Board 391: SUCCESS Scholars: Early Findings from an NSF S-STEM Project

Ms. 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 Co-Director of the Office for Women in Science and Engineering at Louisiana Tech.

Dr. David Hall, Louisiana Tech University

David Hall develops and promotes project-based engineering courses. He believes that projects build intuition and confidence which are important for the effective application of engineering fundamentals and for the development of robust technology solutions.

Dr. Mary E Caldorera-Moore, Louisiana Tech University

Dr. Mary Caldorera-Moore is an assistant professor of Biomedical Engineering and Nanosystems Engineering, director of Women Influencing Science, Technology, Engineering, and Math (WiSTEM) outreach organization, and the co-organizer of the New Frontiers in

Dr. Mitzi Desselles, Louisiana Tech University

Dr. Desselles is Associate Professor and Chester Ellis Endowed Professorship in the Department of Psychology and Behavioral Sciences at Louisiana Tech University. She is a member of the graduate faculty in Industrial/Organizational Psychology.

SUCCESS Scholars: Early Findings from an NSF S-STEM Project

Abstract

The SUCCESS Scholars Program (SSP) is an NSF S-STEM project awarded in Fall of 2022 to Louisiana Tech University. The five-year project supports two cohorts of engineering students as they each progress through four years of academic study. A first cohort of twenty-four, first-year engineering students was selected for the 2022-23 academic year, and a second cohort of twenty-two students was selected for the 2023-24 year. Each year the students in the program receive scaffolded levels of financial support based on their unmet need.

Cohorts in their first year of the program are provided with concentrated academic support through an additional two hours per week with their engineering instructor and supplemental instruction led by upper-level peer mentors. Faculty mentors are introduced to the students through weekly lunches beginning after their first quarter. The lunches, which provide a venue for professional development discussions, are also leveraged to build community among the students and faculty. As the first cohort progresses into their second year of study and begins to branch out into more discipline-specific courses, the weekly lunches have become the primary connection point for the students and faculty. Additionally, the faculty mentors meet with their students regularly and serve as academic advisors to guide the students as they progress academically.

This paper will discuss the SSP in detail by outlining the many activities implemented and highlighting lessons learned as the project moves into the second year of implementation. Preliminary data will be used to assess outcomes pertaining to retention and academic performance. Initial results indicate a positive impact on the student population participating in the project.

Background

The NSF-funded S-STEM program is designed to provide low–income academically talented students with financial and academic support through scholarships and activities that promote their retention to graduation [1]. S-STEM programs differ from institution to institution. However, there are key elements like academic support, community engagement, and career readiness that are included in most programs. The entry point for scholars within an S-STEM program can vary depending on the institution. Some programs focus on transfer and community college students [2] - [4], while others provide support during the student's sophomore year [5]. However, because the first year is a critical juncture for retention [6] - [7], many S-STEM programs provide support for students beginning their first year in a science, technology, engineering, and mathematics (STEM) program [8] - [12]. Programs that focus on first-year

students are often built with Tinto's Model of Integration in mind. This model places significant importance on academic and social integration to first-year success [13].

Engineering students in their first year must adjust to a new and challenging academic environment. Certain pre-requisite skills that are expected in these programs can be barriers for students [7], [14] - [15]. Most engineering programs enroll their first-year students in core math, engineering, and science courses, which often require a strong understanding of fundamentals and contain rigorous computational content [7], [16]. Studies indicate that the experience of a first-year engineering student in their first mathematics course can be critical to their retention [17] - [18]. Specifically, the grade that they earn, even more than the class they take, is a strong indicator of retention [19]. Therefore, it is important to provide opportunities that help students transition successfully and integrate academically.

One S-STEM program from The University of Washington, Tacoma provided students in their first year of engineering with strategic academic support initiatives. They offered the incoming students an introduction to research course and a first-year hands-on engineering course to engage and immerse them in engineering. They also provided math assistance to build their math confidence and skills. Mentoring both from faculty and peers was also a main component of their academic support initiatives. Additionally, the students were encouraged to attend a seminar class that provided resources to strengthen their academic skills [8]. The University of Nevada, Reno, provided its S-STEM students with similar opportunities: first-year engineering course experience, faculty and peer mentors, and undergraduate research experiences. They also included peer tutoring and a pre-college enrichment program [10]. Both programs saw positive impacts on academic success and retention.

