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Evaluating the Effectiveness of Supplemental Instruction on Generation Z Students in AGN 331

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By

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ABSTRACT

The purpose of this research was to determine the effectiveness, barriers and benefits of Supplemental Instruction (SI) on Generation Z students in AGN 331. The theory used as a model for this research was the Pace's Model of College Impress. Prior research indicated that SI improves test scores, final grades, and persistence in historically difficult courses. Correlations and ANOVA's were performed on SAS in order to determine a relationship between the non-SI attendees to those who did attend SI. The final grade reported an average of 0.56 points higher and on the final exam 4.26 points higher if the student had access to SI sessions. The conclusion: SI was effective in increasing final grades in AGN 331. Student perceptions of SI were gathered via Qualtrics. The survey showed that all students, regardless of attendance, thought SI was beneficial. The biggest barrier to their attendance was other obligations at that time.

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INTRODUCTION

Background

As Generation Z goes to college, it is necessary to understand how to create learning environments that maximize a student's capacity to learn. As students have more access to technology than previous generations, learning in college takes place in a variety of settings. This increased access to technology does not necessarily mean that they are learning the most accurate information online (Seemiller & Grace, 2017). This lends its own problem in today's university setting. Students who do not get accurate information are not learning correctly. Those who are not learning may find it extremely overwhelming to meet the academic demands of college. Many students meet the basic requirements for college acceptance. However, they aren't adequately prepared for university-level classes and end up struggling to pass. An estimated 60% of American students are not ready for college courses (Shulock & Callan, 2010). This feeling of being overwhelmed and stressed is one of the top reasons students' drop-out of their university courses (Shulock & Callan, 2010).

Generally, the literature on university drop-outs argues against the common belief that students withdraw because of academic failure, while the educational background is

advocated as a main influence along with some personal characteristics of the student (Fowler & Boylan, 2010; Kalsner, 1991; Levitz, Noel & Richter, 1999; Montmarquette, Mahseredijan & Houle, 2001). For example, Kalsner (1991) argues that the student's qualification and motivations are the main determinants of retention. Montmarquette et al. (2001), more recently sampled 3,400 Canadian students showing that a relatively better academic performance does not reduce the probability of drop-out.

It is the goal of many universities to increase enrollment and to have students return the following semester. A foundational goal on the Strategic Plan 2015 - 2023 at Stephen F. Austin State University (SFASU) is "meaningful and sustained enrollment growth" (Office of the Institutional Research, 2018b). Over the last 10 years SFASU has grown by 2.3% (Office of the Institutional Research, 2018). But what about retention of students from their freshman year on? Among first year, first time university undergraduates in the Department of Agriculture, there was a 75.8% retention rate after one year (Office of Institutional Research, 2018b). The retention rate of the university was 70.5% for the year 2017-2018 (Office of Institutional Research, 2018). In the last year, the retention rate has dropped by 1.1% at the university. But, over the last five years, the retention rate has gone up by 0.5% at the university (Office of Institutional Research, 2018). While the department has grown by 3.3% in the last year, students not graduating is also a big concern (Office of Institutional Research, 2018). SFASU has come a long way in their graduation rate from a staggering 40.9% in 2009 - 2015 to 48.6% in 2012-2018, an increase of 7.7% (Office of Institutional Research, 2018). While

retention and graduation rates are very important to many universities, those issues are not resolved overnight. There are many programs that could be implemented into the university to help students with difficult courses. Ultimately, these programs help students in their lower level courses so they accomplish their goal of graduating with a degree. For students, it took hard work and a lengthy admissions process before going to college, therefore they do not just pack up their bags and leave (Araque, Roldan, & Salguero, 2009).

Through the Academic Assistance and Resource Center (AARC) students can work with other students who have successfully completed the course. This is done through online resources, on-call tutoring at walk in tables, 1:1 appointments, and Supplemental Instruction groups (Stephen F. Austin State University, 2018b). The implementation of Supplemental Instruction (SI) at SFASU was in the year 1983 (Stephen F. Austin State University, 2018b). SI is geared towards retention in lower level historically difficult courses (100 and 200) (Blanc, Debuhr & Martin, 1983). SI offers regularly scheduled, out-of-class review sessions to all students enrolled in a targeted course. SI study sessions are informal seminars in which students review notes, discuss readings, develop organizational tools and prepare for examinations. Students learn how to integrate course content with reasoning and study skills (UMKC, 2018). These are interactive sessions that help students to grasp ideas and practice problems in the course so that they can get a better understanding of the course material in a low-stress environment.

Statement of Problem

Research has shown a significant difference between the learning preferences of Generation Z as compared to previous generations. Not only that, Supplemental Instruction (SI) has been shown to improve retention rates, test scores, etc. in historically difficult courses. Most of the research on the effectiveness of SI has been done on entry level courses (100 and 200 level). This research study aims to focus on the effectiveness of SI in an upper level historically difficult course, AGN 331, in the Agriculture Department at Stephen F. Austin State University (SFASU).

Research Objectives

1) Determine students' perceptions of SI
    a. Survey distributed to the class
2) Determine the relationship of student's performance in AGN 331 and GPA
    a. Compare non-SI semesters to SI semester (GPA and final weighted grade in course)
    b. The null hypothesis for this objective is there is no relationship between GPA and the final grade in AGN 331
3) Evaluate the effectiveness of SI sessions in AGN 331
    a. Compare each of the exams (1, 2, 3 & Final), GPA (high, middle, low), and hours that they attended SI

b. The null hypothesis for this objective was SI had no impact on exam scores and the final grade in AGN 331.

4) Evaluate the background of SI students and non-SI attending students
    a. GPA, grade in chemistry course, which chemistry course they took, and grade in crop science
    b. The null hypothesis for this objective is the background of students does not affect the outcome of the final grade in AGN 331

Definition of Terms

Academic achievement refers to the state of success or accomplishment within a particular classroom experience. This study uses the variable of numerical grade average on a 100 point scale or a 4.0 scale for GPA to denote academic achievement of an individual.

Generation Z refers to individuals born between the years 1996 to 2010, for this particular study.

Generation Y (Millennials) refers to individuals born between the years 1981 and 1995, for this particular study.

Historically difficult course refers to a course that has numerous weekly readings from textbooks, infrequent examinations that focus on higher order thinking, voluntary/unrecorded attendance, and larger class sizes in which each student has usually

little opportunity for interaction between professors or fellow classmates. These courses usually have a 30% or higher D, F, or withdraw rate.

Intrapersonal Learner refers to students who prefer a more private, introspective and independent learning style. They like to learn by themselves and reflect on their learning by themselves.

Passive learning can be described as students taking part in course elements that include solely the taking in of information. An example is students listening to a lecture. Students learn at the level by taking in the information presented.

Pedagogy refers more broadly to the theory and practice of education, and how this influences the growth of learners. Pedagogy, taken as an academic discipline, is the study of how knowledge and skills are exchanged in an educational context, and it considers the interactions that take place during learning

Peer assisted cooperative learning refers to a program in which students and trainees learn together, and may also teach each other.

Learner centered programs refer to programs focusing on the needs of students. These programs take a learner, or student-centered approach to educating. These programs include tutoring, office hours, Supplemental Instruction, etc. that allow the student one-on-one time with the instructor or assistant. These programs address the distinct learning needs, interests, aspirations, or cultural backgrounds of individual students and groups of students in order to achieve academic success.

Supplemental Instruction refers to an academic support model developed by Dr. Deanna Martin at the University of Missouri- Kansas City in 1973 that uses peer-assisted study sessions to improve student retention and success within a targeted historically difficult course.

Limitations of the Study

This study was limited to the population of students that have taken AGN 331 since fall 2017. This included a total of three semesters of data, two of those semesters did not have the option of attending an SI session for the course (n = 63), while the most recent semester, fall 2018, had the option of attending the SI sessions (n = 36). This led to a small population size when correlations and ANOVA's were performed on different groups. A small sample size increases the likelihood of a Type II error skewing the results, which decreases the power of the study. A Type II error is defined as the retention of a false null hypothesis (Ary, Jacobs & Sorensen, 2010). Ultimately, a small sample size reduces the confidence level of the study and decreasing the sample size also increases the margin of error (Babbie, 2017).

Secondly, the traditional SI model includes three stakeholders: the SI leader, the faculty member, and the SI supervisor. The research model for this SI involved two stakeholders, the SI leader and the faculty member, no SI supervisor. There was no need for the supervisor because there was only one SI session being conducted in the agriculture department at SFASU. The SI leader was trained in pedagogy and proactive

learning, thus there was no need for a supervisor. Also, the SI leader did not take a soils course from the same professor. Traditionally the SI leader is a former student who took the course and excelled in it. Since the SI leader took various Soil Science courses at a previous university and a higher level Soil Science from the faculty member at SFASU, this was considered to be acceptable.

Additionally, after the data was gathered it indicated not all students in the agriculture department took AGN 110 (Crop Science) as a prerequisite for AGN 331. Since Crop Science grades were used to assess the background information of students, having an even smaller subset of 22 students further limits the conclusions drawn from the data. Another limitation was the researcher did not have access to all transcripts and continuous data for all 99 students and was not able to assess the background influence of the chemistry course taken to the final grade outcome in AGN 331. Similarly, a name was not tied to the survey piece of the research so again the influence of the background could not be fully assessed on the outcome of soils grade in AGN 331. The sample for this study was defined as a convenient sample. The participants were chosen simply because of ease of access and availability (Ary et al., 2010). This has limitations in itself but the demographic information gathered by the survey instrument showed that the population of the course was a model representation of the agriculture department, but may not be the same case if compared to other universities. This research is readily applicable to the agriculture department at SFASU.

Purpose/Need for the Study

AGN 331, Soil Science, has been identified as a historically difficult class. This course employs the use of higher order thinking throughout the semester. It requires students to recall previous knowledge from a variety of courses like chemistry, biology, and Crop Science. Both chemistry and biology have SI sessions through the AARC.

AGN 331, while not being a lower level course that fits with the traditional model of SI aimed at retention, is an important course for students in the agriculture department to take. It is required for all majors in this department. Because AGN 331is a requirement of all degree plans in the department, students must be successful in the course, get a passing grade. The SI section being held for the AGN 331 course is currently the only SI session provided by department. This study is aimed at evaluating the effectiveness and determining these students' perceptions of SI because it has yet to be researched.

CHAPTER II

REVIEW OF LITERATURE

Overview

The purpose of this literature review is to establish a foundation of pertinent literature. This chapter will review literature related to Supplemental Instruction and Generation Z students. This review includes a discussion of previous research that has been conducted at universities and community colleges, as well as other disciplines in education. This literature will also give a brief history of Stephen F. Austin State University and AGN 331 as well as educational pedagogy that relates to the research.

Theoretical Framework

The theory that guided this research was the Model of Student Development and College Impress (Pace, 1979). This Pace model theorizes that student time and effort are key constructs associated with outcomes of the college experience, and that the extent to which students exert their time and efforts in the educational opportunities contribute significantly to the student's outcome at the university level. Furthermore, it argues that there are multiple types of experiences within both academic and social areas. His model allowed the study of "students' learning and development and how the student and the

institution interact in contributing to education effectiveness" (Pace, 1979, p. 125). Central to this model is the conception of quality of effort. Pace (1979) argues as follows:

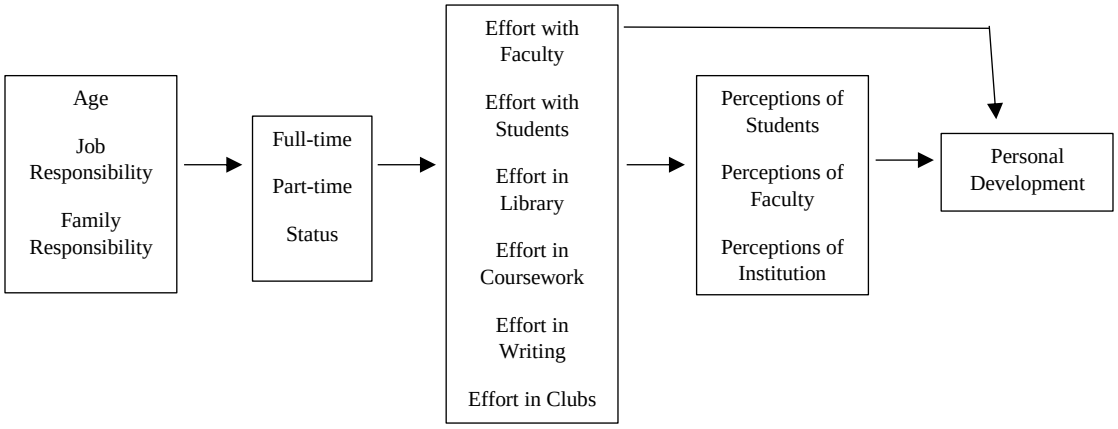
> All learning and development require an investment of time and effort by the student. What students can gain from the variety of events depends on the amount, scope and quality of their engagements. As these encounters broaden and deepen, the students' capacity for growth is enhanced. To document objectively the scope and quality of students' effort is crucial for understanding growth and development (pg. 127).

The Pace model is comprised of three basic propositions. First, university experiences encompass the events in which students engage while in university. These events involve those in the classroom and out of the classroom. They may include: opportunities to meet with the instructor, meeting with other students about the class, or even a session where they improve certain skills that pertain to the class (Ethington & Horn, 2007). The second proposition is that the sense made of these experiences is impacted by the characteristics of the environment and the quality of effort that students actually put forth (Ethington & Horn, 2007). The third is that a combination of environment and student effort contributes to student development (Ethington & Horn, 2007).

Pace (1979) argues that one must first consider their students' background, otherwise known as what characteristics and knowledge they bring to the university level with them. He also states that their status at the university, whether they are full-time or part-time students depend on what activities they engage in during college. He continues by saying these activities show the quality of effort they invest in taking advantage of the opportunities for learning provided by the institution. It is effort that students expend that Pace argues that this is the most important determining factor in whether the student will be successful in their academics or not (Ethington & Horn, 2007; Pace, 1979).

Figure 2.1

Contribution of Pace Model of College Impress to Student's Personal Development



Note. This figure was reproduced from Ethington & Horn (2007).

Who are Generation Z?

Just like cultures, generations have their own attitudes, beliefs, social norms and behaviors that define them (Seemiller & Grace, 2016). For the purpose of this study, Generation Z (Gen Z) can be defined as individuals born from 1996 through 2010. These students have peaked our interest because they currently walk the halls at the university level. Unlike generations before them, they are "natives to the digital and online world" (Seemiller & Grace, 2016).

So, what makes Generation Z different from generations before them? They are the first generation to grow up in a fully digital world, they are sometimes referred to as digital natives, the net generation, or iGeneration (Seemiller & Grace, 2016). In a Kaiser Family Foundation (2010) study, 2,000 Generation Z youth reported that besides sleeping, they are exposed to media more than any other activity. Every 60 seconds, 2.5 million pieces of content are shared on Facebook®, 100,000 tweets are sent, and 48 hours of YouTube video are posted (Daughetry & Hoffman, 2014). This increase in the use of technology and media sets this generation apart from any other. They currently make up a quarter of the United States population and will make up a third of the population by 2020 (Seemiller & Grace, 2016). They are the most racially diverse generation to date (Pew, 2014; Seemiller & Grace, 2016).

Although Generation Z has been largely shaped by the advancement of technology. They have also been shaped by, living in a world at war for the majority of their lives. These events like 9/11, our country being at war with foreign countries, and

school shootings becoming more common are the events that have shaped their childhood. A volatile economy, they witnessed the economy crash and saw the unemployment rate rise substantially.

While these events have also impacted those in other generations, the historical context of these individuals is much deeper than those in Generation Z, who may have never known differently (Seemiller & Grace, 2017). Generation Z was primarily raised by Generation X (born 1965 – 1976), since the aforementioned events shifted lives of the parents so heavily, they raised their children accordingly (Seemiller & Grace, 2017). Generation X (Gen X) raised their children to be loyal to a company and save their money so that if another recession hit, their children might be more prepared than they were in dealing with the situation at hand. Young adults in this generation seek out a secure path (Twenge, 2018).

As Generation Z goes to college, it is necessary to understand how to create learning environments that maximize a student's capacity to learn because these students will be entering the job force and shaping the economy. Advancing technology certainly does play a role in learning, but technology and learning are not necessarily synonyms for this generation (Seemiller & Grace, 2016). Learning in college takes place in a variety of settings and the lessons range from content in books to interactions and experience with peers, faculty and staff. What contributes to learning for Generation Z students? While the generation in college before Generation Z, Millennials, also utilized technology, the abundance of information available to Gen Z is immense. Access to this amount of

technology and information might not only make learning easier but help students learn more simply by having access to more information (Seemiller & Grace, 2016). On the other hand, because students have access to all this information, students will need to be taught what accurate information is. The convenience and instant access the internet and technology provided to this generation have made a difference in learning and education in general. For example, where previous generations attended an animal science class to learn about reproduction of animals, Generation Z can quickly look up this topic and find something about it online; they do not need to wait to learn in the traditional setting (Seemiller & Grace, 2016).

