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Persistence of Freshman Support on Student Success into the Sophomore Year

Dr. Krystal Corbett Cruse, Louisiana Tech University

Dr. Krystal Corbett is the First-Year Engineering Programs Coordinator and Assistant Professor in the Mechanical Engineering Department at Louisiana Tech University. She is also the Director of the Office for Women in Science and Engineering at Louisiana Tech.

Mr. Carl Boyet, Louisiana Tech University

Carl Boyet is an Instructor of Mathematics who has worked for Louisiana Tech University for nine years.

Dr. James D Palmer P.E., Louisiana Tech University

Virgil Orr Professor of Chemical Engineering Director of Biomedical and Chemical Engineering

Dr. William C. Long, Louisiana Tech University

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Abstract

Louisiana Tech University is a Carnegie High Research Activity University that has approximately 20% of its 7500 undergraduates as engineering majors, is geographically distanced from large metropolitan areas but draws its student population both statewide and regionally, and operates on the quarter calendar. Louisiana Tech merged the math, chemistry and physic programs with the engineering, technology and computer science programs into a single college in 1995, and created an integrated freshman engineering curriculum in 1998. Louisiana Tech has a long history of educational innovations in engineering education, with a hands-on project based approach implemented in 2004, and four other NSF funded programs to increase student success in engineering since 2007.

The SUCCESS Scholars Program (SSP) is an NSF funded effort established in Fall of 2022 to build on these prior efforts by providing financial, academic, personal, and professional support to engineering students starting in their first year of college through four years of academic study. Two cohorts of students have completed their first year of this program which included three to four additional days of supplemental instruction a week, an extra Friday session in their Engineering classes, and weekly lunches each to build community within the students. The supplemental instruction in the first year was targeted towards the engineering and math courses that all students were taking. Although the program continues career development, social support, and financial assistance into the sophomore year, the supplemental instruction and extra Friday engineering sessions were phased out as students segregated among seven engineering disciplines.

The SSP program has resulted in a statistically significant increase in exam performance in first-year engineering and mathematics classes and a much higher success rate of completing the final first-year engineering and math course by the end of Fall sophomore year, which has been shown to be a critical marker for graduation in engineering. This paper assesses two years of quarterly GPA for the 15 SSP students in the first cohort that participated in SI sessions across all three quarters of their first year, along with all 62 other engineering students that demonstrated similar academic progress over their freshman year to determine the persistence of this intervention and the effects of scaling back academic support. The results indicate that removal of the SI sessions in the second year did not hinder the continued success of the SSP students.

Introduction

According to a report from the National Center for Education Statistics, an astounding 35% of students who begin their academic journeys pursuing a STEM degree change their field of study within their first three years [1]. When observing engineering students specifically, a longitudinal study that referenced data from nine four-year institutions across southeastern United States found that students switching out of engineering most often choose to major in business or a non-engineering STEM discipline [2]. Understanding the factors that drive student attrition versus persistence, while identifying effective resources and activities to support retention, has become a major priority for many engineering departments.

When investigating persisters versus non-persisters, one study cites factors like academic confidence, financial concerns, and outside familial/friend influences as being impactful on the students' belief in their ability to succeed. Further, they state that early interventions like academic advising, engaging in-class experiences, and meaningful extra-curricular activities could have a lasting and meaningful impact on their retention [3]. Thus, strategic and targeted planning and interventions can be implemented to increase the students' confidence in their choice to pursue an engineering degree [4]. One engineering program that developed multiple early intervention activities for students found a measurable increase in persistence with students that participated in at least one intervention activity. These activities included a summer bridge program for incoming first-year engineering students, an Introduction to Engineering course, an on-campus engineering residential community, study groups, and mentors [5].

One intervention technique that is prominent in the literature is Supplemental Instruction (SI). SI has long been recognized as an effective strategy for improving student outcomes in high-risk university courses—those with historically high failure or withdrawal rates [6]. Beyond its academic benefits, SI has been shown to support at-risk students, such as those from underrepresented or low socioeconomic backgrounds, by fostering a collaborative and supportive learning environment. Research indicates that SI not only enhances course performance but also helps build confidence [7] and enhances social connections among participants [8], potentially making it a valuable tool in efforts to improve persistence and retention in challenging academic programs.

While many of the interventions mentioned can apply to the second year and beyond, often, the activities are targeted to first-year students [5, 9]. However, the second year has been identified as a critical period when students begin to solidify their choice of major, which significantly influences their retention in a program [10], [11]. Students in their second year can experience "the sophomore slump" which is characterized by a lack of academic engagement [12]. Retention issues occurring in the sophomore year should be studied and addressed [10], [11], [13].