Community building and a sense of belonging are also a cornerstone of S-STEM programs [20]. Tinto asserts, "Students have to come to see themselves as a member of a community of other students, faculty, and staff who value their membership — that they matter and belong. Thus, the term 'sense of belonging'" [21]. The S-STEM programs at the University of Washington, Tacoma, and the University of Nevada, Reno, both provided opportunities for community engagement. These programs organized their S-STEM students into cohorts, enrolled the cohorts into the same course sections, established living and learning communities, and conducted community-building activities within their seminar courses [8], [10]. The American Association for the Advancement of Science published a report entitled, "STEM Students and Their Sense of Belonging: S-STEM Programs' Practices and Empirically Based Recommendations" in late 2023 that provides an exploration of the impact a sense of belonging has on the success of S-STEM students and the strategies that S-STEM programs use to establish a sense of belonging. These strategies included faculty mentoring, academic advising, cohort experiences, professional development, peer mentoring, research experiences, and course instructional style with mentoring, academic advising, and cohort experiences being the three most often used strategies across S-STEM programs. The report found that these strategies have been found to improve the

sense of belonging among S-STEM students but are not all broadly applicable and should be customized to the institutions and their particular S-STEM students [20].

Recognizing the effectiveness of the academic support initiatives and community engagement strategies of other S-STEM programs, the SUCCESS Scholars Program (SSP) at Louisiana Tech University employed similar activities. This paper provides an overview of the academic, social, and professional development opportunities provided to the SSP students, along with a summary of the early findings from the SSP's first-year implementation.

SUCCESS Scholars Program

Upon receiving an NSF S-STEM grant award in the Fall of 2022, the College of Engineering and Science at Louisiana Tech University established the SSP. This initiative provides academic and financial support to first-time engineering students demonstrating academic potential and facing unmet financial needs. The SSP equips students with various resources for academic assistance, career readiness, and decision-making, all while fostering a sense of community among peers and faculty mentors.

Selection Process

During the summers of 2022 and 2023, the grant's Principal Investigator (PI) presented the SSP at university orientation sessions, guiding students on how to apply. The application process began with an interest form, allowing the University's financial aid office to assess financial eligibility. Once eligibility was confirmed, students completed an application designed by the grant team which is comprised of three engineering professors, a student success specialist from the College of Engineering and Science, and a behavioral science professor from the University's psychology department.

Before selecting scholars, the grant team convened to discuss scholarship requirements and methods to minimize selection bias during the application review. They developed a rubric and points system to standardize and reduce subjectivity in the evaluation process. Each team member assigned scores to applicants, and based on these results, twenty-four and twenty-two students were chosen for Cohort 1 and Cohort 2, respectively.

The grant team committed to weekly meetings to plan activities and events, develop resources, and address any concerns related to the program. This consistent commitment to weekly meetings not only fostered team building among the grant team members but also contributed to the long-term sustainability of the program.

Scholar Support

Each year, in addition to financial assistance, the scholars receive strategically curated academic support and professional development resources. The level of support and resources evolve with

the changing needs of the students. Since the program's inception in the Fall of 2022, only one cohort has completed a full year of study, and the second has begun their first year. Therefore, this paper will primarily focus on the 2022-2023 academic year, looking at the first-year experience of for Cohort 1 SUCCESS Scholars. Figure 1 provides an outline of the SSP year 1 activities and implementation.

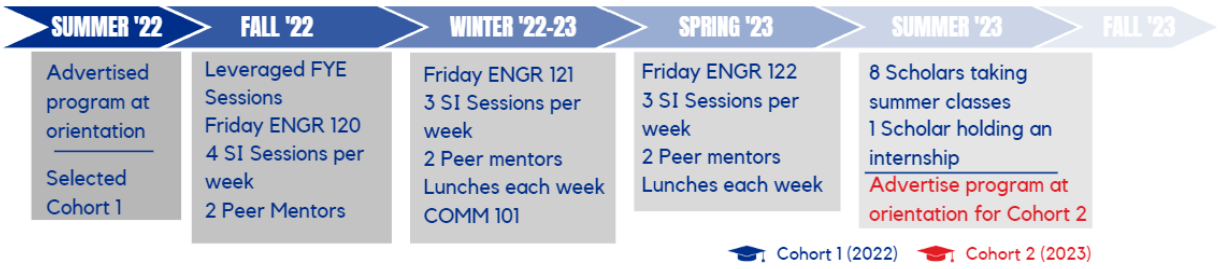

Figure 1. Timeline of activities throughout the first-year implementation of the SSP.