Learning preferences of Generation Z

Knowledge of effective teaching practices is better now than it was even 40 years ago, thanks to research done in an array of disciplines, resulting in a remarkable amount of information on how students learn (Igel & Urquhart, 2012). Learning preferences of Generation Z are clearly different from that of previous generations. Research has shown that Generation Z students are very practical, more so than generations in the past (Seemiller & Grace, 2016). They want learning they can immediately apply to real life, and want to know that what they are learning has broader applicability to more than just a practice example (Seemiller & Grace, 2017).

According to Seemiller and Grace (2016), although students of all ages might prefer applied learning, there are two specific aspects that stand out for Generation Z.

First, they are observers; they like to watch others complete tasks before applying the learning themselves. In addition to their desire for applied learning, Gen Z students prefer intrapersonal learning. Technology has created a sense of individualism and helped Gen Z to become comfortable and accustomed to learning independently (Seemiller & Grace, 2016). According to a research study, *Meet Gen Z: Forget Everything You Learned about Millennials,* by Sparks & Honey (2014), Gen Z students are very accustomed to engaging in individual learning. These students prefer it because they can focus, set their own pace, and make meaning of their learning before having to share that with others. Now this does not mean that instructors or professors should abandon group work but be mindful of grouping students too largely when in the classroom setting (Sparks & Honey, 2014).

Summary of Generation Z Students

Generation Z students are their own. They differ in many ways from the Millennials (Generation Y) before them. They have an even shorter attention span, about eight seconds (Igel & Urquhart, 2012). This is creating an increased need to grab their attention and hold onto it. Research shows this can be done using technology in the classroom. They are practical, students in this generation grew up in a post-9/11 world and saw the housing and stock markets collapse. They care less about "following their passions" and more about choosing a secure path (Seemiller & Grace, 2017).

Overall, Generation Z students have unique learning characteristics and preferences. They are self-directed learners who thrive on technology. Traditional

lecture-format classes will be less effective in engaging students, and assigned readings may not be completed before class as with previous generations (Seemiller & Grace, 2016). Teaching Generation Z students will challenge instructors to adopt new methods. To be more effective in getting Generation Z students to learn the material hiding behind a PowerPoint and talking at students is not going to work; today's teacher must interact more and lecture less (Seemiller & Grace, 2016). By creating a dynamic learning environment, educators will be able to help Generation Z students become more effective learners.

Students at Stephen F. Austin State University

Stephen F. Austin State University is located in Nacogdoches, Texas. This university was founded in 1923 and has nearly 13,000 students in total (Stephen F. Austin State University, 2018a). Sixty-four percent of the students are female, making this a female dominated university. About 60% of the students are white, 15% are black, 18% are Hispanic, and 7% identified as other. The university has students that come mainly from three areas: Houston, Dallas, or East Texas (Office of Institutional Research, 2018).

In total, there are six colleges within the university. This study focuses on the Arthur Temple College of Forestry and Agriculture. The college offers four majors: Forestry, Agriculture, Environmental Science, and Spatial Science, with numerous areas of emphasis in each of those majors. There are 826 students within the college (Office of Institutional Research, 2018). More specifically, this study is looking at the Department

of Agriculture. This department generally follows along with the university demographics (SFASU, 2016 & 2017). Meaning, most of the university's students come from Houston, Dallas, or East Texas, and this department is a white and female dominated department (SFASU, 2016 & 2017). In the fall of 2018 semester there were 361 students in the department (Office of Institutional Research, 2018).

Every freshman student in the agriculture department is required to take Agriculture 100 (AGR 100). This is an orientation course for new students to welcome them and get them comfortable in the agriculture department. During this course, for the last two years (2016 and 2017), the students have been given a Freshman Survey that asks a multitude of demographic and department specific questions. The purpose of this survey was to gain an understanding of the background of the department's freshman students and their experiences within the agriculture department, positive and negative. Arguably, one of the biggest pieces to be taken from this survey in relation to this research, is that over half of the department's students come from large urban areas in the state of Texas. And, roughly 40% of the students have not even been exposed to agriculture classes, or agriculture in general, until they enrolled in Stephen F. Austin State University. The background of these students is an important factor to consider when determining how successful they will be in their academics (Pace, 1979).

Soil Science Education in the United States

Like many other subjects and disciplines, Soil Science has evolved considerably in the last 100 years of it being taught at the university level. Over time, Soil Science has moved from being taught at liberal arts schools to being strongly associated with the land grant universities. Baveye et al. (2006) suggested that enrollment in Soil Science programs had decreased by 83% from 1992 to 2004 at the 36 universities that participated in the study. On the other hand, Baveye et al. (2006) did not assess as many land grant institutions as Brevik et al. (2014). While Brevik et al. (2014) assessed only 14 institutions, these universities represent 20% of the schools in the United States that offer Soil Science degrees/programs. Their findings were the opposite of Braveye et al. (2006). At these institutions, a survey of enrollment trends showed that 46% of the surveyed undergraduate programs had trends of increasing enrollment, 39% had steady enrollment, and only 15% had declining enrollment (the school that discontinued their undergraduate Soil Science program during the study was included in the declining enrollment group, n = 13). In the same survey, 40% of graduate programs reported trends of increasing enrollment, 50% had steady enrollment, and 10% had declining enrollment (n = 10). The increase of enrollment in Soil Science classes may be due to the fact that many degree programs require this course. In the SFASU Agriculture Department it is required by all degree programs that students take AGN 331. As it pertains to this study, an increase in the enrollment of Soil Science means larger class sizes and less one on one instruction

with students. A possible solution to meeting the needs of Generation Z students might be the addition of SI to the course.

Supplemental Instruction

The completion of a college degree is a challenge, and many students fail to earn their degree and reach their educational objectives (Bowen, Chingos, & McPherson, 2010). As a result, support programs and services aimed at increasing retention and enhancing academic success for the diverse student body have been put in place at many universities and colleges (Bowen et al., 2010). One of those programs, Supplemental Instruction (SI) has become a widely used model across the country. Supplemental Instruction has been offered to many students at various universities and colleges across the nation (Ning & Downing, 2010). Supplemental Instruction was developed at the University of Missouri- Kansas City (Rabitoy, Hoffman, & Person, 1983).

What is SI?

Supplemental Instruction is an academic support program that targets historically difficult courses. A historically difficult course can be defined as one that has numerous weekly readings from textbooks, infrequent examinations that focus on higher order thinking, voluntary/unrecorded attendance, and larger class sizes in which each student has usually little opportunity for interaction with the professor or fellow classmates (Martin & Arendale, 1994). They can be further identified as those entry level courses

where student's D, F, and withdraw rates exceed 30 percent of course participants (Blanc et al., 1983).

Supplemental Instruction is a non-remedial approach to learning enrichment that increases student performance and retention. SI offers regularly scheduled, out-of-class review sessions to all students enrolled in a targeted course. SI study sessions are informal seminars in which students review notes, discuss readings, develop organizational tools and prepare for examinations. Students learn how to integrate course content with reasoning and study skills (UMKC, 2018).

Typically, learning centered programs, like tutoring or one-on-one with the instructor, operate on a drop-in basis, offering services primarily designed to address the needs of high-risk students. Staff devote a high percentage of time to one-on-one tutorial instruction. SI is different for two major reasons. Firstly, the emphasis has been shifted from identification of high-risk students to the identification of high-risk courses (see historically difficult courses above). Secondly, SI is designed to assist students in mastering course concepts while also increasing student competency in reading, reasoning, and study skills (Blanc et al., 1983). Unlike a drop-in time with professors, SI creates deeper skills, rather than a basic understanding of the material with the use of peer-assisted cooperative learning.

Key Stakeholders in SI

The SI leader. The SI leader is a student who has successfully completed that course or a comparable course. It is ideal if the student has taken the course from the same instructor for whom they are now providing the SI assistance for. The SI leader is trained in proactive learning and study strategies and operates as the "model student" in the classroom, attending all lectures, taking notes and reading all assigned materials. The SI leader conducts out-of-class sessions in which they integrate how to learn and what to learn (Arendale, 1994; Martin et al., 1983). A central responsibility for the SI leader is to integrate study skills with the course content. As someone who has performed well in the course, or related course, they have displayed mastery of this skill. If the students only learn content material and not the underlying study strategies, they'll have a high probability of experiencing academic difficulty in succeeding courses. The integration of study skills with the course content is a key difference between SI and other forms of collaborative learning. By combining what to learn and how to learn it, students develop both content competency and transferable academic skills, which pays off in higher grades during future academic terms (Arendale, 1994; Martin et al., 1983).

The SI supervisor. The SI supervisor is an on-site professional staff person who implements the SI program and supervises the SI leaders. The supervisor is responsible for identifying the targeted courses, gaining faculty support, selecting and training leaders and monitoring and evaluating the program. Their duties include meeting with the SI leader weekly during the term (Arendale, 1994; Martin et al., 1983).

The faculty member. The third key person in implementing SI is the faculty member who teaches the course in which SI is offered. SI leaders are encouraged to meet weekly with SI course faculty to ensure content competency and to discuss SI activities. Many faculty members also request that the SI leader provides some feedback from the students concerning difficulties encountered during class lectures or the reading materials. Some faculty members choose not to devote any additional time to the program (Arendale, 1994; Martin et al., 1983). The principle components of successful SI programs include faculty members, SI leaders, and a diversified student body. Much of the success of SI programs is predicated upon the relationships established between these key stakeholder groups (Lockie & Van Lanen, 2008; Rath et al., 2007; Zaritsky & Toce, 2006).

Why and How SI Works

Supplemental Instruction begins during the first week of classes and the SI leader establishes a set time in which to hold the SI session (Martin & Arendale, 1992). SI relies on active out of class study sessions aimed at increasing student comprehension of course content and the integration of reasoning and study skills with specific course content (Martin & Arendale, 1992). During these sessions, students interact collaboratively with one another to construct an accurate account of course information in an attempt to integrate and to process course curriculum through discussion (Congos 2002).

Supplemental Instruction works because SI sessions are proactive and participatory. SI strives to break what is called the dependency cycle or learned helplessness (University of Missouri-Kansas City, 2003). The dependency cycle is a pattern of learned behavior that allows students to remain dependent on an authority figure (instructor/TA) for learning (Hurley et al., n.d.). Typically, if students have a problem, they will ask a question, leading to the instructor just repeating the same information, but slower, not necessarily in a different way. This obviously does not correct the issue. The student's failure in one situation may lead them to believe they cannot learn new complicated information at all. SI works to help students use new learning strategies, so they are less dependent on being told information (Hurley, Jacobs & Gilbert, n.d; University of Missouri-Kansas City, 2004).

Supplemental Instruction also works because, besides allowing students to get higher grades and gain effective learning skills, it provides them with peer collaborative learning experiences that promote integration into campus culture. SI makes efficient use of study time and provides an opportunity for students to develop relationships with other students and staff, an important factor in retention (University of Missouri-Kansas City, 2004). Numerous studies suggest that peer learning and student's involvement in programs outside of the classroom at the university contribute to student learning outcomes, participation and retention rates (Blanc et al., 1983).

Evidence of Effectiveness of Supplemental Instruction

There is a wealth of existing research which provides evidence that Supplemental Instruction is effective in improving student performance and retention. Results usually indicate that SI participants have higher average course grades and lower attrition rates than non-participants (Blanc et al., 1983; Jacobs & Stone, 2008; Javaher, 2010; Martin & Arendale, 1992).

Breaking the Attrition Cycle: The Effects of Supplemental Instruction on Undergraduate Performance and Attrition

Blanc, DeBuhr and Martin (1983) further support SI's effectiveness in retaining undergraduate students. They conclude that high-risk students do utilize SI and that both performance in the course and retention appear to be improved by SI attendance (Blanc et al., 1983). Their study also looked at longitudinal shifts in the percentage of D and F grades, as well as the number of withdrawals. It should be noted in Table 2.1 that the reduction of D and F grades, as well as withdrawals was proportional to the level of SI participation (Blanc et al., 1983).

Table 2.1

Percentages of D and F Grades and Withdrawals in an Introductory Economics Course by year

Measure	1976	1977	1978	1979	1980
D/F/W Rate	34%	33%	27%	17%	18%
SI Utilization			13%	32%	45%

Note. Table is reproduced from Blanc et al. (1983).

In other disciplines, the impact of SI on pass rate remains similar. *The Effect of SI on Pass Rates, Academic Performance, Retention and Persistence in Community College Developmental Reading Courses*, a study done by Dalton (2011), found that students who chose to attend SI for a college reading techniques course received a final grade that was five percentage points higher than the non-SI attending students.

Supplemental Instruction: The Effect of Demographic and Academic Preparation Variables on Community College Student Academic Achievement in STEM- Related Fields

Some studies report a different impact on academic achievement based on ethnicity (Fjortoft, Bentley, Crawford & Russell, 1993; Rath, Peterfreund, Xenos, Bayliss & Carnal 2007; Shaya, Petty, H. & Petty, L. 1993). However, very few published studies evaluate the relationships between demographic and academic preparation variables with participation in an SI program in relation to academic achievement within the college.

Rabitoy et al. (2015), evaluated SI participation in relation to Astin's (1970) Input-Environment-Outcome College Impact Model. This model suggests that college outcomes depend on both the input and environmental experiences of students. According to this model, an input variable consists of the attributes students bring with them to college. Environmental variables consist of people, programs and cultures experienced by students as a result of their enrollment in college. This study evaluated the relationships between student demographics and academic preparation, faculty and SI member demographics, levels of participation in SI, and academic achievement (Rabitoy et al., 2015). In addition to analyzing the population, demographic pieces, like gender (male or female), and race (white or persons of color) were done as well. This approach allowed Rabitoy et al. (2015) to evaluate the impact of each of these variables on student achievement.

In conclusion, this study identified a difference in the impact of demographic and academic preparation variables on students based on their gender. This was based on GPA before SI and after attending SI. These results suggest that female students are more receptive to academic interventions than males. In addition to gender, differences in student ethnicity affected the influence of SI variables on academic achievement. For students of color, enrollment in a course section with an SI leader who was also a student of color, served as a statistically positive predictor of academic achievement. The results of this study suggest the impact of both demographic and academic preparation variables

should be considered when evaluating the effectiveness of SI programs on college campuses (Rabitoy et al., 2015).

Similarly, Javaher (2010) focused on students of different ethnicities and the impact that SI had on their academic outcomes. This study specifically focused on whether SI was associated with the retention of Hispanic students in two organic chemistry courses at New Mexico State University (NMSU). Hispanic students who participated in SI for both organic chemistry courses studied, had fewer grades of a W than students who did not participate in SI (Javaher, 2010). It also showed that those students who participated in SI had a higher distribution of grades of A, B, and C and lower distribution of grades D and F as compared to students who did not participate in SI classes for the course (Javaher, 2010). The importance of the study is that, if Hispanics, the fastest-growing population segment in the United States, do not obtain an adequate and relevant education, the number of academically prepared Hispanics in the United States will decrease. The lack of educational and academic success may influence future efforts by Hispanics to enter higher education. The results of this study can be utilized to improve academic success and retention of Hispanic students (Javaher, 2010).

The Impact of Supplemental Instruction on Learning Competence and Academic Performance

While previous studies focused on peer assisted learning and how it can improve student's motivation, academic self-concept and academic performance, Ning and

Downing (2010) wanted to look at other aspects of learning that are also positively influenced by peer-assisted learning. They used a pretest/posttest design, for SI attending students and non-SI attending students, and assessed learning competence by the use of the Learning and Study Strategies and Inventory (LASSI) instrument from Weinstein and Palmer (2002). The LASSI consisted of 80 statements, which were divided into 10 different scales, each having eight statements. Students gave a response to each of the 80 statements on a Likert-style scale, from 1 (not at all like me) to 5 (very much like me). Overall, Weinstein and Palmer (2002) concluded that SI is a feasible tool for enhancing students' learning competence and academic performance.

Although it may be challenging for SI to be incorporated into the curriculum for every program, efforts should be made to try because the benefits are apparent from the results across the numerous studies done (Blanc et al., 1983; Rabitoy et al., 2015; Seemiller & Grace, 2016). This study has shown that after a one-year implementation of SI, participants had become stronger proactive learners compared to non-SI attending students (Ning & Downing, 2010).

Summary of Supplemental Instruction

Since the creation of SI at the University of Missouri- Kansas City in 1973, it has been implemented at a variety of institutions across the United States and around the world (Arendale, 1994). SI has attempted to encourage students to become actively involved in their own learning. By integrating appropriate study skills with the review of

course content, students begin to understand how to use the learning strategies they have heard about from instructors. SI is a program that is designed to warrant student success while ensuring that academic standards are met. SI can, and will, contribute to institutional success of students that attend and use the skills taught throughout their university careers (Blanc et al., 1983; Ning & Downing, 2010; Rabitoy et al., 2015; Seemiller & Grace, 2016; Weinstein & Palmer, 2002).