The SUCCESS Scholars Program (SSP) at Louisiana Tech University is designed to provide financial and academic support for low-income engineering students. Participants enter the SSP as first-term, first-year engineering students. While students receive support throughout their four years of academic progress, the most intensive academic support is provided during the first year. As students transition into their second year, the support evolves, with many formal elements of the academic resources being phased out [9], [14].

This shift is justified by the belief that, during the first year, students should develop a strong foundation of effective habits, enabling them to carry these practices into their second year without needing the same level of structured support. However, it is uncertain if this intended result is occurring. Understanding the impact of reducing interventions from the first year to the second year can provide valuable insights for shaping future interventions and best practices. This paper examines the second-year academic performance of the first cohort of SSP students by assessing them against comparable engineering students who did not receive the same first-year academic support resources. The research question driving the study is:

What impact does reducing academic support from the first year to the second year have on SSP students' academic progress and success?

The SUCCESS Scholars Program

The SSP, funded by the NSF, was created to support low-income first-year engineering students by offering academic resources, financial aid, community-building initiatives, and career preparation opportunities. During the 2022-2023 academic year, the program launched with its first cohort of 24 students, selected from 53 eligible applicants who satisfied the academic requirements to start in Precalculus and demonstrated financial need. The students, pursuing various engineering majors, were enrolled in exclusive, coordinated ENGR/MATH block schedules with consistent instructors over the first year. Academic support included an additional weekly engineering class session focused on quizzes, community-building activities, and deeper explorations of course concepts, as well as SI sessions led by peer mentors. These SI sessions, offered up to four times per week, provided targeted reinforcement of engineering and math concepts, test preparation, informal study opportunities, and homework support, with 79 sessions held throughout the year.

Community-building efforts fostered strong connections among students and faculty through shared schedules, extra engineering class sessions, a First-Year Experience seminar, and regular social events, such as a bowling party and a student-organized Christmas gathering. Weekly lunches, which started in the winter term, introduced students to faculty mentors who offered academic guidance and insights into their engineering disciplines. Career development was integrated into the program through guest speakers, resume workshops, career fair participation, and an industry field trip to tour a working factory and open dialogue with working engineers. These experiences helped students gain confidence, with one participant securing a summer internship. Overall, the first year of SSP successfully established a supportive environment that encouraged academic success, personal growth, and professional readiness for its participants.

As the students transition to more discipline-specific courses in their second year, the supplemental instruction sessions were retired, while the other components of the program, such as the weekly lunches and meetings with faculty mentors, continued. During the first quarter of their sophomore year, SSP students appeared to encounter increased difficulties in their coursework compared to their first year. This observation raised concerns among program faculty and staff, particularly as it coincided with the removal of the SI sessions, which had been a key component of their academic support during their first year. However, it remained unclear whether these challenges were primarily due to the absence of SI or if they reflected the typical struggles students face when transitioning into more advanced coursework and the increased academic demands of their second year. To determine if the decrease in performance was unique to the SSP students, their quarterly GPA was compared to other engineering students with similar academic progress over the first year.

First and Second Year Engineering at Louisiana Tech University

The students in this study completed their first and second years of engineering at Louisiana Tech University, where all engineering disciplines share a common set of required courses during these years. In the late 1990s, Louisiana Tech University introduced the Integrated Engineering Curriculum (IEC), which features a six-course mathematics sequence and a six-course engineering sequence [15]. The math sequence begins with an engineering pre-calculus course and progresses through calculus, culminating in differential equations. Alongside these math courses, students follow a first-year engineering course sequence common to all engineering majors. As students advance in their math sequence during their second year, they take sophomore engineering courses in an order determined by their chosen major. The sophomore engineering curriculum includes the fundamental engineering courses of statics and mechanics of materials, circuits, and thermodynamics.

The first-year sequence has undergone further development and is now called Living with the Lab (LWTL). LWTL utilizes a microcontroller platform to drive fundamental engineering concepts. Design, troubleshooting, and problem-solving are core components of the curricula [16]. The math sequence has also experienced multiple iterations of improvement, including most recently a redesign of the precalculus course [17]. While components of the IEC have evolved over the years, the core structure remains unchanged: six math courses and six engineering courses that are required by all students in an engineering discipline. Table 1 provides an example course schedule for an engineering student at Louisiana Tech University in their first and second year of study. Because mechanical engineering is the largest program, its curriculum was used for the sample table. The bolded courses are common across all engineering disciplines and are considered part of the core first and second-year course sequence. The science and elective courses are generally the same across disciplines but may vary depending on the student and their major. The table also reflects current course codes and names, but it should be noted that the course codes and names have changed over time since the start of the IEC. Louisiana Tech University is on the quarter system which is reflected in the sample schedule. The system has a unique structure that awards semester credit hours by increasing the contact hours for each course. For example, a 3-semester credit hour lecture course meets either Monday, Wednesday, and Friday for 75 minutes each or Tuesday and Thursday for 110 minutes each week. Full-time status is designated by students taking between 8-12 semester credit hours (SCH) per quarter.