Research identifies the first year as a critical juncture for engineering students to establish good study habits [7], [15] - [19]. These skills not only build confidence but also set the foundation for future academic success. A feeling of connection to the college and peers contributes to retention and a sense of belonging. Consequently, the primary focus for first-year SSP students centered on academic support and community-building, with some integrated career resources. Leveraging evidence-based practices from S-STEM programs, the grant team identified nine key components for the first year of the SSP:

1. Cohorting the SSP students
2. Additional Engineering Course Meetings
3. Supplemental Instruction Sessions with Peer Mentors
4. Faculty Mentors
5. Professional Development Lunches
6. Social Activities
7. Invited Guest Speakers
8. Career Fair
9. Industry Tour

Cohorting the SSP students

At Louisiana Tech University, all first-year engineering students are required to take the same first-year engineering course sequence, irrespective of their chosen engineering discipline. These courses are blocked with a series of mathematics courses. To foster community, connect with instructors, provide consistency in instruction, and plan co-curricular and extra-curricular activities, students were placed in the same sections of courses during their first year. Table 1 identifies the courses the SSP students enrolled in each quarter of their first year with the cohorted classes bolded and highlighted. The cohorted classes included a first-year seminar,

engineering, mathematics, chemistry, physics, and communications sections. The chemistry, physics, and communication classes had additional students in their section and did not exclusively consist of SSP students. When applicable, some students elected to take a general education course in addition to the core curriculum courses; these general education courses were not linked with their cohort.

Table 1. First-year courses taken by SSP students with cohorted classes bolded and highlighted.

Fall Quarter	Winter Quarter	Spring Quarter
ENGR 120 (2 SCH) Engr Problem Solving I	**ENGR 121 (2 SCH)** Engr Problem Solving II	**ENGR 122 (2 SCH)** Engr Problem Solving III
Math 240 (3 SCH) Precalculus	**Math 241 (3 SCH)** Calculus I	**Math 242 (3 SCH)** Calculus II
CHEM 100 (2 SCH) General Chemistry	**CHEM 101 (2 SCH)** General Chemistry	**PHYS 201 (3 SCH)** Physics for Engr & Sci I
FYE 100 (1 SCH) First Year seminar	**CHEM 103 (1 SCH)** General Chemistry Lab	General Education Requirement Course
	COMM 101 (3 SCH) Principles of COMM Studies	

The math and engineering sections were exclusively reserved for SSP students, resulting in smaller class sizes, and enabling the formation of stronger connections between the students and their instructors. Throughout the first year, instructors for the engineering and math sequence consistently followed the students each quarter. This continuity fostered a sense of familiarity and comfort between faculty members and students, contributing to the development of accountability due to the established rapport.

Furthermore, the math and engineering instructors collaborated in co-teaching the first-year experience university seminar course that the students had to take the fall quarter of the academic year. This collaboration built a strong connection between the two instructors and the students. The course provided a more casual environment beyond the structured technical content of each instructor's respective discipline-specific courses.

Additional Engineering Course Meetings

The standard first-year engineering course is typically taught twice a week, with each session lasting an hour and fifty minutes. Throughout the year, the engineering class for SSP students was extended to three days, providing increased contact hours with their instructor. This adjustment facilitated greater access to laboratory equipment, a broader range of in-class

problems, quizzes, open-ended project time, and professional development presentations given by invited guest speakers.

Supplemental Instruction Sessions & Peer Mentors

A core component of the SSP first-year experience is the Supplemental Instruction (SI) sessions. Each quarter, students were offered multiple opportunities for co-curricular assistance through SI. Two second-year peer mentors, selected from students who had completed a pilot version of the SSP the previous year, led the SSP students through the SI sessions. Weekly meetings between the peer mentors and the instructors of the math and engineering courses were conducted to plan the following week's SI sessions based on identified needs. Session types included homework assistance, extra practice problems, test preparation, such as mock exams, and concept enrichment through deeper dives into course content.

Throughout the first year, students had the opportunity to participate in a total of seventy-nine SI sessions, with thirty-one in the fall quarter, twenty-five in the winter quarter, and twenty-three in the spring quarter. In the fall quarter, SI sessions were available on Monday and Wednesday from 3:30-5:30 PM and Tuesday and Thursday from 10 AM-12 PM, attracting an average of fourteen students per session. Due to an afternoon lab that SSP students were required to attend during winter quarter, the SI sessions were reduced to three opportunities per week on Monday, Tuesday, and Thursday from 4-6 PM. These sessions also averaged fourteen students per session. Spring quarter also offered three SI opportunities per week, with Monday meetings from 6-8 PM and Tuesday and Thursday sessions from 4-6 PM. While there was a slight reduction in attendance during the spring quarter, the sessions still averaged thirteen students per session.