Pedagogy

The SI model has several learning theories that support its intentions. These theories emphasize information processing and the student-centered learning activities, rather than simply effecting a change in the learner's behavior. There are three dominant learning theories that have emerged during the last century that will give a greater understanding of SI's role in shaping student learning.

Behaviorism Theory

French philosophers Rene Descartes and Julien Offray de LaMettrie, as well as later Ivan Pavlov and E.L. Thordike proposed that learning is represented by a change in behavior, and this change can be brought about by training the learner to respond appropriately to stimuli. Behavioral learning theory assumes that if students are given the right stimulus, then the students will give you the response you want (Behaviorist, 2006). Basically, if the teacher presents the desired response and the students demonstrate that

behavior correctly the student will be rewarded, positive reinforcement. If the student does not give you the response you are looking for, they will not be rewarded, negative reinforcement. The learning activities suggested by this theory include drill-and-practice. Meaning, teach the material, clarify the material being taught and put the information into action. From the behaviorist vantage point the student is viewed somewhat as a passive respondent to the stimuli provided by the instructor, and learning occurs when the correct response is provided most of the time (Behaviorist, 2006).

This directly applies to SI because learning equals a behavior change. If a student is struggling in a large classroom setting and is constantly being "put down" for giving the wrong answer and being punished for that answer, they are not learning. Supplemental Instruction is in a much smaller setting than the classroom. The environment is different, typically lead by a peer, it is smaller and more inclusive to students who learn at different paces. If the learning environment and response to the answer is more positive the effect is that the retention of the learning material will be improved, as compared to a negative environment (Jacobs & Stone, 2006).

Cognitivism Theory

While a handful of theorists contributed to the cognitivism theory, Bruner proposed that the learning process could not adequately be judged by simply observing behavior, but that it is important to understand what is happening in the mind of the learner (McLeod, 2012). Cognitive theory defines learning as "a semi-permanent change

in mental processes or associations." Cognitivists do not require an outward exhibition of learning, but focus more on the internal processes and connections that take place during learning. The main assumption of cognitive psychology is that there are cognitive processes that take place and influence the way things are learned (McLeod, 2015).

Cognitivism is based on two main assumptions: that the memory system is an active, organized processor of information, and that prior knowledge plays an important role in learning (Ertmer & Newby, 2008). Cognitivists emphasize the need for active, engaged learning, and assert that passive learning is not learning at all (GSI, 2018).

The direct correlation to SI is that the small group is more of a model of cooperative learning. Cooperative learning is a type of active learning, which cognitivists suggest is actual learning. By asking questions and being more involved in their learning in this smaller and inclusive environment SI is actively contributing to knowledge growth and retention of each student that attends. SI produces a different type of learning than that which results from memorization of lecture notes or textbook material.

Constructivism Theory

Vygotsky and other constructivists view learning as a process during which learners construct their own understanding of a subject by integrating information, they are receiving with information they already know (Vygotsky, 1980). Constructivists emphasize the importance of building on the learner's prior knowledge to build new knowledge. The goal is that the learner will integrate what they already know with the

new information being taught in order to form a conceptual framework of their own (Vygotsky, 1980).

While all three theories are evident in the SI model and activities, it is constructivism that is most closely related to SI activities. In the peer-led, cooperative learning setting of SI sessions, students are required to examine what they know and understand when they come to the session and are challenged to build new knowledge in collaboration with their peers.

Table 2.2 Summary of the SI Model and the Theoretical Influences

Learning Theory	***Learning Process***	***Learning Activities***
Behaviorism	Learner is trained to respond appropriately to stimuli	Drill and practice
Cognitivism	Learner receives, processes, stores and retrieves information for use in solving the new problem	Engage in active learning
Constructivism	Learner integrates new information with what they already know	Integrate new and old information to form a conceptual framework
Supplemental Instruction (SI)	Learner builds new knowledge in collaboration with peers	Group discussion and problem solving; prediction of test items; study skills

The SI Model in Agronomy (AGN) 331

Through the Academic Assistance Resource Center (AARC), Stephen F. Austin State University (SFASU) has a system for Supplemental Instruction (SI) already implemented for the entire university. Through the AARC, SI is offered for historically difficult classes, like introductory courses (100 & 200) in sciences and math (Stephen F. Austin State University, 2018b). This is because those lower level courses might deter students from continuing at the university. Hence, SI is all about retention (Blanc et al., 1983). The university currently offers over 20 SI sessions for several different courses (Stephen F. Austin State University, 2018b).

Agronomy 331, Soil Science, has been identified as a historically difficult class within the Department of Agriculture at SFASU. Because of this, an SI session has been assigned to it through the Ag Department, not through the AARC. While the AARC has a model for SI already established, the program does not have enough money to support more courses. Also, AGN 331 is an upper level course, and as stated, the university is focusing on retention and working with those lower level courses, not upper level.

The pilot model for this SI involved two stakeholders, the SI leader and the faculty member, no SI supervisor. The role of the supervisor was not included because the SI leader was trained in pedagogy. This model allowed the SI leader and the faculty member to meet and talk regularly about the course, overall this allowed for a more cohesive environment for the SI leader and the faculty member. While not following the

traditional model of SI, this was a new SI session and could grow and involve a supervisor in the future.

The SI model used for the AGN 331 course met once a week for a two-hour regularly scheduled session. The session material covered was mostly student driven. The SI leader may have had an idea of what material may be covered in that session based on previous sessions, but was mostly based on the needs of students attending the session. The total number of students enrolled in the course for the fall 2018 semester was 36. Of those 36 students 38.9% identified as male, and 61.1% identified as female. The total number of students that attended the SI sessions regularly were 18. Students that did attend SI who identified as male make up a total of 27.7%, while 83.3% of students identified as female.

CHAPTER III

METHODOLOGY

Purpose and Objectives

Purpose

AGN 331, Soil Science, has been identified as a historically difficult class. This course employs the use of higher order thinking throughout the semester. It requires students to access previous knowledge from a variety of courses like chemistry, biology, and crop science. Both introductory chemistry and biology have Supplemental Instruction (SI) sessions available through the Academic Achievement Resource Center (AARC). Soil Science, which is not a lower level course that fits with the traditional model of SI aimed at retention, is an important course for students in the agriculture department to take. It is required for all majors in the agriculture department as a core course. Because it is a requirement of all the degree plans in the department, students must be successful in the course, by achieving a passing grade. The SI section being held for the AGN 331 course is currently the only SI session provided by agriculture department. This study is aimed at evaluating the effectiveness and determining these students' perceptions of SI because it has yet to be researched.

Research Objectives

1) Determine student's perceptions of SI
    a. Survey distributed to the class
2) Determine the relationship of student's performance in AGN 331 and GPA
    a. Compare non-SI semesters to SI semester (GPA and final weighted grade in course)
    b. The null hypothesis for this objective is there is no relationship between GPA and the final grade in AGN 331
3) Evaluate the effectiveness of SI sessions in AGN 331
    a. Compare each of the exams (1, 2, 3 & Final), GPA (high, middle, low), and hours that they attended SI
    b. The null hypothesis for this objective was SI had no impact on exam scores and the final grade in AGN 331.
4) Evaluate the background of SI students and non-SI attending students
    a. GPA, grade in chemistry course, which chemistry course they took, and grade in crop science
    b. The null hypothesis for this objective is the background of students does not affect the outcome of the final grade in AGN 331.

Research Design

This research project was a descriptive-correlational study. The descriptive approach (also called survey research) is described as a method to summarize the characteristics of different groups, or to measure their attitudes and opinions toward some issue (Ary et al., 2010). According to Ary et al. (2010), correlational research is useful for assessing relationships, assessing consistency and prediction. To properly assess if Supplemental Instruction (SI) was effective for Generation Z students in AGN 331 data was collected to examine students' perceptions of SI together with demographic information. In addition, existing data, like grades, were taken from AGN 331 and other background courses such as Chemistry and Crop Science. Lastly, the student's GPA, and which chemistry course they took were gathered from the students' transcripts.

Population and Sample

The population for this study was Generation Z students in AGN 331. Generation Z students were born from 1996 to 2010. While not all of these students fall into this category, the vast majority do. The students that do not fall into this category have to learn alongside Generation Z students, so they were treated as such. The accessible population was a total of three semesters of data. Two of those semesters were counted as non-SI semesters because they did not have the opportunity to attend an SI session (n = 63). The most recent semester did have an opportunity to attend an SI session for the

class, they were treated as the SI semester group (n = 36). The sample for this study was defined as a convenient sample. The participants were chosen simply because of ease of access and availability (Ary et al., 2010).

The two non-SI semesters were not given a survey. The SI semester students were given a survey at the end of the semester during class time, resulting in a 100% response rate.

Instrumentation/Data Collection

Objective 1:

Survey Data Collection

This study used a single-group survey design. This survey was given to the students enrolled in AGN 331 during fall 2018 (n = 36) via a link emailed to them from Qualtrics. This survey was approved by the Institutional Review Board at SFA (AY2019-1090). Individual emails were entered into Qualtrics and the students completed this survey during a single class period during the last week of the course. The survey instrument used was researcher developed based on literature with similar research designs. Content and face validity was confirmed by a panel of experts. Validity refers to the extent to which an empirical measure adequately reflects the real meaning of the concept under consideration (Babbie, 2017). Instrument reliability was determined post hoc using Cronboch's alpha. Cronbach's alpha is a measure of internal consistency, that is, how closely related a set of items are as a group. It is considered to be a measure of

scale reliability (Introduction to SAS, n.d.). A Cronbach's alpha score >0.900 is considered to have excellent internal consistency, construct five would fall into this category. A Cronbach's alpha score of 0.900 to 0.800 would be considered good, construct four falls into this category. A Cronbach's alpha score of 0.700 to 0.600 is considered questionable on internal consistency, constructs two and three would fall into this category (Ary & Jacobs, 2010). Cronbach's alpha scores were only ran on questions that contained Likert-type statements.

The survey instrument was composed of three parts: demographics, perceptions and specialized questions based on whether or not the students actually attended an SI session during the time of the course. The survey consisted of 12 constructs, six of which were Likert-type statements, the rest were open ended. The first construct was demographic information, so it was not necessary to determine reliability. The second construct was the accessibility of SI in AGN 331 as perceived by all students, a Cronbach's alpha score of 0.618 was calculated. The third construct was also answered by all students on which type of students attend SI, a Cronbach's alpha score of 0.600 was calculated. The fourth construct was perceptions of the SI leader and only geared towards students who did attend SI, a Cronbach's alpha score of 0.833 was calculated. The fifth construct was a self-efficacy rating for students who did attend SI sessions, a Cronbach's alpha score of 0.909 was calculated. The sixth construct was services provided by attending SI sessions, geared towards students who did attend SI sessions, a Cronbach's alpha score of 0.858 was calculated.

Demographics (Appendix A)

The first construct of the instrument, called the demographic data, was to describe the participants in the study. This construct was answered by all students. Demographics are considered to be extraneous variables, meaning they are variables that are uncontrolled but may affect the dependent variable in a study (Ary et al., 2010). In the case of this research study the dependent variable would be the final grade in soils, some demographic variables that might have affected their grade would be the number of times they missed class, where they are from, if they have had any exposure to agriculture before coming to SFASU, if they are an athlete or work, whether they are a full time or part time student, if they commute to school, if they are responsible for taking care of dependents or family members, their attendance in SI, etc. (see Appendix A for survey demographic questions). The researcher used this section to describe the population in order to see, if it was an accurate representation of the department as a whole.

Perceptions (Appendix B)

The second part of the questionnaire was for all students. Perceptions of SI were measured by two constructs, each containing five Likert-type statements on a six point scale from 1 being "Strongly Disagree" to 6 being "Strongly Agree". The first construct dealt with the convenience and publicity of SI: "SI was well publicized", "my professor encouraged students to attend", "sessions were scheduled at times I could attend", "sessions were held in a convenient location", and "I was informed in advance when

changes were made to the SI schedule". The second construct regarding perceptions of all students regardless of attendance were: "SI is for students who are not good at math and science", "SI is for students who want to learn all they can to do well in the class", "SI is not beneficial for a student who is already doing well", "SI sessions are not beneficial to me", and "the SI leader does not know the material". The last three questions were reverse coded, this helped to prevent students from "straight-lining" their answers on the survey. These statements were recoded for analysis (See Appendix B for perception questions).

Specialized Questions (Appendices C & D)

In the last section of the survey, skip logic was used to separate students who did and did not participate in SI. For students who did participate in SI (Appendix C), there were four open ended questions: "briefly describe why you came to SI", "what other benefits do you think SI provided you", "how would you improve SI sessions", and "additional comments", these were divided each into their own construct. Three Likert-type questions were asked on a six point scale from 1 "Strongly Disagree" to 6 being "Strongly Agree". The first Likert-type question was regarding their perceptions of the SI leader (construct four). Secondly, students answered a total of nine self-efficacy statements on skills gained through SI (construct five). Lastly, students used a Likert-type scale from 1 "Absolutely did not help" to 6 being "Absolutely Helped" regarding how much the SI session helped with the following: "understanding material", "study

strategies", "keeping up with course material", "meeting other students", "motivation to do well in class" (construct six).

Students who did not attend SI sessions were asked questions mainly regarding their barriers of coming to SI. Three open ended questions were asked: "briefly explain why you did not attend an SI session", "other perceptions of SI", and "additional comments about SI or SI leader" (constructs 10 and 11). The last construct answered by these students was a ranking (construct 12). Students ranked their barriers from 1 to 10, 1 being the biggest barrier: "class schedule conflicts", "work schedule conflicts", "did not need the help", "did not like the SI leader", "did not like the content of the sessions", "did not find sessions helpful", "did not understand how the program worked", "felt unprepared or was too far behind", and "other (text entry option)".

Objectives 2, 3, & 4:

Existing Data

In addition, existing data was gathered by the researcher from the faculty member who taught AGN 331, AGN 110 (crop science) and through the students' university transcripts. This data was organized into an excel spreadsheet and included the number of hours they attended SI, exam score for three exams and the final, final grade in soils, and GPA. For students in the SI semester, additional information like crop science grade, chemistry course and chemistry grade were gathered. This data allowed the researcher to

assess the background information of the students and perform correlations and ANOVA's on all three semesters

Data Analysis

Objective 1: Determine student's perceptions of SI

Survey Data Analysis

The data gathered by Qualtrics was analyzed. Open ended questions were analyzed using open and axial coding to identify emergent themes. Likert-type statements were analyzed using the Statistical Package for the Social Sciences (SPSS) version 25 to gather descriptive statistics.

Objectives 2, 3, & 4:

An excel spreadsheet was made to organize the data of 99 students for the three semesters of data. This spreadsheet was then uploaded to Statistical Analysis System (SAS) version 9.4 to perform correlations and Analysis of Variances (ANOVA). Two of these semesters (n = 63) were non-SI semesters. The data collected for those semesters was their final grade in AGN 331, exam scores for the first three exams and the final, as well as GPA. For the SI semesters the same data was recorded in addition to their grade in crop science, which chemistry course they took (Introductory or General), and the grade achieved in chemistry.

Objective 2: Determine the relationship of student's performance in AGN 331 and GPA

For this objective, a comparison of non-SI semesters to SI semester was made on GPA and the final grade in the course. A correlation was performed on the final grade in the course and their GPA. Since a correlation was performed, a *P* value was used to determine if there was a statistical significance in a hypothesis test (Field, 2009). In this case a *P* value of <0.05 was considered significant. Secondly, students were coded into three different groups, low GPA (2.0 or below), middle GPA (2.1 to 3.0) and a high GPA (3.1 to 4.0). It was necessary to split each semester into these categories so that a fair comparison of the students could be made. Additionally, students were coded again into just two GPA groups, low (2.499 or below) and high (2.5 to 4.0). This comparison was made between the GPAs and final course grades from the most recent semester of students (SI semester) to the two semesters of data that the faculty member collected previously (non-SI semesters). A mean of all those GPAs and final course grades (in a percentage) were calculated in SAS using the GLM procedure. The GLM procedure stands for general linear models, is uses the method of least squares to fit general linear models. The GLM procedure handles models relating one or several continuous dependent variables to one or several independent variables. Thus, the GLM procedure can be used for many different analyses, including the following: regressions (several types), ANOVA, correlations, etc. (SAS Institution Inc., 2008). The significance level of the GLM procedure is labeled as *F*.

Objective 3: Evaluate the effectiveness of SI sessions in AGN 331

For the first part of this objective, a comparison between non-SI semesters to SI semester was made from scores on each of the exams (1, 2, 3 & Final) and their final grade in the course. The statistical methodology for comparing the means of several populations is called analysis of variance, or ANOVA (Waigandt, 2003). For this data set a one-way ANOVA was performed using the GLM procedure. First, a correlation was performed on the first three exams and the final. Students were compared to the control group data (non-SI semesters) to the SI semester. The least squares mean and Pr>t value of <0.05 was used to compare the data between each exam and final grade in soils. The Pr>t value is the probability of getting a larger value of *t* if the parameter is truly equal to zero, a very small value for this probability leads to the conclusion that the independent variable contributes significantly to the model (Introduction to SAS, n.d.).