Table 1. Sample schedule for engineering students at Louisiana Tech University with SCH for each course in parentheses.

First-Year Schedule		
Fall	**Winter**	**Spring**
ENGR 120 Engr Problem Solving I (2)	**ENGR 121 Engr Problem Solving II (2)**	**ENGR 122 Engr Problem Solving III (2)**
MATH 240 Precalculus (3)	**MATH 241 Calculus I (3)**	**MATH 242 Calculus II (3)**
CHEM 100 Gen. Chem. (2)	CHEM 101 Gen. Chem. (2)	CHEM 102 Gen. Chem. (2)
FYE 100 The Experience (1)	CHEM 103 Gen. Chemistry Lab (1)	PHYS 201 Physics for Engr & Sci. I (3)
ENGL 101 Freshman Comp I (3)	COMM 101 Principles of Communication Studies (3)	

Second-Year Schedule		
Fall	**Winter**	**Spring**
ENGR 220 Statics and Mechanics of Materials (3)	**ENGR 221 Electrical Engineering Circuits I (3)**	**ENGR 222 Thermodynamics (3)**
MATH 243 Calculus III (3)	**MATH 244 Calculus IV (3)**	**MATH 245 Differential Equations (3)**
MEMT 202 Engr. Materials (3)	MEMT 203 Dynamics (3)	PHYS 202 Physics for Engr & Sci. II (3)
BISC 101 Fundamentals of Biology (3)	ENGL 102 Freshman Composition (3)	ENGL 303 Technical Writing (3)

Methods

The dataset for this study, which was includes 15 SSP students who participated in SI sessions across all three quarters of their first year, along with 62 other students who demonstrated similar academic progress. To ensure a consistent basis for comparison, the analysis focuses exclusively on students who began their first quarter in precalculus and successfully progressed to calculus III by the fall of their sophomore year. This criterion aligns with the SSP cohort's structured math and engineering course sequence, as the SI sessions were specifically tailored to support the current courses in this sequence each quarter. The 62 non-SSP students represent the entirety of engineering majors who met the same academic milestones without the additional support. The quarterly GPA of these two groups was compared to determine if discontinuing the SI sessions led to a significant change in performance for the SSP students.

Results

The GPA for each group is provided for all quarters of both of their first and second years shown in Table 2. Although the SSP students achieved a slightly higher GPA in their first year the difference is not statistically significant and both groups entered their second year with the same amount of curricular progress.

Table 2. Average GPA for SSP students and comparable cohort each quarter over academic years 2022-2023 and 2023-2024

	2022-2023 (first year)			**2023-2024 (second year)**		
	Fall	**Winter**	**Spring**	**Fall**	**Winter**	**Spring**
non-SSP (N=62)	3.41	3.35	3.38	3.04	2.97	3.23
SSP (N=15)	**3.47**	**3.52**	**3.45**	**3.26**	**3.19**	**3.35**
Difference	0.06	0.17	0.07	0.22	0.22	0.12
p-value	0.4604	0.2322	0.3117	0.3877	0.2670	0.2646

Discussion

The small differences in average GPA observed during the first year are unsurprising, given that similar levels of academic progress in math and engineering were prerequisites for inclusion in the study. Notably, the findings revealed that the relative GPA of SSP students compared to the other students did not decline following the removal of Supplemental Instruction (SI) in their sophomore year. This suggests that removing SI sessions did not have a disproportionately negative effect on the outcomes of the SSP students in subsequent courses. The slight increase in the difference between the GPA averages between the two groups in the second year is not a statistically significant shift but may be an early indicator of continued long-term success.

One possibility is that the skills students developed in their first year SI sessions, such as effective study habits, organizational techniques, and time management strategies, continued to benefit them. Additionally, the foundational knowledge and confidence gained from improved performance in first-year math and engineering courses may have better prepared them for advanced coursework. Another important consideration is the potential influence of other components of support in the SSP, such as faculty mentorship and the sense of community fostered by the weekly lunches and peer connections. These elements may have played a significant role in the students' continued success in their Sophomore year. Given the inability to isolate the effects of the various components of support the program provides, it is difficult to determine how much SSP students' success in their first year should be attributed to SI relative to these other components.

Conclusion

While previous findings suggest that SI may have contributed to the success of SSP students during their first year [9], the specific impact of SI on their performance in these courses remains unclear due to the interplay of multiple support components within the program. The observed stability in relative GPA following the removal of SI in the sophomore year highlights the potential lasting value of the skills and confidence developed during the first year and the ongoing support offered by the program. Tracking future retention and graduation rates of the students in this study is planned, which will provide additional insights into the long-term outcomes of SSP participants. Further research is needed to isolate and evaluate the specific effects of SI on performance in first math and engineering courses, as well as its contribution to overall academic success and persistence.

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