Faculty Mentors

As students often explore different majors and paths during their first year, the grant team opted not to officially pair faculty mentors with students until late spring quarter. Instead, soft introductions began midyear, allowing students and faculty mentors to build familiarity through various planned interactions. Faculty mentors attended weekly lunches with students, providing an opportunity for casual conversations. Occasionally, a faculty mentor addressed the group, sharing insights about themselves and their specific discipline. Faculty mentors also participated in Friday engineering sessions, responding to questions submitted by students.

In spring, faculty mentors and students were officially paired according to discipline. At this juncture, faculty mentors became the students' official academic advisors, assisting them in planning their next academic term according to their curriculum. Previously, advising sessions were held with their engineering instructor and the student success specialist from the grant team.

To prepare for the 2023-2024 academic year, the grant team organized a workshop with the faculty mentors. During this session, psychology faculty representatives presented the benefits of mentorship, mentorship goals, and best practices. Career center representatives shared available resources, while the grant team provided an in-depth overview of the project's goals, objectives, and activities. The workshop concluded with the group brainstorming activities for the upcoming year and planning research initiatives to inform and enrich the project.

Professional Development Lunches

Starting in winter quarter, the grant team initiated a weekly lunch for the students. Each week, the grant team planned a menu and divided the food responsibilities among each other. This informal gathering provided faculty members an opportunity to connect with students while addressing homesickness through home-cooked meals and alleviating food insecurity among scholars. Each week, students could anticipate enjoying a complimentary, quality meal without the need to pay or utilize a "swipe" from their meal plan. During these lunches, the faculty also organized brief discussions of various professional development topics. Additionally, upper-level students were invited to share insights about student organizations and college involvement, while graduate students provided valuable information on benefits of pursuing graduate school.

Social Activities

While numerous events and in-class activities contributed to community building among SSP students, there were dedicated occasions specifically designed for fostering engagement and community. During the first week of the academic year, the psychologist on the grant team orchestrated a team-building activity known as the "marble run." Students were divided into two teams, each assuming different roles. An observer, situated in a room with a pre-built structure, communicated solely with two teammates—the communicators. The communicators, unable to see the structure, conveyed instructions to their team of builders, fostering discussions on teamwork and communication in a competitive yet collaborative setting.

Following the engineering midterm in the fall quarter, SSP students and the grant team convened at the intramural center for a volleyball game and pizza, providing a post-exam stress relief opportunity. This casual setting allowed students to engage informally with the grant team and share their concerns and experiences so far in college. To begin the winter quarter, the grant team and SSP students met at the intramural center for a bowling party, welcoming everyone back to campus after the break. Before the holiday break in the winter quarter, students expressed a desire to organize a holiday party for their group. A subset of students took charge of planning the menu, activities, and logistics, showcasing their initiative in forming a community and taking ownership of their group.

Many social activities occurred throughout the year, but the culminating activity was the "Scholarbration" party that commemorated each scholar's completion of their first year of

college. The students planned superlative awards for everyone, while the grant team presented scholars with water bottles and stickers. The water bottle serves as a vessel for stickers marking major accomplishments and activities throughout their college journeys, symbolizing their individual and collective achievements.

Invited Guest Speakers

Throughout the year, the students interacted with various guest speakers who helped enrich their learning experience. Representatives from the career center provided valuable insights into the resources available, including the career closet—an on-campus facility offering students complete professional outfits at no cost. Financial aid experts addressed the group, shedding light on additional scholarship opportunities and addressing general questions related to financial aid. A faculty representative shared information on Research Experiences for Undergraduates (REU) opportunities and offered guidance on best practices for applications. The students also had the privilege of hearing from alumni who shared their experiences in both industry and college. Notably, a psychology alumna employed by Dell provided unique insights into STEM careers, expanding the scholars' awareness of potential paths in the field.

Career Fair

During the winter quarter, the University hosted a career fair, providing companies with an opportunity to recruit students for both full-time employment and internships. Although it is uncommon for most first-year students to secure internship offers, the SSP students were required to attend the fair to familiarize themselves with such events and to explore potential future career opportunities for them in their chosen discipline. To help them prepare, presentations on resume writing, elevator pitches, and career fair strategies were provided.