Secondly, using the GLM procedure, the SI attending semester was compared on the number of hours students attended SI sessions through the semester to grades on each of the three exams and the final grade in AGN 331. This was done to assess the relationship and determine if SI had a significant impact on the final grade and scores on exams. Additionally, each category of the number of hours attending SI sessions (n = 10) was compared to see if attending SI for a certain number of hours influenced exam scores and the final grade.

Lastly, the number of hours each student attended SI during the semester was taken into account and compared to the improvement of their exam scores throughout the

semester. This was only performed on the SI attending semester. A correlation procedure was performed to determine a relationship between number of hours that a student attended SI and the improvement of exam scores through the semester. Post-hoc comparisons on ANOVA tests were completed using the Tukey-Kramer HSD test.

Objective 4: Assess the background of SI students and non-SI attending students

This objective only used data from the semester that had access to SI. The background of SI attending students and non-SI attending students in the SI attending semester was assessed by comparing the students on their grade in chemistry, which chemistry course they took, and their grade in crop science. A correlation was performed to determine if their performance in previous courses relates to their performance in AGN 331. These two courses were specifically selected because crop science and chemistry are two courses that are utilized the most in AGN 331 as background knowledge. It was necessary to split the students into groups based on which introductory chemistry course they took simply because one chemistry course is more complex than the other. If they took the more complex chemistry course (General Chemistry) their background knowledge and use of chemistry in this course varies greatly from the students that did not take the complex chemistry course (Introduction to Chemistry). The grade students earned in crop science influences their background knowledge being used in AGN 331. If they did not receive a passing grade, a D or better, in that course, it can be assumed they did not retain much information and cannot apply it as well in AGN 331 compared to a

student who did well in that course. It was determined after all of the data was gathered that not all students in the department are required to take AGN 110 (Crop Science). A correlation was performed on a subset of students (n = 22) that had data for all four factors: AGN 110 grade, chemistry course taken and GPA, and final grade earned in soils. Additionally, a correlational analysis was performed regarding the chemistry course completed, GPA, and final grade earned in soils (n = 36).

CHAPTER IV

Results and Findings

Overview

Chapter IV presents the results and findings of the qualitative and quantitative data collected in this study. There were a total of four research objectives consisting of both qualitative and quantitative data. The findings presented in this chapter relate to each of those objectives.

Purpose and Objectives

Research Objectives

1) Determine student's perceptions of SI
    a. Survey distributed to the class
2) Determine the relationship of student's performance in AGN 331 and GPA
    a. Compare non-SI semesters to SI semester (GPA and final weighted grade in course)
    b. The null hypothesis for this objective is there is no relationship between GPA and the final grade in AGN 331
3) Evaluate the effectiveness of SI sessions in AGN 331

a. Compare each of the exams (1, 2, 3 & Final), GPA (high, middle, low), and hours that they attended SI
b. The null hypothesis for this objective was SI had no impact on exam scores and the final grade in AGN 331.

4) Evaluate the background of SI students and non-SI attending students
    a. GPA, grade in chemistry course, which chemistry course they took, and grade in crop science
    b. The null hypothesis for this objective is the background of students does not affect the outcome of the final grade in AGN 331.

Objective One

Objective one was to determine students' perceptions of Supplemental Instruction (SI) for AGN 331. The data sample included 36 undergraduate students enrolled in AGN 331. A survey was distributed to the students via Qualtrics. The questions in this survey were individually designed based on their participation in SI. First, the students answered a generic set of questions that dealt with demographics and perceptions of SI, then skip logic was used to target questions based on their attendance in SI. If the student did attend SI they had a different set of questions focusing on the effectiveness of SI, and if the student did not attend SI the questions were targeted towards their barriers of coming to SI and alleged perceptions of the SI sessions that were held all semester.

Demographic Information (Construct 1)

Demographic information like student's agricultural background before coming to SFASU, the chemistry courses taken, employment or providing care for a dependent, etc. was asked in construct one of the survey. These are important questions to ask in order to have an accurate understanding of the background for the population of students in the course. The theory that guided this research, Pace (1979), states that the background information the student comes with to the class (AGN 331), plus the effort they put into the course (SI), both influence students' outcome in the course. According to the survey, 61.11% of students identified as female and 38.89% identified as male. Of those that participated in SI 76.47% identified as female and 23.52% identified as male. As for ethnicity, 72.22% of students enrolled in the course identified as white, 11.11% identified as black, 11.11% identified as Hispanic and 2.78% identified as other or mixed race. For those that did attend SI, the majority of attendees identified as white (64.71%). Other demographic information like where students grew up showed that a total of 38.88% of students were from East Texas (29.41% of SI attendees), 22.22% of students were from the Dallas/Fort Worth (DFW) area (17.64% of SI attendees), 25.00% of students were from the Houston metro area (41.17% of SI attendees), and 5.56% of students were from other locations like San Antonio and Corpus Christi (11.76% of SI attendees). This closely lines up to the demographic data of the department where the majority of students are from East Texas, closely followed by Houston, then DFW (Office of Institutional

Research, 2018a). This suggests the population in AGN 331 is a model representation of the entire Department of Agriculture.

Perceptions Gathered by all Students

In addition to demographic information, there were two constructs that were presented to all students, regardless of their participation in SI. In the second construct of the survey, students had to rate the statements about SI in AGN 331 that they felt most directly fit their beliefs, based on accessibility. The scale went from "Strongly Disagree" (1) to "Strongly Agree" (6). The statements with the highest means were "SI was well publicized in my class", mean of 5.64 (SD = 0.980), and the second highest mean was 5.51 which was "My professor encouraged students to attend SI" (SD = 0.702) (Table 4.1). The lowest reported mean on the accessibility construct was "SI sessions were scheduled at times I could attend" with a mean of 3.80 and a standard deviation of 1.641 (Table 4.1).

Table 4.1

Accessibility of SI in AGN 331 (Construct 2)

Statements	Mean	Standard Deviation
SI was well publicized in my class	5.64	0.980
My professor encouraged students to attend SI	5.51	0.702
I was informed in advance when changes were made to the SI schedule (e.g. cancelled, postponed)	5.46	0.657
SI sessions were held in a convenient location	5.26	0.817
SI sessions were scheduled at times I could attend	3.80	1.641

Note. The scale went from "Strongly Disagree" (1) to "Strongly Agree" (6)

For construct three, perceptions on who students believe SI is for, all of the students answered regardless of their participation in SI. Construct three was very similar to construct two in the way that the students rated each statement about SI in AGN 331 that they felt most directly fit their beliefs. This construct dealt more with their perceptions of the SI session rather than the convenience and publicity of SI in construct two. The scale remained the same, "Strongly Disagree" (1) to "Strongly Agree" (6). The highest reported mean was 5.44, this was for a reverse coded statement "The SI leader does not know the material" (SD = 0.939). The second highest reported mean was for the statement "SI is for students who want to learn all they can to do well in the class" (SD = 1.237). The lowest reported mean was "SI is for students who are not good at math and science" (SD = 1.433).

Table 4.2

Who is SI for? Perceptions by all Students (Construct 3)

Statements	Mean	Standard Deviation
The SI leader does not know the material[a]	5.44	0.939
SI is for students who want to learn all they can to do well in the class	4.89	1.237
SI is not beneficial for a student who is already doing well[1]	4.72	1.031
SI sessions are not beneficial to me[a]	4.44	1.340
SI is for students who are not good at math and science	4.06	1.433

Note. The scale went from "Strongly Disagree" (1) to "Strongly Agree" (6)
[a]indicates a reverse coded statement

Perceptions Gathered by Students Based on Their Attendance in SI

After construct three, skip logic was used to ask a set of questions to students based on their attendance in SI sessions in AGN 331. Students who did attend SI were presented with Likert-type items in three different constructs as well as three different open ended questions. Students who did not attend SI were presented with Likert-type items in one construct and two different opened ended questions.

The theme for construct four was regarding perceptions of the SI leader, a total of six items were asked on a Likert type scale from strongly disagree (1) to strongly agree (6). The statement "My SI leader treated me and other students with respect" reported the

highest mean of 5.69 (SD = 0.479). The second highest mean reported, 5.50 was "The material covered in SI was connected to what was being taught in the classroom" (SD = 0.632). The lowest mean reported was 4.44 which was "My SI leader used a variety of activities in SI" (SD = 1.263) (Table 4.3).

Table 4.3

Perceptions of the SI leader (Construct 4)

Statements	Mean	Standard Deviation
My SI leader treated me and other students with respect	5.69	0.479
The material covered in SI was connected to what was being taught in the classroom	5.50	0.632
My SI leader explained course concepts clearly	5.44	0.629
My SI leader encouraged independent thinking	5.44	0.814
My SI leader was well prepared and capable	5.31	0.873
My SI leader used a variety of activities in SI	4.44	1.263

Note. The scale went from "Strongly Disagree" (1) to "Strongly Agree" (6)

Construct five was also answered only by students who participated in SI. Students answered a total of 11 Likert-type statements in this section. The theme for this construct was students rating themselves on how they feel SI impacted them as a student and with certain tasks, otherwise noted as self-efficacy. The statement with the highest reported mean, 5.53, was "I would recommend the AGN 331 SI session to other

students" (SD = 1.007). The statement with the second highest mean was "I would use SI again in the future" (Mean = 5.24, SD = 1.147). In regards to skills the students learned over the course of attending SI, the highest mean reported was 5.00 with statement "SI sessions have helped me to understand the course material" (SD = 0.070). The second highest skill "SI sessions have helped me to organize my course material" had a mean of 4.82 (SD = 0.728). The lowest reported mean, 3.88, "SI sessions have made me more confident about doing well in my other courses than I was at the begging of the semester" (SD = 1.654).

Table 4.4

Self-Efficacy of Students Skills after Attending SI Sessions (Construct 5)

Statements	Mean	Standard Deviation
I would recommend the AGN 331 SI session to other students	5.53	1.007
I would use SI again in the future	5.24	1.147
SI sessions have helped me focus on important aspects of the course material	5.00	0.707
SI sessions have helped me to understand course material	4.82	0.728
SI sessions have helped me to organize my course material	4.35	1.169
SI sessions have made me a better problem solver	4.18	1.425
SI sessions have improved my study habits	4.12	1.269
SI sessions have helped me to become a better student now than I was in the beginning of the semester	4.06	1.478
SI sessions have improved my note taking skills	4.00	1.118
SI sessions have improved my grade in the course	3.94	1.478
SI sessions have made me more confident about doing well in my other courses than I was at the beginning of the course	3.88	1.654

Note. The scale went from "Strongly Disagree" (1) to "Strongly Agree" (6)

The last Likert-type item answered by students who did attend SI was construct six. The overall theme for construct six was the services provided by attending SI

sessions. In this construct students were asked to use a six point scale very similar to the previous Likert-type items. This scale went from 1 “Absolutely did not help” to 6 being “Absolutely helped”. The statement with the highest mean of 4.31 was “Understanding the material” (SD = 1.493), the second highest reported mean of 4.25 was “Keeping up with course material” (SD = 1.390), and the lowest reported mean was 3.56 for the statement “Study strategies” (SD = 1.209) (Table 4.5).

Table 4.5
Services Provided by Attending SI Sessions (Construct 6)

Statements	Mean	Standard Deviation
Understanding the material	4.31	1.493
Keeping up with the course material	4.25	1.390
Motivation to do well in class	4.06	1.181
Meeting other students	4.06	1.237
Study strategies	3.56	1.209

Note. The scale went from 1 “Absolutely did not help” to 6 being “Absolutely Helped”

The other three constructs in the survey that students who participated in SI answered were all open ended questions. Construct seven asked why they chose to come to SI sessions in AGN 331. Construct eight asked what other benefits they think SI provided them. Construct nine asked in what ways they might improve the SI sessions. Those open ended questions were analyzed using open and axial coding to identify

emergent themes. Tables 4.6, 4.7, and 4.8 provide the major results of the coding analysis of constructs seven through nine.

Construct seven was the first open ended question students who participated in SI answered that just applied to them. This had the students briefly describe why they came to SI sessions for AGN 331. The four major themes that emerged were: help with class/assignments (clarity), review material/exam, understand lecture/lab, and help with math (Table 4.6)

Table 4.6
Major Themes Emerging for Why Students Came to SI Sessions (Construct 7)

Major Categories	Associated Concepts	Frequency
Help with Class/Assignments (Clarity)	Over all information, help with upcoming assignments, confused by certain concepts, material in class to be cleared up, simplified version of the content	8
Review Material/Exam	Exam reviews, extra time to review material	2
Understand Lecture/Lab	Need to understand course and lab, better understand course material, not understanding material in the course and lab	4
Help with Math	Needed some help with math problems, confused about some calculations on quizzes, questions about math problems	3

The next open-ended question was construct eight. This question had the students briefly describe what other benefits they felt SI provided them. The four major themes that emerged were: simplify/clarify material, help, relationship building, and none (no other benefits) (Table 4.7).

Table 4.7
Major Themes Emerging from What Benefits Students Felt SI Provided Them (Construct 8)

Major Categories	Associated Concepts	Frequency
Simplify/Clarify Material	Talking over material more than once, re-explain/calculate things in a simpler way, understand the material, other ways of working the problems	5
Help	Helped prepare for exams and work through quizzes, help in the class, help with understanding course, pass the class, specific concepts, rewrite notes, better connection to the class,	8
Relationship building	Closer relationship with professor/SI leader	1
None (No Other Benefits)	None, nothing	2

The last open-ended question students answered in relation to their experience attending SI for AGN 331 was construct nine. This question had students briefly describe what they might improve about the SI sessions. The four major themes that emerged

were: organization, give student's materials/variety of activities, variety of times, none (Table 4.8).

Table 4.8

Major Themes Emerging from Ways Students Would Improve SI Sessions (Construct 9)

Major Categories	Associated Concepts	Frequency
Organization	Not give excess formulas that will not be used in exams, allowing more students to ask questions rather than just a few, different SI structure, more focused on specific exam content	4
Give Student Materials/Variety of Activities	Study sheets, variety of activities, more information, the faculty member should provide more guides for SI leader	4
Variety of Times	Times, hold them multiple times a week to make them easier to access, hold it during the evening, start later in the day, more than one per week	6
None	N/A, I don't know, I can't think of any	3

Perceptions Gathered of SI from Students who did not participate in SI sessions

There were a total of three constructs in this section. Two of which were open-ended questions and were analyzed using open and axial coding. The major themes that emerged from construct 10, regarding barriers as to why students did not attend SI sessions, were: other obligations (work, class, and other time interference), no motivation to go, did not need to go (Table 4.8). The biggest barrier for students who did not come to SI was 'Other Obligations' with a frequency of 15 of the 19 students (Table 4.8).

Table 4.9
Major Themes Emerging From Barriers of Coming to SI Sessions (Construct 10)

Major Categories	Associated Concepts	Frequency
Other Obligations (work, class, other time interference)	Had to work and was not convenient to go, did not have time in class schedule, time interference, commute is too long to stay, it did not fit schedule, time problems, study groups with other classmates (did not need it as much), busy with other classes that were harder	15
No Motivation to Go	Lazy, terrible student	2
Did Not Need to Go	Top 10% of the class for the first two exams, was not in great need for it	2

Construct 11 was also an open-ended question. This question asked students to "Briefly describe other perceptions you have of SI". This question was also coded using open and axial coding. The four major themes that emerged from construct 11 were: good resource, get better grades, was not "traditional" SI, and suggestions. The frequency of students who perceived SI as a good resource was eight out of the 19 total students (Table 4.10).

Table 4.10
Major Themes Emerging From Non-Attendee Perceptions of SI (Construct 11)

Major Categories	Associated Concepts	Frequency
Good Resource	It was a good resource to use if needed, can be beneficial for students who utilize it, it is a good source to better understand the material even though it's boring and time consuming, a way to get more informal help in the class, really good study session	8
Get Better Grades	Good way to gain information about the tests, I would have gotten a better grade in course and on exams if I would have gone, SI only helps by improving your overall grade	3
Was Not a "traditional" SI	SI sessions should meet at night time so all students can attend, should be in a huge classroom and like lecture instead of a study group	2
Suggestions	Review for exams would be better rather than asking lots of questions, not necessarily to learn the material but to learn the professors idiosyncrasies, more helpful to have a one on one tutoring rather than SI, I do not know, good	6

Lastly, students that did not attend SI were asked to rank their barriers (construct 12). They were given a list of 10 options, one of those being an other/text entry option if they did not see their biggest barrier on the list. They were to rank their biggest barrier #1 to the smallest barrier #10, if it did not apply to them they typed in a zero, which was

later coded as an 11. The options listed for them to rank were: “I had class schedule conflicts”, “I had work schedule conflicts”, “I did not need the help”, “I did not like the SI leader”, “I did not like the content of the sessions”, “I did not find the sessions helpful”, “I did not understand how the program worked”, “I was not interested”, “I felt unprepared or was too far behind to join” and “other (text entry box)”. The other text entries by students were: “lived too far away to come late in the day”, and “I was just lazy”. Note that the higher the mean, the least likely it was a barrier to them. The biggest barrier to students (Mean = 4.50, SD = 4.58) was that students had schedule conflicts (Table 4.11).The second biggest barrier to non-SI attending students were work schedule conflicts (Mean = 4.85, SD = 4.42). The barrier that did not apply to them, or was least likely their barrier was “I did not like the SI leader” (Mean = 10.82, SD = 0.39) (Table 4.11). These barriers were similar to those being reflected in Table 4.9.

