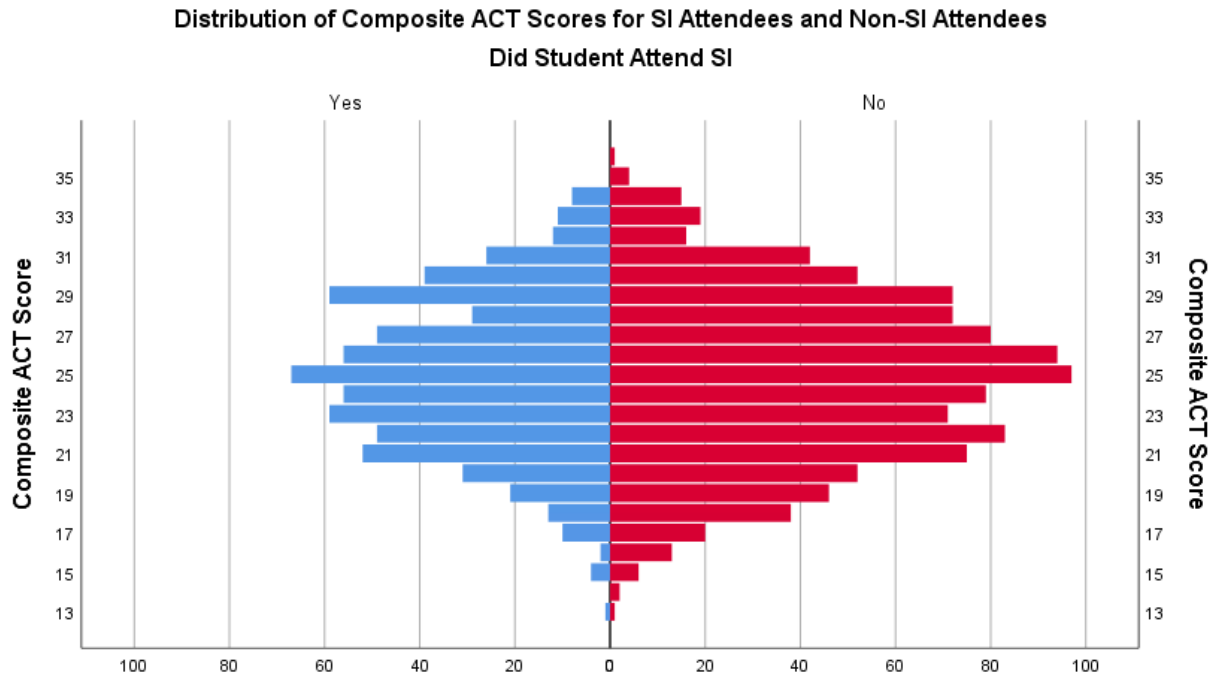
Distribution of Composite ACT Scores





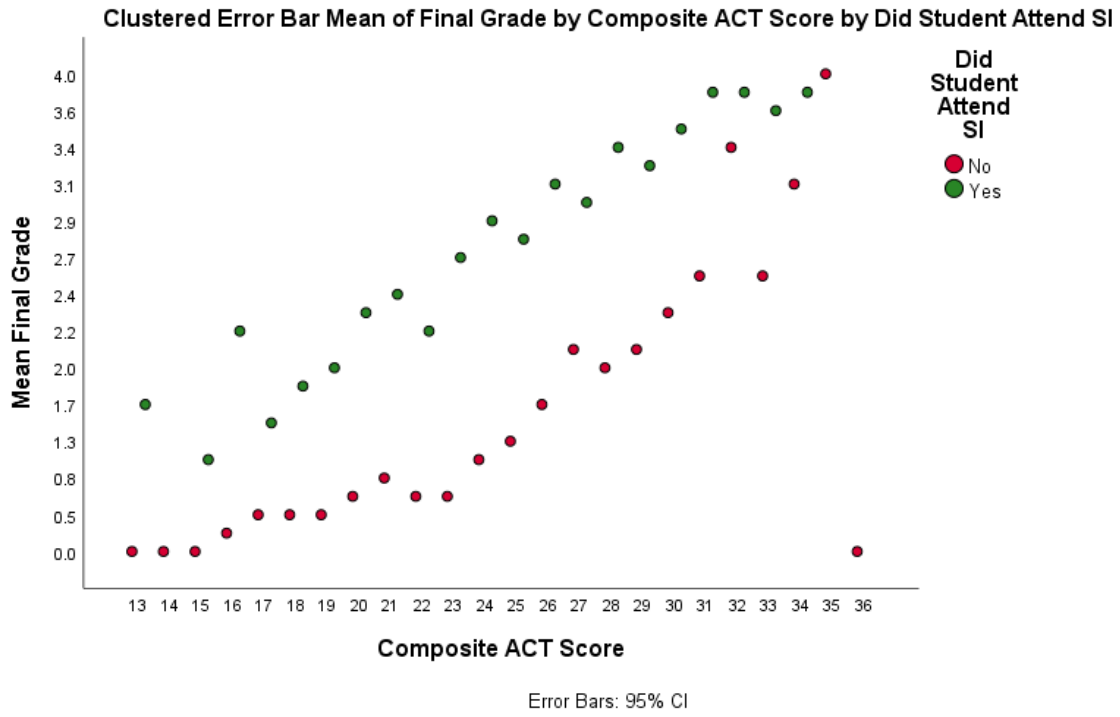
## Appendix B

### Distribution of Composite ACT Scores for SI Attendees and Non-SI Attendees



# Appendix C

## Mean Final Grade by SI Attendance and Composite ACT Scores



VITA

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Graduate Assistant, Center for Academic Achievement, East  
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