For the event, the only initial requirement for students was to walk around the booths; their instructor encouraged them to do so together. As they grew more comfortable in the space, the engineering instructor challenged them to engage with one or two companies. The students returned from the career fair buzzing with excitement. Notably, at least four SSP students received invitations for follow-up interviews, and one student successfully secured an internship for the summer.

Industry Tour

Scholars were taken on an industry field trip to Proctor and Gamble in Pineville, LA, where they toured the laundry detergent production facility. Over lunch, the students had a unique opportunity for a Q&A session with the P&G engineering team. Members of the grant team and faculty mentors accompanied the scholars on this industry tour. The drive to and from the facility provided an opportunity for community building between students and the faculty members present.

End-of-Year Survey

At the conclusion of the year, the SSP students shared their feedback on the program through a survey administered by an external evaluator. Among the twenty-four students in the first cohort, twenty responded to the survey.

The survey was comprised of eight statements about the SSP, and students were asked to indicate their level of agreement with each statement using a 5-point scale ranging from strongly disagree to strongly agree. Additionally, a three-point scale question was included to gauge the extent to which the SSP interfered with other responsibilities. Following these questions, students were prompted to select up to three SSP activities that had the most meaningful impact on them. The survey concluded with an open-ended question, inviting students to indicate what they wished the SUCCESS Scholars program had included but did not, along with a space for any additional comments.

Survey Results

Figure 2 presents a compilation of results for the initial eight statements on the SSP and the respondents' level of agreement with each statement. The results overwhelmingly reflect positivity, with each of the eight prompts receiving at least 95% of responses in the agree or strongly agree category. Questions 1, 3, and 5 pertain to the SSP program activities and the students' participation, with Question 3 specifically inquiring about the perceived impact on their confidence in their chosen major. Questions 2, 6, and 7 focus on the support the students received throughout the year. The theme of community is addressed in Questions 4 and 8.

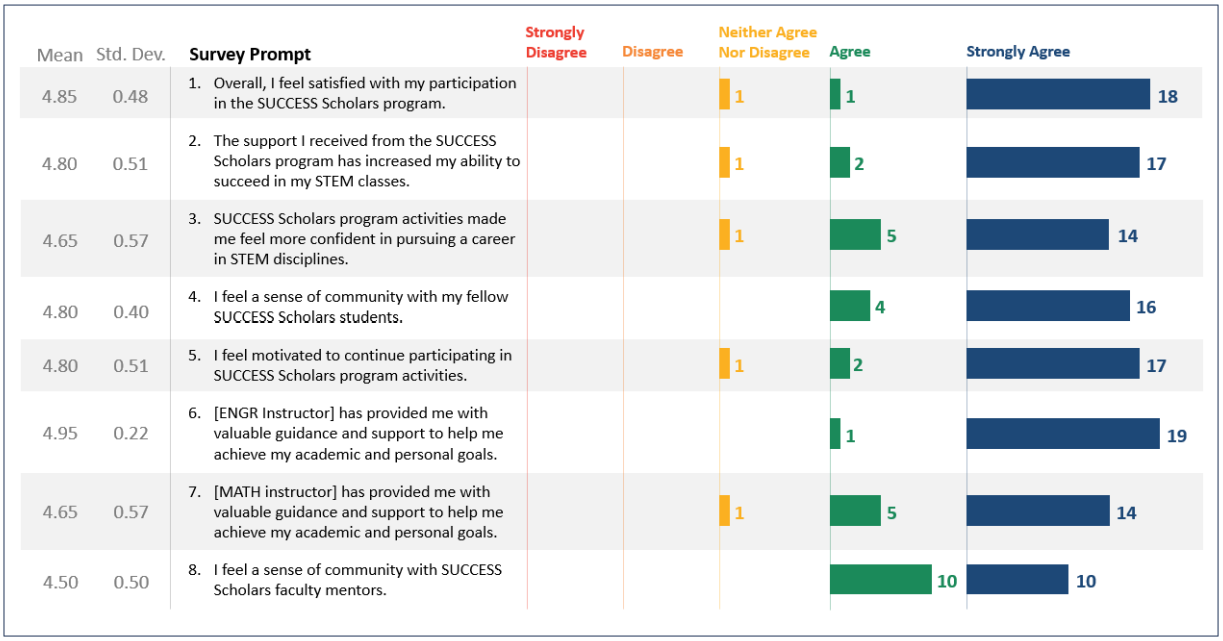

Figure 2. Results of the eight "level of agreement" questions from the end-of-year survey given to the SSPs after their first year in the program.