Table 4.11

Ranking of Barriers by Non-SI Attending Students (Construct 12)

Barrier Options	Mean	Standard Deviation	Range
I did not like the SI leader	10.82	0.39	0-10
I did not like the content of the sessions	9.55	2.97	0-9
I did not find the sessions helpful	9.19	3.04	0-6
I did not understand how the program worked	9.00	3.05	0-8
I felt unprepared or was too far behind to join	9.00	3.34	0-10
I was not interested	7.77	4.23	0-6
Other[a]	7.67	4.71	0-1
I did not need the help	7.00	4.16	0-9
I had work schedule conflicts	4.85	4.42	0-9
I had class schedule conflicts	4.50	4.58	0-9

Note. Ranking of barriers went from 1 (biggest barrier) to 10 (smallest barrier). If it did not apply students put a 0 in the ranking box (0 was later coded to an 11)
[a]indicates a text entry option. Entries included: lived too far away to come late in the day, and I was just lazy.

Objective 2

Objective two was to determine the relationship of student's performance in AGN 331 and GPA. The null hypothesis (H_0) for this objective was there is no statistical significance between GPA and the final grade in soils (SG). A correlation was performed on the final grade in the course and their GPA category. First, a correlation was

performed on SAS using the continuous data, final grade in soils and the raw GPA. There were a total of 99 observations from all three semesters of data. The average GPA in AGN 331 was 2.94 (SD = 0.52), average SG 68.74 (SD = 10.72) (Table 4.11). The Pearson Correlation Coefficient was reported as a strong correlation between the two variables (r = 0.77), with a p-value of <0.001 (Figure 4.1). For this research a p-value of <0.05 is considered statistically significant. For the Pearson Correlation Coefficient, a strong relationship or correlation is indicated by r is 1.00 to 0.50, a moderate correlation is 0.30 to 0.50 and a weak correlation is 0.10 to 0.30. Anything below an r value of 0.10 suggests no correlation or very weak (Ary et al., 2010).

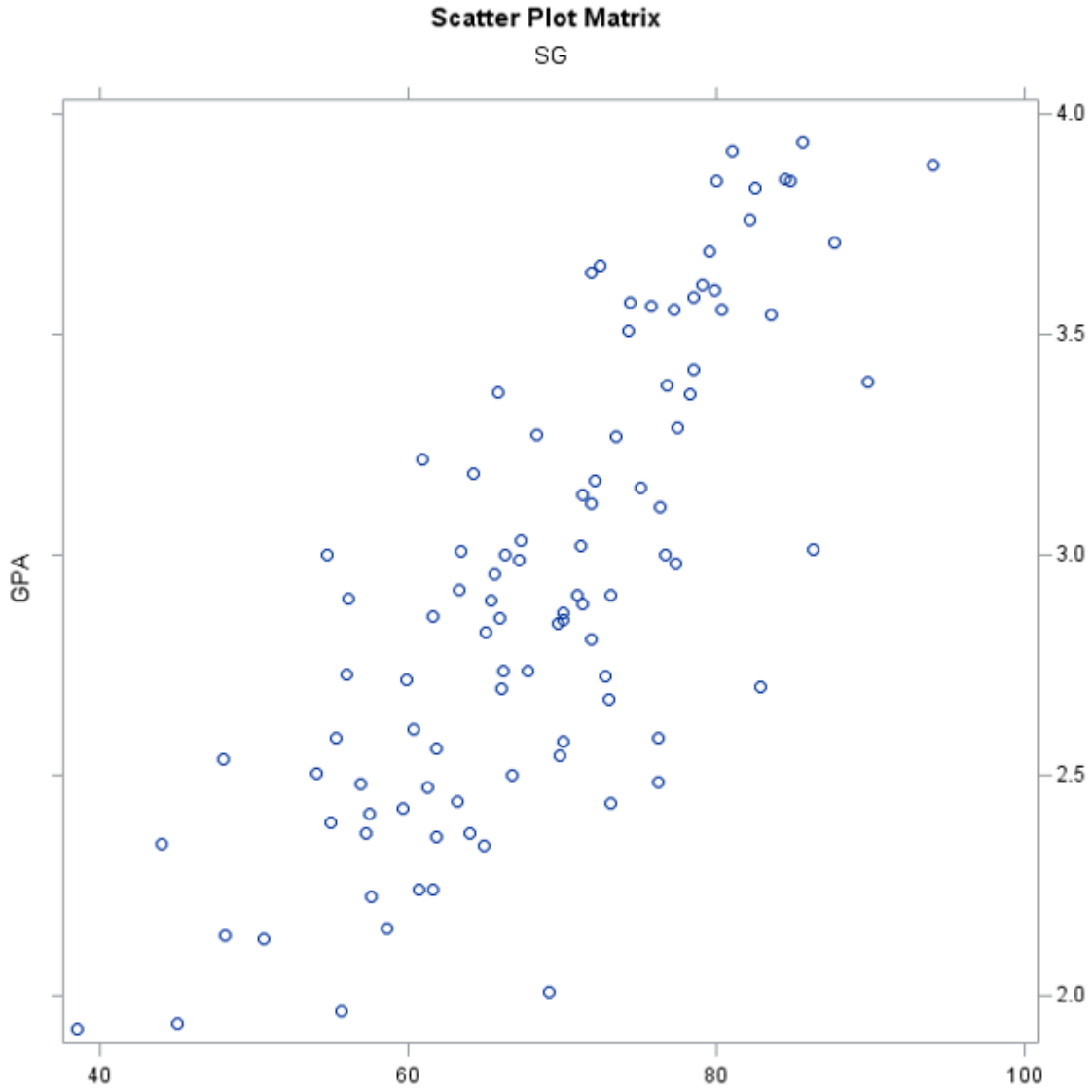
Table 4.12

Objective 2 Correlation Data (n = 99)

Variable	Mean	Standard Deviation	Minimum	Maximum
GPA	2.937	0.524	1.923	3.935
Final grade in AGN 331	68.739	10.719	38.467	94.071

Figure 4.1

Scatter Plot Matrix for Correlation Between GPA and SG (Final Grade in Soils)



Note: r = 0.7733, p = <0.001

With a p-value of <0.001 it can be determined that the null hypothesis is rejected, and in fact there is a significant correlation between the student's GPA and their outcome

in AGN 331 (SG). A second procedure, general linear model (GLM), was performed on SAS to compare the distribution of SG with the student's GPA categories (GPAC). The GLM procedure uses the method of least squares to fit general linear models (Introduction to SAS, n.d.). The GLM procedure in this research project was used for an analysis of variance (ANOVA). Students were coded into three different groups, low GPA (2.0 or below), middle GPA (2.1 to 3.0) and a high GPA (3.1 to 4.0). It was necessary to split each semester into these categories so that a fair comparison of the students could be made. The significance level of the GLM procedure is labeled as *F*, still a value of <0.05 is considered statistically significant. In SAS the significance probability value associated with the *F*-value is reported as Pr>F. The calculated value was <0.001, rejecting the H_0.

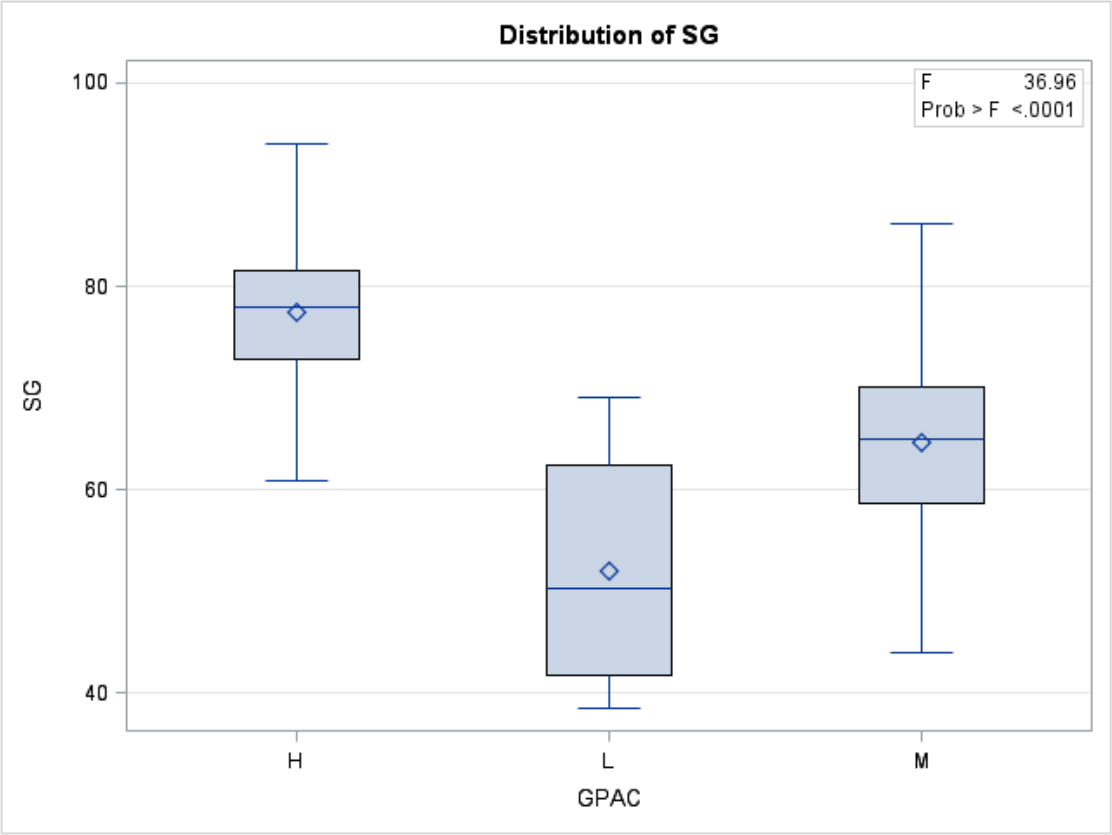
Table 4.13
Objective 2 Correlation Data (SG vs GPAC)

GPA Category	N	Final Grade Mean	Standard Error
High GPA Category	36	77.472	1.357
Medium GPA Category	59	64.542	1.059
Low GPA Category	4	52.055	4.070

Note that there is some overlap between the three categories of GPA in comparison to the final grade in soils. Figure 4.2 shows that in the low GPA category (L), that the highest performing student was actually in the 2nd quartile of the medium (M)

GPA category students. While there is some overlap in data, the Pearson Correlation Coefficient still shows a significant relationship between GPA and SG.

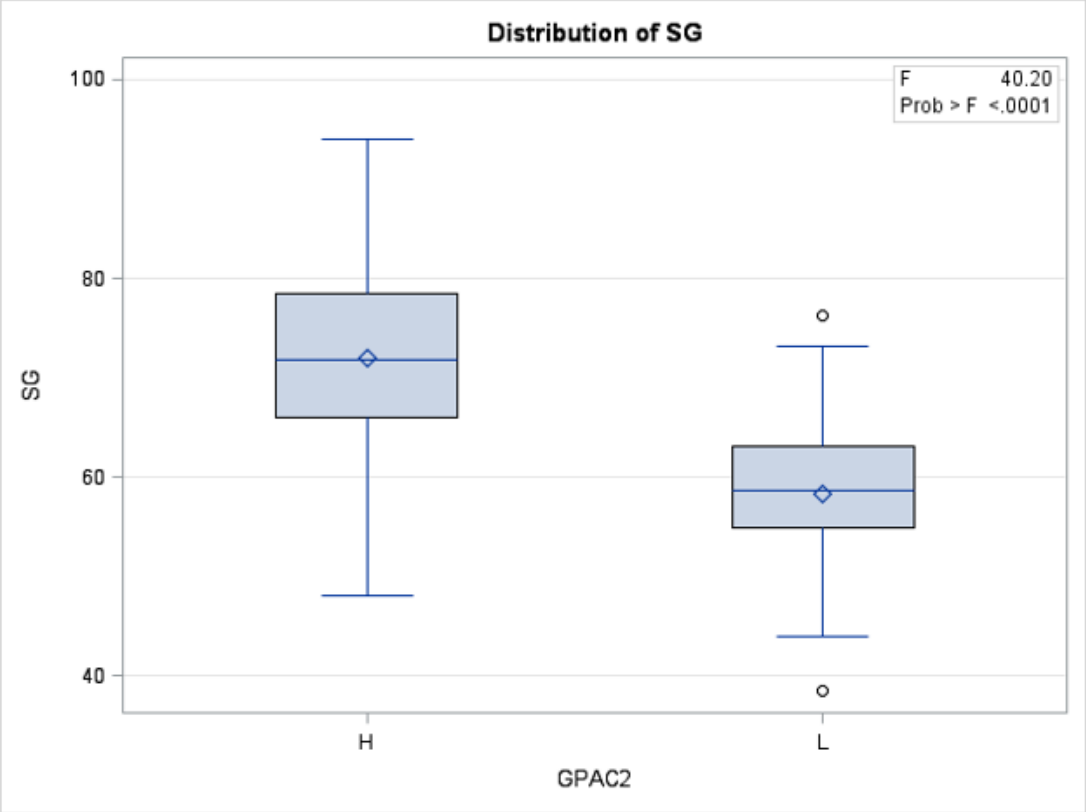
Figure 4.2
Distribution of Soils Grade in Comparison to GPA Category of H, M, L



Additionally, students were recoded into just two GPA groups, low (2.499 or below) and high (2.5 to 4.0). This comparison was made by collecting the GPAs and final course grades from this semester of students (SI semester) and comparing that to the two semesters of data that the faculty member collected previously (non-SI semesters).

Students were coded into only two groups for the third run of data to show a different distribution of grades (Figure 4.3). When students were recoded into just two categories a total of nine students fell into the low GPA category, while the other 27 students fell into the high GPA category. The mean final grade in AGN 331 for the high GPA category was 72.33 and the mean for the low GPA category was 59.39. Once again, a significant relationship could be determined by the p-value (0.0007).

Figure 4.3
Distribution of Soils Grade in Comparison to GPA Category of H and L



Objective 3

Objective three was to evaluate the effectiveness of SI in AGN 331 for students who have participated in SI to those who did not participate in SI. The null hypothesis for this objective was SI has no impact on exam scores and the final grade in AGN 331. A correlation was performed to compare each of the following dependent variables: exams (1, 2, 3, and the final) as well as their final grade in the course. This was done for all three semesters, two non-SI attending semesters and one SI attending semester. Additionally, the same information was analyzed to compare just the SI attending semester on the number of hours they attended SI on the dependent variables. The GLM procedure was used to perform an ANOVA to compare the above information. The least squares mean and Pr > t value was used to compare the data between each exam and final grade in soils (Table 4.14). The Pr > t value is the probability of getting a larger value of *t* if the parameter is truly equal to zero, a very small value for this probability leads to the conclusion that the independent variable contributes significantly to the model (Introduction to SAS, n.d.). For this research a Pr > t value of <0.05 is considered significant. In this case, the independent variable is attendance of SI, signified by yes, for the SI semester, and no for the two non-SI semesters. Table 4.14 summarizes all of the dependent variables with LS Means and Pr > t values. The null hypothesis was rejected for SI semester and exam one (Pr > t = 0.193) as well as SI semester and exam two (Pr > t = 0.0015) (Table 4.14). For the other three dependent variables, SI semester and final grade in soils, SI semester and exam three score and SI semester and final exam score the

null hypothesis was accepted. For those three dependent variables access to SI did not have a significant impact.

Table 4.14

Least Squares Means of All Semesters as Compared to Soils Grade, Exam 1, Exam 2, Exam 3 and Final Exam Scores

Item	SI Semester	LS Mean	Pr > t
Final Grade in AGN 331	NO	68.535 ± 1.357	0.8037
	YES	69.096 ± 1.795	
Exam 1 Score	NO	58.286 ± 2.086	0.0193*
	YES	66.361 ± 2.708	
Exam 2 Score	NO	60.921 ± 2.087	0.0015*
	YES	49.583 ± 2.761	
Exam 3 Score	NO	60.031 ± 1.939	0.7231
	YES	58.889 ± 2.566	
Final Exam Score	NO	74.238 ± 2.871	0.3729
	YES	78.500 ± 3.978	

Note. *indicates a significant figure <0.05

For the second part of objective three, the same dependent variables, final grade, exam one score, exam two score, exam three score, and final exam score were performed on the SI attending semester. The null hypothesis was the number of hours a student

participates in SI does not have an effect on the dependent variables. The independent variable for this section was the total number of hours the student attended SI (SIH). Table 4.15 summarizes the results of the GLM procedure performed on SAS. Comparisons were made based on the Pr > F value, like P > t this is a measure of probability and a significance level of <0.05 was used. The null hypothesis was rejected for dependent variables Soils Grade (SG) (Pr > F= 0.0251), Exam 2 (E02) (Pr > F= 0.0358), and Final Exam (E0F) (Pr > F= 0.0045), meaning the attendance of SI had a significant impact on the final grade in soils, exam two score, and the final exam.