Question 8, which centers on the sense of community with faculty mentors, had the most responses not in the strongly agree category, with an equal split of ten responses each in the agree and strongly agree categories. Given that faculty mentors were intentionally introduced later in the year and not officially paired with students until mid-spring, these results align with expectations. As the second year progresses, it is anticipated that the sense of community will increase. Nonetheless, it is promising that students felt a sense of community with faculty mentors through the soft introduction activities conducted throughout the first year.

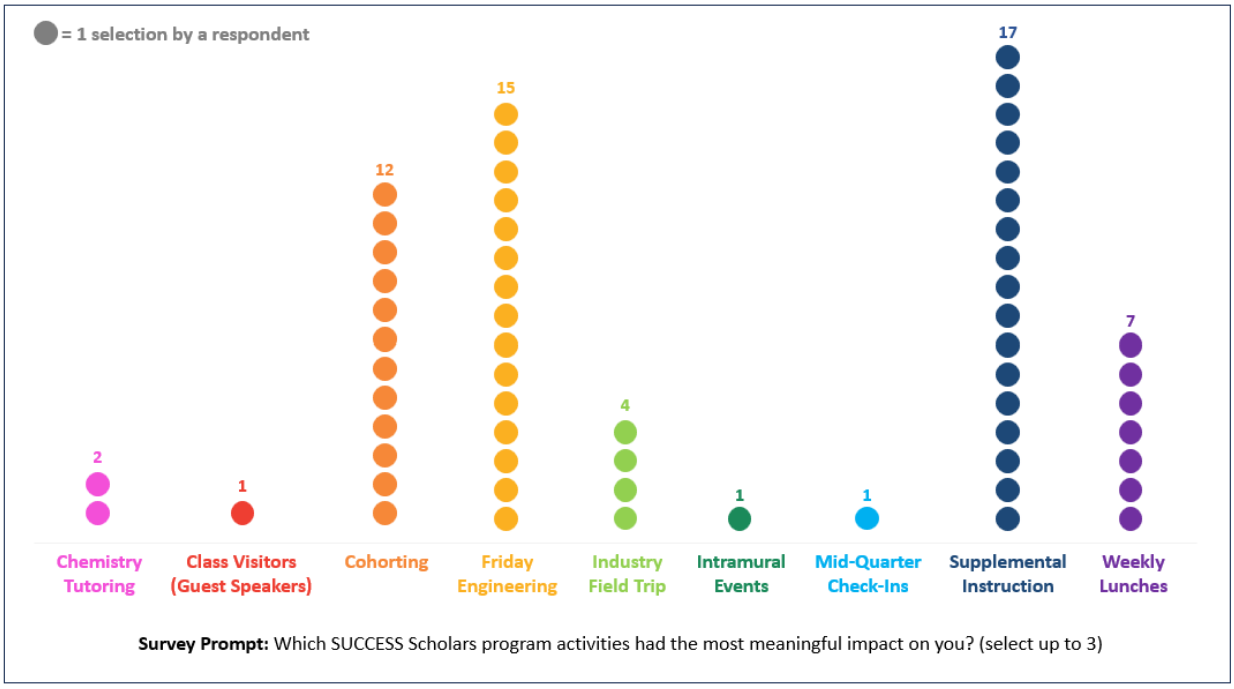

Figure 3. Frequency results of which SSP program activities that had the most meaningful impact on the students.

After the initial eight questions, students were prompted to identify up to three SSP activities that had the most impact on them. The results of this question are presented in Figure 3. While every activity received at least one selection by a respondent, cohorting, Friday engineering, supplemental instruction, and weekly lunches emerged as the top four activities. Interestingly, these four activities were constant throughout the school year, with all but lunches having begun in the fall quarter. The fourth-ranked activity, weekly lunches, began in the winter quarter and was available for two-thirds of the academic year. In contrast, the remaining activities on the list were occasional and lacked the same level of consistency or recurrence.

Following this question, students were asked to suggest any activities not listed that they believed had a meaningful impact. In response, one student expressed that "more than three of them had an impact on me, but none that weren't listed." Another student indicated a desire to select lunches as an activity but was restricted to choosing only three. Two students mentioned the Christmas party organized by their cohort. Additionally, two students highlighted the

guidance provided by peer mentors. While peer mentors did not appear as their own category, their leadership in the SI sessions played a significant role in its success. Presumably, most students associated the peer mentors with the SI sessions, which was the most selected activity from the list provided.

A three-point question inquired, "To what extent has participation in the SUCCESS Scholars program interfered with other responsibilities?" The results revealed that 20% experienced a high extent, 50% some extent, and 30% not at all. Despite 70% reporting a high level or some interference with certain responsibilities, an overwhelming 95% expressed that the SSP had a positive impact on them as illustrated in Figure 2. Given the lack of definition for the term "responsibilities," the question remains somewhat ambiguous. Further investigation is necessary to understand precisely which responsibilities the students perceived were affected by the SSP.

The open-ended question in the survey asked students, "What do you wish was in the SUCCESS Scholars program that was not provided?" Three responses referenced enhancements to the Supplemental Instruction (SI) sessions, with students expressing a desire for more practice problems, flexible times, and the inclusion of additional disciplines beyond engineering and mathematics. Two students requested more discussions on involvement in student organizations, while others sought more fun team-building activities. One student noted, "I think the structure for freshman year was great. I would like to do more stuff geared towards our career path in the future." This response is particularly encouraging for the grant team as it aligns with their initial plan of focusing on academic support and structure with a gradual shift towards a stronger emphasis on career-related aspects as the students progress academically.

Project Outcomes

This project encompasses four direct outcomes and two indirect outcomes. Given the early stage of implementation, the grant team is actively engaged in measuring and attaining these outcomes. The direct outcomes center on (1) reducing financial stress, (2) improving academic progress, (3) first-year indicators for program scholars' perseverance to graduation, and (4) a path to enter the workforce or a graduate school program in a STEM Field. The two indirect outcomes aim to achieve (1) increased confidence in the chosen career field and (2) increased confidence in academic ability.

Direct Outcome 1: Reduce the Financial Stress of Low-Income Engineering Students

In the first year of the project, approximately $167,000 worth of scholarships was awarded to twenty-four academically talented, low-income students. Beyond scholarships, the grant covered additional expenses such as project kits for their engineering classes. The project further reduced financial stress through weekly lunches provided by the grant team. Additionally, a guest speaker from the University's financial aid office enhanced the financial aid literacy of the first-year cohort, empowering them with valuable knowledge and resources to effectively manage their college related finances.

Direct Outcome 2: Demonstrate Improved Academic Progress

The first-year engineering course is divided into three types of sections: one SSP section, a set of sections for engineering students (ENGR), and a set for students in the University's Honors Program (HNRS). The population in the ENGR sections is most comparable to the SSP students, sharing a range of ACT math scores from 23 to 32. The HNRS sections are designated for students with a math ACT score of 28 or higher who are accepted into the University's Honors Program. The course content for each section is the same; all students, regardless of section, take a common midterm and final. Notably, the SSP students consistently outperformed the ENGR students on engineering examinations, averaging 11.2 points higher. Impressively, the SSP students achieved a performance level comparable to the HNRS students. A study was conducted on the impact of fall quarter enrichment activities provided through the program, revealing statistical significance and a positive impact on the students [12].

The program's implementation of SI sessions played a pivotal role in advancing academic progress. Survey results, shown in Figure 3, highlight the significant impact of SI sessions, with many students considering them the most meaningful program activity. Alongside SI sessions, the extra Friday Engineering class received high praise from students. One student conveyed their appreciation, stating, "I think that this is a great program, and it should be continued if possible. The extra classes and supplemental instruction really helped me learn the content." These activities helped the students achieve improved academic success.

Moreover, the SSP students demonstrated outstanding performance at the annual First-Year Projects Showcase. A panel of judges selected one group of three students from the SSP class to receive the First Place Overall Project award out of a total of eighty-eight projects. Additionally, three SSP students were recognized as Tau Beta Pi Freshmen of the Year, further underscoring their outstanding academic achievements.

Direct Outcome 3: Persist to Graduation & Direct Outcome 4: Enter the Workforce or Graduate School Program

While no graduates are expected until the end of the fourth year, the SSP students have made significant strides toward graduation and entering the workforce or a graduate school program. At the conclusion of the first year, twenty-two students met all requirements to continue with the SSP program. One student chose to move to a discipline at the University but outside of the college, while another student encountered academic challenges that led to their departure from the program. Among the twenty-two funded scholars, fourteen have successfully completed all first-year core courses in their curriculum by the end of their initial year. Eight students faced challenges in their mathematics courses and have worked with their faculty mentors to develop plans to fulfill those requirements by the fall of their second year.