Table 4.15

Least Squares Means of Attending SI Sessions as Compared to Soils Grade, Exam 1, Exam 2, Exam 3 and Final Exam Scores

Dependent Variable	Mean	Pr > F
Final Grade in AGN 331	69.096	0.0251*
Exam 1 Grade	66.361	0.1212
Exam 2 Grade	49.583	0.0358*
Exam 3 Grade	58.889	0.1339
Final Exam Grade	78.500	0.0045*

Note. *indicates a significant figure <0.05

Further broken down into the number of hours and influence on the final grade and each of the exams. There were 10 different categories of hours that students attended SI sessions: 0, 1, 2, 3, 3.5, 4, 5, 8.5, 9.5, and 13. When broken down by number of hours

attending SI throughout the semester (SIH) in those 10 different groups and compared with the dependent variables soils grade, exams 1, 2, 3 and final exam all values, except three in total, reported reject the null hypothesis. While some values are less significant than others, all that were less than 0.05 were considered significant. The three that were not considered significant were exam 3 grade, SIH was equal to 8.5 hours ($Pr > t = 0.2092$), final exam grade equal to hours of 5 ($Pr > t = 0.1141$) and hours of 8.5 ($Pr > t = 0.1754$). It should be noted that the two students who failed the course came to SI sessions a total of five and eight and a half hours in total.

Finally, the number of hours students attended SI sessions was compared to the improvement between exam scores. The report is summarized in table 4.16. Overall the table reports that the total improvement of exam scores (ETI) had a weak correlation of 0.16819. The highest reported improvement was between exam one and two (E02I) with a moderate Pearson Correlation Coefficient of 0.36522 (Table 4.16).

Table 4.16
Pearson Correlation Coefficients and Probability of Number of Hours Attended SI to Improvement Between Exam Scores

Exam Improvement	Pearson Correlation Coefficient	Prob > r under H_0
Total Exam Improvement	0.17	0.33
Improvement between 1 and 2	0.37	0.03*
Improvement between 2 and 3	-0.03	0.09
Improvement between 3 and final	0.06	0.74

Note. *indicates a significant figure <0.05

While D, W and F grades were not analyzed statistically for each semester, they were gathered from existing data (Table 4.17). It is seen from this table that there was a constant increase in D letter grades. From semester one to two, there was a sharp increase in D, total of four, and F, total of three, grades. However, the F grades increased by three from semester one to two and decreased by three from semester two to three.

Table 4.17
D, W, and F Rates for Each Semester

Semester	D	F	W
Semester 1 (non-SI)	5	2	0
Semester 2 (non-SI)	9	5	0
Semester 3 (SI)	11	2	0

Objective 4

The fourth and final objective was to assess the background of SI attending students and non-SI attending students. This data only looked at the semester that had access to SI. The students were compared on their grade in chemistry course, which chemistry course they took (Introduction or General), grade in crop science and their grade in Soil Science (independent variables). The null hypothesis for this objective was that the background of students (independent variables) do not affect the outcome of the grade in AGN 331. First, the researcher compared students on two background courses, chemistry and crop science, on their outcome in AGN 331. Those two classes were selected because AGN 331 employs background information learned in both of those courses throughout the semester. Ideally, the student should come to Soil Science having mastered chemistry and crop science, and be familiar with the material taught in both of those courses. The GLM procedure was used to perform an ANOVA on soils grade (SG), chemistry course taken (Introduction or General), and their grade in crop science (CSG). For both sets of data ran on SAS, comparisons were made on the Pr > F value of type I LS Means. The Type I test assesses differences between the arithmetic treatment means when the treatment effect comes first in the model. Type I Pr > F values and LS Means were chosen to assess the significance of this data because Type I LS Means are the arithmetic means, or the actual calculated means of the data set. For the purpose of evaluating the effectiveness of SI in AGN 331, actual (Type I) means need to be used (Introduction to SAS, n.d.). In Table 4.18 the results are summarized for the comparison

of the final grade in soils to which chemistry course students took, grade in crop science, and which GPA category they belong to. According to table 4.18 the only statistically significant correlation was between GPA category and soils grade (Pr > F= 0.005). This was already determined in objective two. Figure 4.4 shows the data plotted out, further showing the lack of correlation between the three independent variables on the dependent variable (SG).

Table 4.18

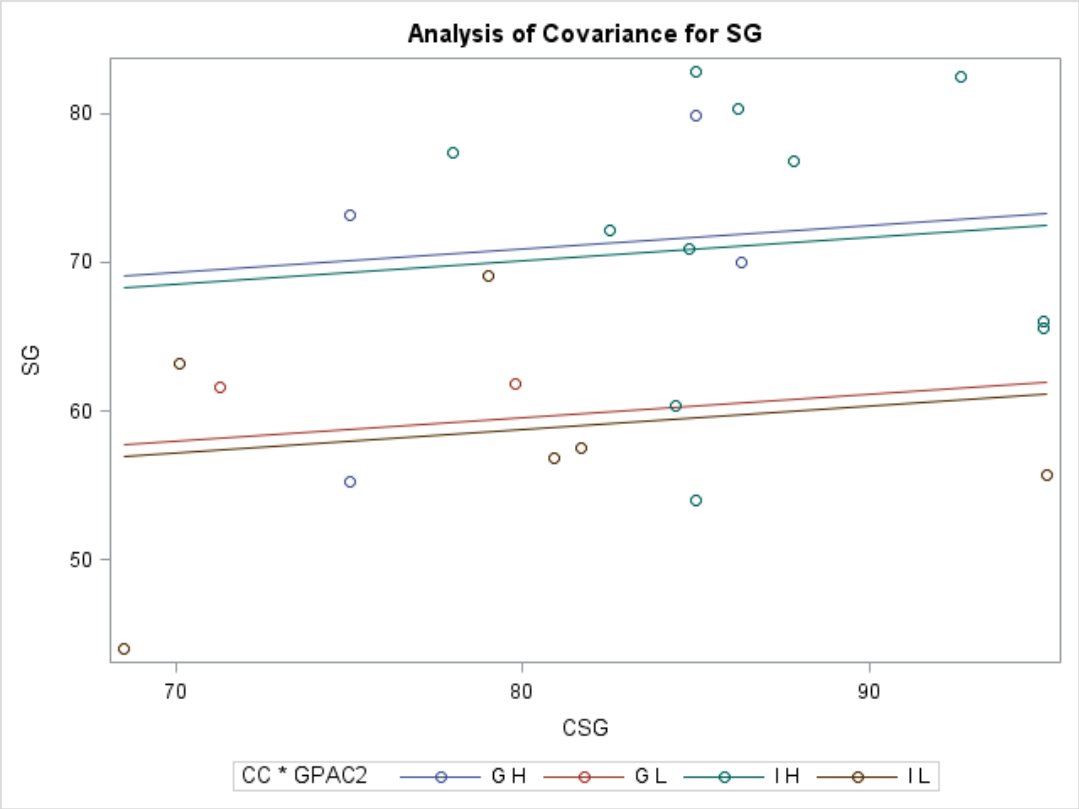
Type I Pr>F Values for Comparison Between Chemistry Course Taken, GPA Category and Crop Science Grade on Final Grade in Soils (n = 22)

Independent Variable	Type I Pr > F Value
Chemistry Course Taken	0.96
GPA Category (2)	0.005*
Final Grade in AGN 110	0.61

Note. *indicates a significant Pr > F value of <0.05

Figure 4.4

ANOVA Plots for Comparison Between Chemistry Course Taken, GPA Category and Crop Science Grade on Final Grade in Soils (n=22)



Based on this report, the null hypothesis was accepted, to some degree. Meaning that not all of the variables in the null hypothesis could be accepted. From the calculations reported by SAS it should be noted GPA did have an effect on the outcome in AGN 331. For this variable, the null hypothesis was not accepted. Regarding the other two variables, chemistry course taken and grade in AGN 110, the null hypothesis was accepted because a statistically significant relationship was observed between those variables and the final grade in AGN 331.

In addition to running the dependent variable to these three independent variables, the researcher felt it was necessary to perform an additional ANOVA on just GPA category and chemistry course taken since that would result in a larger pool of data (n = 35). A total of 35 data points were collected because one student still had not finished chemistry. The calculations are summarized by Table 4.19. According to Table 4.19 Type I F-value for both chemistry course taken and GPA category, were statistically significant with a Pr > F value of 0.05 and 0.0008. Once again the significance was measured by the F-value and a score <0.05 is considered to have a statistically significant relationship.

Table 4.19
Type I Pr>F Values for Comparison Between Chemistry Course Taken, and GPA Category on Final Grade in Soils (n = 35)

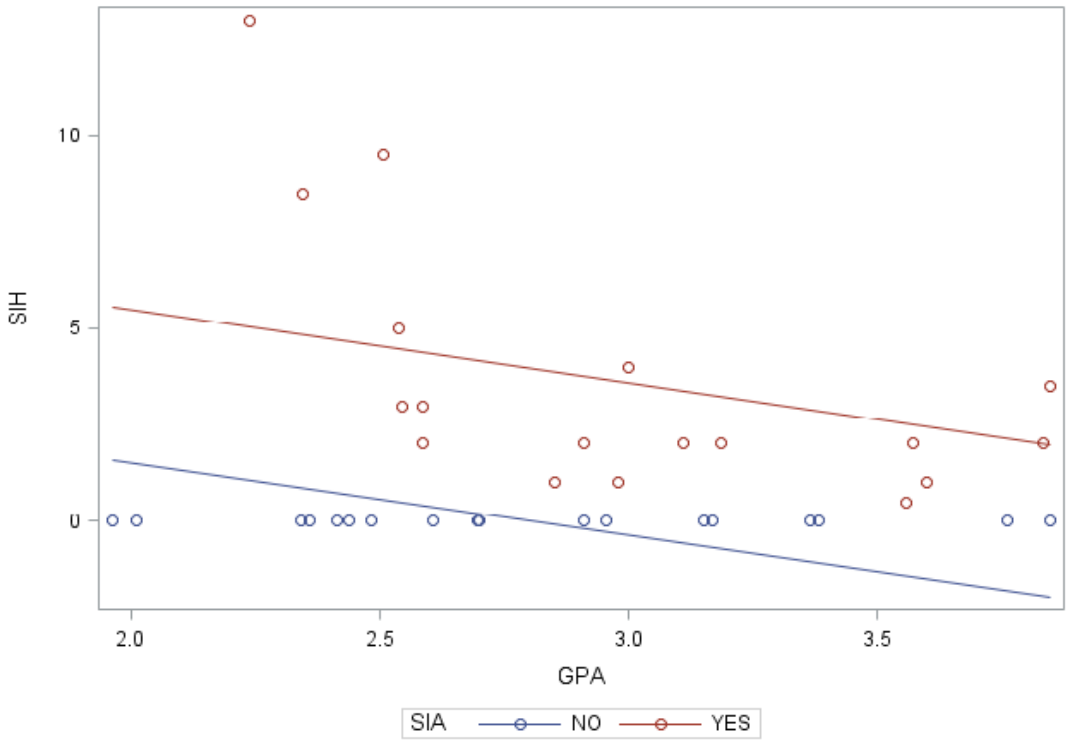
Independent Variable	Type I Pr > F Value
Chemistry Course Taken	0.05*
GPA Category (2)	0.0008*

Note. *indicates a significant Pr > F value of <0.05

There was no relationship between the number of hours a student attended SI and their GPA, as shown in Figure 4.5. It was thought that students who did attend SI had a lower GPA, but that was not true. Some students who had lower GPA's (less than 2.5) did not attend SI sessions.

Figure 4.5

Correlation Between GPA and the Number of Hours Students Attend SI (SIH)



CHAPTER V

Summary, Conclusions and Implications

Overview

Chapter V provides a summary of the study, offers conclusions and implications for each objective that guided the study, and proposes recommendations for future practice and research.

Purpose and Objectives

The purpose of this study was to evaluate the effectiveness of SI on Generation Z students in AGN 331 and to determine their perceptions of SI based on their attendance. This research was done to determine if the program should be continued for AGN 331 or expand and be offered for other courses in the department.

1) Determine student's perceptions of SI
    a. Survey distributed to the class
2) Determine the relationship of student's performance in AGN 331 and GPA
    a. Compare non-SI semesters to SI semester (GPA and final weighted grade in course

b. The null hypothesis for this objective is there is no relationship between GPA and the final grade in AGN 331

3) Evaluate the effectiveness of SI sessions in AGN 331
    a. Compare each of the exams (1, 2, 3 & Final), GPA (high, middle, low), and hours that they attended SI
    b. The null hypothesis for this objective was SI had no impact on exam scores and the final grade in AGN 331.
4) Evaluate the background of SI students and non-SI attending students
    a. Compare GPA, grade in chemistry course, which chemistry course they took, and grade in crop science
    b. The null hypothesis for this objective is the background of students does not affect the outcome of the final grade in AGN 331.

Conclusions and Implications for Objective One

Objective one sought to determine the students' perceptions of SI. This was done through a survey given to students via Qualtrics on the last week of the course. This survey was broken into 12 constructs. Construct one was demographic information. While the population size for this study was small (n = 36), the demographics of the population closely line up to the demographic data of the department where the majority of students are from East Texas, closely followed by Houston, then Dallas/Fort Worth

(Office of Institutional Research, 2018a). This suggests the population in AGN 331 is a model representation of the entire Department of Agriculture.

Overall, this data shows that the majority of students that attend SI identified as white females, this can be correlated to similar results from Rabitoy et al., (2015). They stated that gender and ethnicity play a role in SI, and the SI leader identified as a white female, more white female students may have been inclined to come to SI. Other important information gathered from construct one would be to keep in mind that the population in the course do not all come from an agricultural background. Students that have an agricultural background may have an easier time relating to the course material. A limitation to having a blind survey was that the researcher could not correlate their demographic information, especially agriculture background with their grades in AGN 331.

Constructs two, three and four were answered by all students in AGN 331. Perceptions gathered by all students from construct two, accessibility of SI in AGN 331, include that students felt that it was well publicized and the professor encouraged them to attend, but the barrier of when the SI sessions were held was prevalent. Perceptions gathered by all students from construct three, “Who is SI for?”, revealed that students perceive SI as being for students who want to learn all they can to do well in the class. This concluded that all students felt it could be beneficial to them. Perceptions gathered by students who did attend SI started with construct four, “Perceptions of the SI leader”. Overall students felt comfortable in SI sessions as they thought that the SI leader treated

them and other students with respect (Mean = 5.69) (Table 4.3). The lowest reported mean (4.44) was for the statement “My SI leader used a variety of activities in SI” (Table 4.3). This might be due to the fact that this was the SI leaders first semester of running this type of program and the small size of the group that regularly attended SI sessions. For these three constructs it seems like a theme is already starting to emerge from the data, SI is beneficial to all students, yet the sessions have to be at a time that all students can attend.

That directly ties into construct 10, which was aimed at students who did not attend SI sessions. The biggest barrier keeping students from attending sessions were that students had other obligations like class and work (frequency = 15) (Table 4.8). Perceptions from non-SI attending students were gathered and returned the results that even though they did not attend a session, they felt that is was a good resource (frequency = 8) (Table 4.9). From all of the survey data, the researcher can conclude that the biggest barrier of coming to SI was students had schedule conflicts. This could be combated by providing a wider variety of times for students to choose from when selecting an SI session, or hold two, one-hour sessions instead of a two hour block once a week. Additionally, the researcher can conclude that the perceptions of SI are that it is a useful resource and students that did attend felt that they benefitted from coming. Finally, students would like additional resources that they can take with them from the SI sessions each week. This feedback of students wanting additional resources they can take with them from SI sessions came from the survey data. While Seemiller & Grace (2017) point

out that students may not complete out of class assignments and readings as readily as generations in the past, Gen Z students are intrapersonal learners, like to learn on their own. By giving students handouts with extra practice problems from the course they can learn on their own if they so choose.

Other important demographic data to further explain the background of the population in AGN 331 was the number of credits students are taking. The average number of credits being taken during the AGN 331 semester was 14, while the mode was 13 credits, while the minimum full load is 12 credits. This is an important piece of information to have because one barrier of students attending SI sessions was other course work or class schedule conflicts.

Another barrier to students coming to SI was because they lived out of town and had to commute. Of the students in AGN 331, 41.67% of students said they commute to campus, the average commute was 30 miles. For the students who did attend SI, 35.29% of students said they commute an average of 12.67 miles to campus. The biggest barrier of students attending SI sessions was the fact that they had to work. For the population of the class, 61.11% of the class were employed, of those students an average of 22.53 hours was worked during a normal week. For the students that did attend SI, a total of 47.06% said they did work, for an average of 21.25 hours during a normal work week. While there is not a large difference between the two, 14.05%, other factors also played a role into their decision to attend SI sessions since almost half of the students that did come also worked a job.

From this data, it shows that from the perception of the students that attended SI sessions (n = 17), the majority felt that the greatest service provided by SI was a better understanding of the course material. Most of the students who did not attend SI did have a perception that SI was a good resource, they just did not use it because of the barriers listed by non-SI attendees as other obligations, including work or class, no motivation to go and did not need to go.

Supplemental Instruction is a program aimed at increasing student retention as well as academic performance. Like Weinstein and Palmer (2002), students rated themselves on 11 different statements regarding the skills they felt they gained by attending SI sessions. Overall, the data showed that students would come and use SI in the future, as well as recommend it to others (Mean = 5.53, 5.24). Additionally, students thought that SI sessions helped them to focus and comprehend the material better (Mean = 5.00), overall increasing their academic performance.

Conclusions and Implications for Objective Two

Objective two sought to determine the relationship between GPA and the final grade in AGN 331. The null hypothesis for this objective was there is no relationship between GPA and the final grade in AGN 331. It can be concluded from a Pearson Correlation Coefficient of 0.77, which is considered a strong relationship, and a reliability score or <0.001 that GPA is very highly correlated to the outcome, final grade in soils. A good student will always be a good student, for the most part, except there

were a few outliers. Figures 4.2 and 4.3 show that even an overall high performing student can have a low performance in this historically difficult course. There are other factors that contribute to the final grade in the course that will be explored in later objectives.

Conclusions and Implications for Objective Three

For objective three, evaluate effectiveness of SI in AGN 331 for students, it can be concluded that the attendance of SI does have an effect on the overall outcome, final grade in soils. The null hypothesis for this objective was SI has no impact on exam scores and the final grade in AGN 331. When all three semesters were compared on means in table 4.13, the final grade reported an average of 0.561 points higher, and on the final exam an average of 4.262 points higher if the student had access to SI sessions. But, when comparing the dependent variables to the independent variable, SI access, only exam one and exam two had a significant statistical difference ($p < 0.05$). When comparing just the semester that had access to SI on the hours they attended SI sessions to the five dependent variables, exam two, final exam and overall grade in the course showed to have significant differences (Table 4.14). Since attending SI and the final grade in the course were statistically significant the null hypothesis was rejected. The researcher can infer this might be due to the fact that not many students came to an SI session before exam one, and after they did not perform well they started to attend SI sessions between those two exams and throughout the semester.

Supplemental Instruction is a program aimed at assisting students in a more personable setting, as compared to the classroom, in courses that have been identified as historically difficult (Martin & Arendale, 1994). Those classes can be defined as larger class sizes where students get little interaction with the professor, or require a large amount of readings and outside work (Martin & Arendale, 1994). They can further be identified as entry level courses where D, F, and W rates exceed 30% of course participants (Blanc et al., 1983). For the purpose of this course the average class size was 36 students, and 30% of that is 10.8, so 11 students. For each semester existing data was gathered on the total number of D, F, and W rates (table 4.19). Of the total D, F, and W rates, two semesters meet the 30% or over rule, one non-SI semester and the SI semester. It can be seen in this data that there was a big increase of F grades from semester one to semester two, an increase from two to five, and an increase of three students is roughly 10% of the class. From semester two to three, the SI semester there is a decrease in F grades. This might be due to the attendance of SI, but it was not evaluated with statistics. It should be noted that the two students who failed during the SI semester did attend SI. But it should also be noted that just coming to SI does not help your grade in AGN 331, there also needs to be some effort put in outside of the class in order to have a greater impact on the outcome (final grade in AGN 331). Additionally, the curve of the class should be taken into account. As traditionally thought of where a 60 to 70% equals a D and anything under 60% equals and F in AGN 331 the final raw score in the class does

not necessarily correlate to letter grade. This is due to the professor using a distribution like curve of scores to assign letter grades.

Conclusions and Implications for Objective Four

The fourth and final objective was to assess the background of SI attending students and non-SI attending students. This data only looked at the semester that had access to SI. The students were compared on their grade in chemistry course, which chemistry course they took (Introduction or General), grade in crop science and their grade in Soil Science (independent variables). The null hypothesis for this objective is that the background of students (independent variables) do not affect the outcome of the grade in AGN 331. It can be concluded that the null hypothesis should be rejected to some extent. Meaning that not all of the variables in the null hypothesis can be accepted. From the calculations reported by SAS it can be seen that GPA did have an effect on the outcome in AGN 331. For this variable, the null hypothesis should not be accepted. Regarding the other two variables, chemistry course taken and grade in AGN 110, the null hypothesis should be accepted because a statistically significant relationship could not be observed between those variables and the final grade in AGN 331. We know from objective two that the correlation between GPA and final grade in AGN 331 are statistically significant, further shown in objective four by Tables 4.18 and 4.19. As for the influence of Crop Science grade, chemistry course taken and GPA on final grade in

soils, there is no statistical significance (Table 4.18), probably because of the small population size.

Additionally, when a correlation is performed on chemistry course taken and GPA category to the final grade in AGN 331, a statistically significant value was calculated for Type I F-value. This means that the chemistry course taken might have a correlation to the final grade in Soil Science. Of the top 10 students in the course, five students took the Introduction to Chemistry course (lower level) and the other five took the General Chemistry course (upper level). It may not matter what chemistry course students take for top performing students, but for the bottom 10 performing students nine took the lower level chemistry while one took the upper level chemistry.

For this objective, it seems that the background information chosen may not have a direct relationship, a P value of <0.05, with the outcome in AGN 331, further research and a larger sample size may help to further explore this. Choosing a natural sciences course that all majors in the Department of Agriculture, like Biology 131, Principles of Botany, would be a better choice and still relate to the background information being recalled by students taking AGN 331. This would help increase population size of the subset and increase confidence levels.

Looking through the eyes of Pace (1979) and his Model of College Impress, which says the background of the student plus the student's effort (or input) produce the student's outcome, this study concludes that GPA, which could be counted as a background item or an input, is highly correlated to the outcome of the course. The other

variables in background, like chemistry course taken and Crop Science grade do not necessarily correlate with the outcome in AGN 331, but might produce different results when the population size is increased or the course was changed from Crop Science to Biology 131. The last variable, effort, could be measured by the number of hours attending SI sessions, or by GPA. GPA could fit in the input category, because like mentioned before a good student is a good student and if they put in enough effort in other classes to produce a high grade they should put forth the same effort in this course as well. The findings in this study were not totally conclusive to all parts of Pace's (1979) theory.

Recommendations

The recommendations for this study are separated into two sections, which included recommendations for practice and recommendations for future research.

Recommendations for Practice

Research on SI for upper level courses has been lacking, essentially because SI is designed for lower level historically difficult courses aiming to keep students coming back and not leaving the university. While SI is usually not geared towards upper level courses, AGN 331 is required by all degree programs in the department of agriculture. This research took a different approach of SI based on the typical criteria for getting SI

sessions implemented. While this model for SI did lack an SI supervisor, it was justified because the SI leader had been previously trained in education and pedagogy.

While many students were aware of the benefits that SI could bring to them, they were not able to attend because of the time the sessions were held. In the future it would be good to offer more of a variety of times that sessions will be held. This means smaller time slots twice a week or offering sessions in the evening when students do not have classes. The AARC at SFASU holds smaller time slot sessions several times a week, usually in the evening so that attendance is higher, according to the AARC and students that attend SI sessions there. The model of SI in AGN 331 could follow suit after the AARC and offer a wider variety of times for students to attend.

Supplemental Instruction has shown that over time participants become stronger proactive learners compared to non-SI attending students (Ning & Downing, 2010). This model of SI could continue to grow and be implemented into other lower level courses in the Agriculture Department as well. If students are taught early on how to take notes, to study, to search for answers, etc. through SI sessions, they may be better prepared to handle upper level courses in and out of the department with a greater success/pass rate. Since our department has a low population of students that do not come from an agriculture background, a total of 36.11% in AGN 331 and 51.22% in the entire department (SFASU 2016 & 2018), starting SI sessions in other required courses across all disciplines in agriculture could prove to be beneficial. Offering SI sessions, for AGN 331 and other courses as well, will cost the department some money in order to pay a

student to prepare and teach material in an SI session, but it should not be more than 10 hours per week. Those 10 hours would include three hours being spent in lecture, two hours being spent in lab, if the course has one, two hours preparing for the SI session, and two hours of SI each week. Typically SI is led by a student who has successfully completed the course, but this could also be done by a graduate student as a part of their required hours.

The students entering our department are Generation Z students. These students have a shorter attention span (Igel & Urquhart, 2012), and research shows that the use of technology in the classroom could help combat this and really grab students' attention (Seemiller & Grace, 2017). They have unique learning characteristics and preferences, traditional lecture-format classes will be less effective in engaging them. These students really need a dynamic learning environment that will encourage them to become more effective learners (Seemiller & Grace, 2016). Why is this not being accomplished? Students go to class and tune out after a while and professors tend to only use one style of teaching, and that is often lecturing to their students while they take notes. A different way to learn would be in SI. Students can utilize this program to learn in a variety of ways, which is not just lecture based. SI encourages students to participate and collaborate with other students. While Generation Z students typically are intrapersonal learners, this system will be more casual and a place for all to feel welcome to share their answers and learn along with other classmates and friends in the department.

Recommendations for Research

Multiple research studies have shown that SI is an effective tool for students to use and to help increase pass rates and course grades (Javaher, 2010; Jacobs & Stone, 2008; Martin & Arendale, 1992; Blanc et al., 1983). The research done on SI sessions in AGN 331 looks less conclusive than research in the past, but it really is due to the small population size. Since a Type II error is the retention of the null hypothesis, as more data is collected over multiple semesters, stronger conclusions will be drawn because the Type II error will be lessened (Ary et al, 2010).

Existing data on Crop Science grades and chemistry courses need to be regularly kept in order to avoid losing data. Another course that works well as a prerequisite of AGN 331 will need to be assessed, like Biology 131- Principles of Botany, which is a course taken by all students in the Department of Agriculture. The subset performed on Crop Science grades was simply too small. In addition to keeping up with grades and courses taken, if access to continuous data for the chemistry course taken, the student's raw score on a 100 point scale that they achieved in the course, a comparison of continuous data could be made to continuous data rather than to categorical data. This would also lessen the chance of a Type II error. Having access to all continuous data is stronger than having categorical data.

Pace (1979) theorized that the background information that the student comes with to the course, plus the amount of effort they put forth in these courses determines the outcome, or the final grade in the course. In addition to selecting a course that better

defines the background of all student's, like Biology 131, a better assessment of the effort put forth, other than just hours attending SI sessions, needs to be established in order to draw added conclusions to better support Pace's (1979) theory. A solution to this might be to have an outside observer during SI sessions. This observer would sit in all SI sessions and see how students are interacting with the SI leader. This observer should also sit in class and assess how much effort students are putting fourth during lecture. This would be a better measure of their input and effort than just the number of hours a student is attending SI sessions. Just because a student is coming to SI does not mean they will pass the course. They also need to put in effort in and out of the classroom as well. This includes time studying materials, not just SI.

Another piece of research may come with ethnicity and gender of the SI leader. Not many studies had been done on the relationship between the ethnicity and gender of the SI leader to the participants that come to SI sessions. Rabitoy et al. (2015) stated that the gender and the ethnicity of an SI leader may have an impact on the students that attend SI. Conclusions cannot be drawn on the SI semester of attendees simply because the SI leader and the students who attended SI sessions made up the majority of the department, white females. With a larger population size and a change in SI leader some conclusions on who attends SI can be made.

Additionally, since a goal of retaining and making sure more students graduate is a goal of the university as whole, research could be done in the department on the implementation of SI and retention rates. Retention rates for the department would need

to be gathered from the university first. Once SI is implemented in lower level courses in the department, where students typically get frustrated and quit the major they chose, a comparison could be made from previous semesters to SI implemented semesters and the retention rates. If there is significant improvement in retention of students in the Department of Agriculture more SI sessions, or student led teaching/study programs should be implemented.

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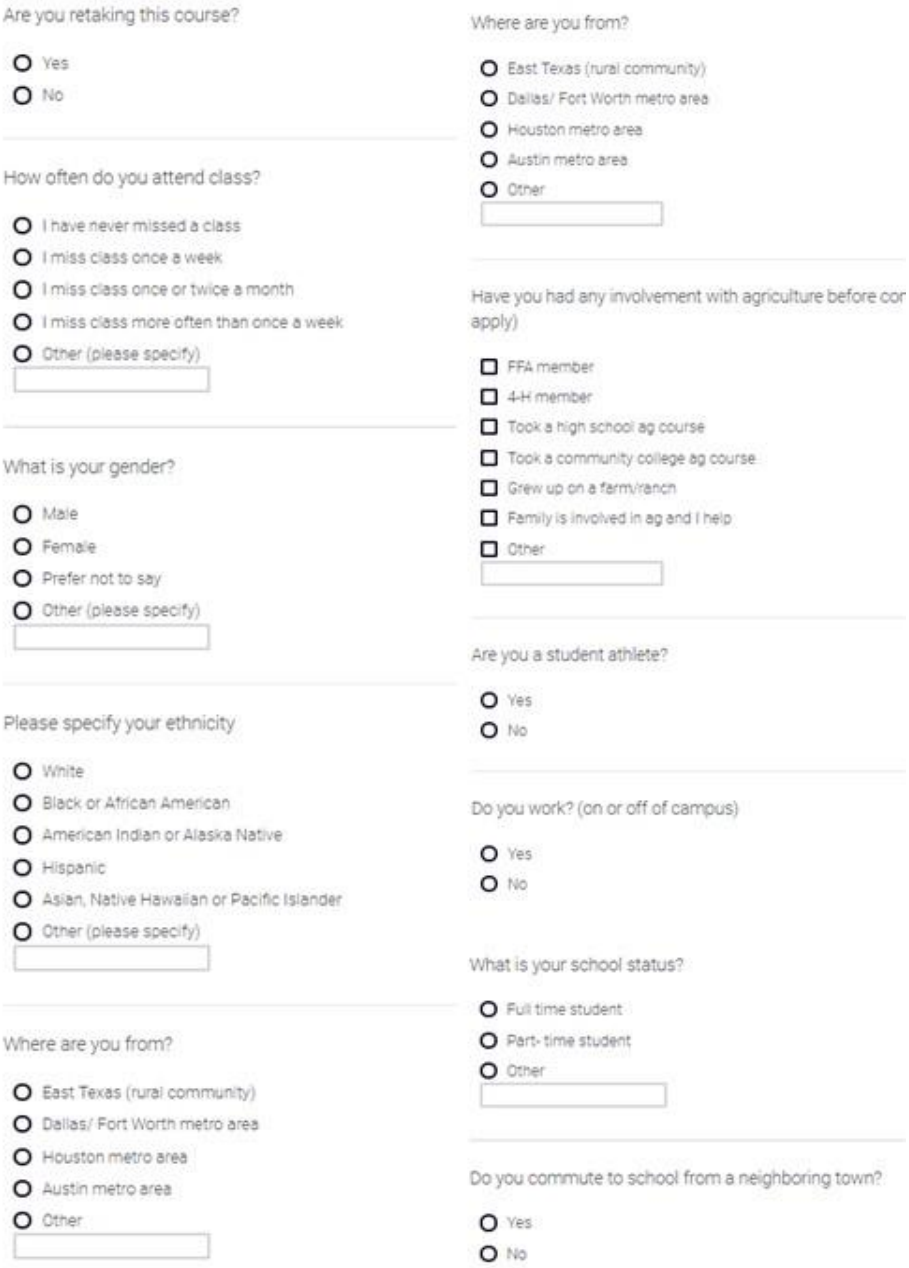
APPENDICES

A. DEMOGRAPHIC SURVEY QUESTIONS

Appendix A

Demographic questions asked on Qualtrics survey instrument


Are you retaking this course?

- Yes
- No

How often do you attend class?

- I have never missed a class
- I miss class once a week
- I miss class once or twice a month
- I miss class more often than once a week
- Other (please specify)

What is your gender?

- Male
- Female
- Prefer not to say
- Other (please specify)

Please specify your ethnicity

- White
- Black or African American
- American Indian or Alaska Native
- Hispanic
- Asian, Native Hawaiian or Pacific Islander
- Other (please specify)

Where are you from?

- East Texas (rural community)
- Dallas/ Fort Worth metro area
- Houston metro area
- Austin metro area
- Other

Where are you from?

- East Texas (rural community)
- Dallas/ Fort Worth metro area
- Houston metro area
- Austin metro area
- Other

Have you had any involvement with agriculture before cor apply)

- FFA member
- 4-H member
- Took a high school ag course
- Took a community college ag course
- Grew up on a farm/ranch
- Family is involved in ag and I help
- Other

Are you a student athlete?

- Yes
- No

Do you work? (on or off of campus)

- Yes
- No

What is your school status?

- Full time student
- Part- time student
- Other

Do you commute to school from a neighboring town?

- Yes
- No

Appendix A

Demographic questions asked on Qualtrics survey instrument

Please specify how far you commute on daily basis (approx. miles)

Are you responsible for taking care of somebody in your household? (Please specify- adult, child, etc)

- O Yes
- O No
- O Other

You answered yes that you are responsible for taking care of someone in your household, please specify.

How many credit hours are you taking this semester?

- O 12
- O 13
- O 14
- O 15
- O 16
- O 17
- O 18
- O Other

What is your classification as a student?

- O Freshman (1-29 credits)
- O Sophomore (30-59 credits)
- O Junior (60-89 credits)
- O Senior (90+ credits)
- O Graduate Student

What is your definition of success in AGN 331?

What grade do you expect to make in this course?

- O A
- O B
- O C
- O D
- O F

Which chemistry course did you take before (or concurrently) AGN 331? (PLEASE SELECT ALL THAT APPLY)

- ☐ Chemistry 100 (Preparation for General Chemistry) or equivalent
- ☐ Chemistry 111 (Introductory Chemistry I) or equivalent
- ☐ Chemistry 112 (Introductory Chemistry II) or equivalent
- ☐ Chemistry 133 (General Chemistry I) or equivalent
- ☐ Chemistry 134 (General Chemistry II) or equivalent
- ☐ Chemistry 331 (Organic Chemistry I) or equivalent
- ☐ Chemistry 332 (Organic Chemistry II) or equivalent
- ☐ Chemistry 452 (Comprehensive Biochemistry I) or equivalent
- ☐ Chemistry 453 (Comprehensive Biochemistry II) or equivalent
- ☐ Other (e.g you got it substituted for another course)

What was your perception of AGN 331 before taking the class?

What was your perception of AGN 331 after taking the class?

APPENDICES

B. PERCEPTION QUESTIONS

Appendix B

Perception questions asked to all students on Qualtrics survey instrument

SI in AGN 331

For each of the statements, choose a response that most directly fits your beliefs on SI in AGN 331.

	Strongly disagree	Disagree	Somewhat disagree	Somewhat agree	Agree	Strongly agree
SI was well publicized in my class	O	O	O	O	O	O
My professor encouraged students to attend SI	O	O	O	O	O	O
SI sessions were scheduled at times I could attend	O	O	O	O	O	O
SI sessions were held in a convenient location	O	O	O	O	O	O
I was informed in advance when changes were made to the SI schedule (e.g., cancelled, postponed)	O	O	O	O	O	O

Perceptions of SI in AGN 331

For each of the statements, choose a response that most directly fits your beliefs on SI in AGN 331.

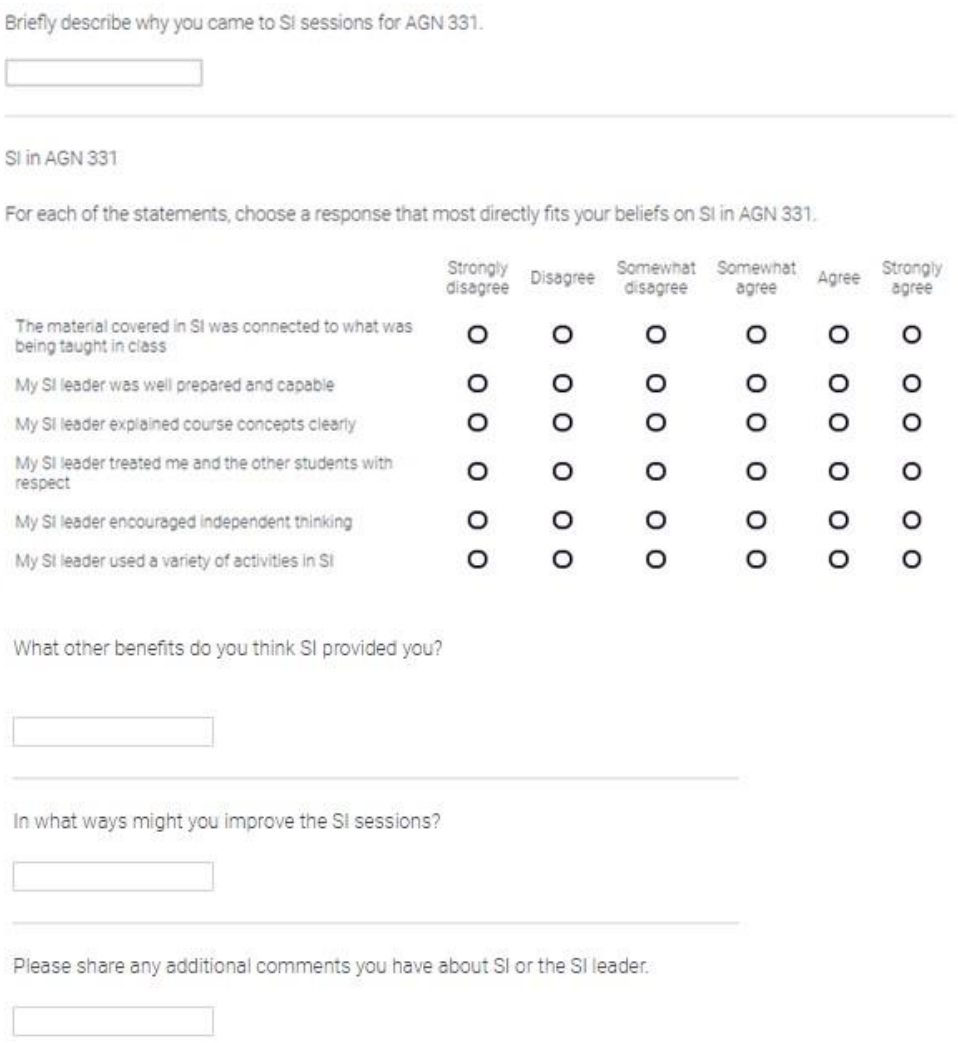
	Strongly disagree	Disagree	Somewhat disagree	Somewhat agree	Agree	Strongly Agree
SI is for students who are not good at math and science	O	O	O	O	O	O
SI is for students who want to learn all they can to do well in the class	O	O	O	O	O	O
SI is not beneficial for a student who is already doing well	O	O	O	O	O	O
SI sessions are not beneficial to me	O	O	O	O	O	O
The SI leader does not know the material	O	O	O	O	O	O

APPENDICES

C. SPECIALIZED QUESTIONS FOR STUDENTS WHO DID PARTICIPATE IN SI SESSIONS

Appendix C

Questions asked to students who did attend SI on Qualtrics Survey Instrument



Briefly describe why you came to SI sessions for AGN 331.

SI in AGN 331

For each of the statements, choose a response that most directly fits your beliefs on SI in AGN 331.

	Strongly disagree	Disagree	Somewhat disagree	Somewhat agree	Agree	Strongly agree
The material covered in SI was connected to what was being taught in class	O	O	O	O	O	O
My SI leader was well prepared and capable	O	O	O	O	O	O
My SI leader explained course concepts clearly	O	O	O	O	O	O
My SI leader treated me and the other students with respect	O	O	O	O	O	O
My SI leader encouraged independent thinking	O	O	O	O	O	O
My SI leader used a variety of activities in SI	O	O	O	O	O	O

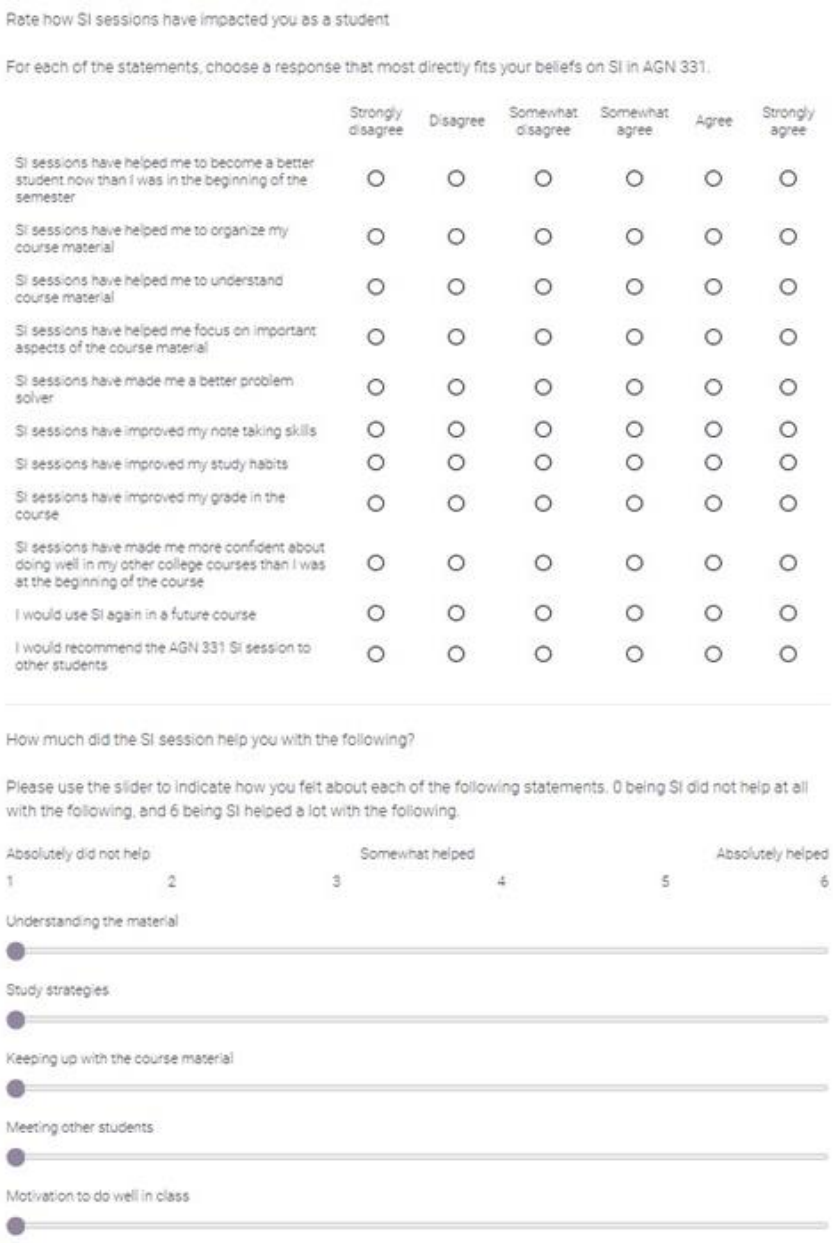
What other benefits do you think SI provided you?

In what ways might you improve the SI sessions?

Please share any additional comments you have about SI or the SI leader.

Appendix C

Questions asked to students who did attend SI on Qualtrics Survey Instrument



Rate how SI sessions have impacted you as a student

For each of the statements, choose a response that most directly fits your beliefs on SI in AGN 331.

	Strongly disagree	Disagree	Somewhat disagree	Somewhat agree	Agree	Strongly agree
SI sessions have helped me to become a better student now than I was in the beginning of the semester	○	○	○	○	○	○
SI sessions have helped me to organize my course material	○	○	○	○	○	○
SI sessions have helped me to understand course material	○	○	○	○	○	○
SI sessions have helped me focus on important aspects of the course material	○	○	○	○	○	○
SI sessions have made me a better problem solver	○	○	○	○	○	○
SI sessions have improved my note taking skills	○	○	○	○	○	○
SI sessions have improved my study habits	○	○	○	○	○	○
SI sessions have improved my grade in the course	○	○	○	○	○	○
SI sessions have made me more confident about doing well in my other college courses than I was at the beginning of the course	○	○	○	○	○	○
I would use SI again in a future course	○	○	○	○	○	○
I would recommend the AGN 331 SI session to other students	○	○	○	○	○	○

How much did the SI session help you with the following?

Please use the slider to indicate how you felt about each of the following statements. 0 being SI did not help at all with the following, and 6 being SI helped a lot with the following.

Absolutely did not help — Somewhat helped — Absolutely helped

1 2 3 4 5 6

Understanding the material

Study strategies

Keeping up with the course material

Meeting other students

Motivation to do well in class

APPENDICES

D. SPECIALIZED QUESTIONS FOR STUDENTS WHO DID NOT PARTICIPATE IN SI SESSIONS

Appendix D

Questions asked to students who did not attend SI on Qualtrics Survey Instrument

Please explain why you did not attend an SI session.

Briefly describe other perceptions you have of SI

Rank your barriers on coming to SI (1 to 10)

(If work was your biggest barrier on coming to SI then rank it #1, if you did not feel you needed to come was the second greatest barrier rank it #2, etc. If it did not apply to you put 0 (zero) in the box provided)

- I had class schedule conflicts
- I had work schedule conflicts
- I did not need the help
- I did not like the SI leader
- I did not like the content of the sessions
- I did not find the sessions helpful
- I did not understand how the program worked
- I was not interested
- I felt unprepared or was too far behind to join
- Other

Please share any additional comments you may have about SI or the SI leader.

APPENDICIES

E. IRB APPROVALS

STEPHEN F. AUSTIN STATE UNIVERSITY

Institutional Review Board for the Protection of Human Subjects in Research
P.O. Box 13019, SFA Station • Nacogdoches, Texas 75962-3046
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Co-investigators: Dr. Stephanie Jones (jonesl19@sfasu.edu), Shania Simons (simonssl1@jacks.sfasu.edu)

RE: Project Title "Evaluating the Effectiveness of Supplemental Instruction on Generation Z Students in AGN 331" Case # AY2019-1090

FROM: Luis E. Aguerrevere, Chair , IRB-H

Luis E. Aguerrevere

DATE: November 27, 2018

I would like to thank you for submitting your project entitled "Evaluating the Effectiveness of Supplemental Instruction on Generation Z Students in AGN 331" to the IRB for review. It has been reviewed and has been **Approved as Exempt** based on the following criteria:

CFR §46.101(b)(2) Research involving the use of educational tests (cognitive, diagnostic, aptitude, achievement), survey procedures, interview procedures or observation of public behavior, unless:(i) information obtained is recorded in such a manner that human subjects can be identified, directly or through identifiers linked to the subjects; and (ii) any disclosure of the human subjects' responses outside the research could reasonably place the subjects at risk of criminal or civil liability or be damaging to the subjects' financial standing, employability, or reputation.

Your project has approval through **November 27, 2019**, should you need additional time to complete the study you will need to apply for an extension prior to that date. The IRB should be notified of any planned changes in the procedures during the approval period, as additional review will be required by the IRB, prior to implementing any changes, except when changes are necessary to eliminate immediate hazards to the research participants. The researcher is also responsible for promptly notifying the IRB of any unanticipated or adverse events involving risk or harm to participants or others as a result of the research.

All future correspondence regarding this project should include the case number **AY2019-1090.**

STEPHEN F. AUSTIN STATE UNIVERSITY

Institutional Review Board for the Protection of Human Subjects in Research
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Co-investigators: Shania Simons (simonssl1@jacks.sfasu.edu)

RE: Project Title "Student Participation in Supplemental Instruction" Case # AY2019-1014

TYPE OF RESEARCH: Thesis

FROM: Luis E. Aguerrevere, Chair, IRB-H

Luis E. Aguerrevere

DATE: September 11, 2018

I would like to thank you for submitting your project entitled "Student Participation in Supplemental Instruction" to the IRB for review. It has been reviewed and has been **Approved as Exempt** based on the following criteria:

CFR §46.101(b)(1) Research conducted in established or commonly accepted educational settings, involving normal educational practices, such as (i) research on regular and special education instructional strategies, or (ii) research on the effectiveness of or the comparison among instructional techniques, curricula, or classroom management methods.

Your project has approval through **September 11, 2019**, should you need additional time to complete the study you will need to apply for an extension prior to that date. The IRB should be notified of any planned changes in the procedures during the approval period, as additional review will be required by the IRB, prior to implementing any changes, except when changes are necessary to eliminate immediate hazards to the research participants. The researcher is also responsible for promptly notifying the IRB of any unanticipated or adverse events involving risk or harm to participants or others as a result of the research.

All future correspondence regarding this project should include the case number **AY2018-1014.**

VITA

After completing her work at Sumner High School, Sumner, Washington in 2013, Shania Simons entered Washington State University in Pullman, Washington. She received the degree of Bachelor of Science in Agricultural Education from Washington State University in December 2017. After completing her undergraduate degree she entered the Graduate School of Stephen F. Austin State University and received the degree of Master of Science in May 2019.

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APA Style Manual

This thesis was typed by: Shania L. Simons