Considering the status of each scholar, the program is on track to meet the projected 70% overall graduation rate for scholars. During the summer between year 1 and year 2, one student secured an internship, while eight students opted for summer classes to persist and, in most instances, advance in their academic pursuits. Figure 4 overlays the program activities from Figure 1 with the SSP student retention numbers.

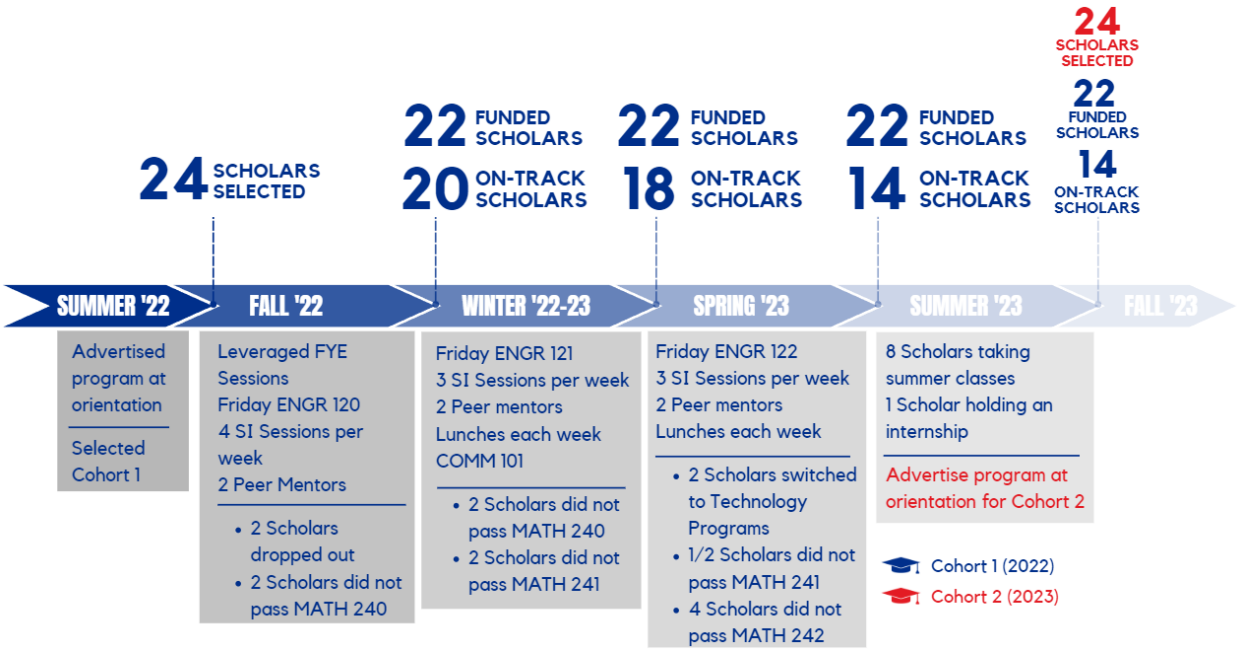

Figure 4. Timeline of activities throughout the first-year implementation of the SSP with academic progress and retention numbers provided per quarter.

Indirect Outcome 1: Increased Confidence in their Chosen Career Field

One of the indirect outcomes of the SUCCESS Scholars program is to bolster scholars' confidence in pursuing a career in STEM disciplines. The program's activities have been instrumental in fostering confidence among the participants. As indicated in Figure 2, students reported an increased sense of confidence in their chosen career field due to their participation in program activities. This suggests that the program has successfully contributed to enhancing scholars' self-assurance and belief in their ability to thrive in their selected fields.

Indirect Outcome 2: Increased Confidence in Academic Ability

Another important indirect outcome under continued evaluation is the program's impact on scholars' confidence in their academic abilities. The introduction of SI sessions, providing additional academic support, has played a pivotal role in shaping this outcome. Scholars expressed that the SI sessions not only offered opportunities to practice and apply newly acquired knowledge but also provided valuable social support through peer mentors. A student articulated, "I feel as though the SUCCESS scholars program has definitely helped me succeed in my engineering and math classes. I found our supplemental instruction sessions especially helpful for my math classes!" This sentiment is echoed through the survey results displayed in Figure 2. The statement "The support I received from the SUCCESS Scholars program has increased my ability to succeed in my STEM classes" garnered highly favorable responses from the twenty surveyed students. This positive rating indicates that the program has effectively enhanced scholars' confidence in their academic abilities, empowering them to excel in their coursework.

Conclusion

While the SSP is in its early stages of implementation, this paper presents an overview of the first-year results, which have shown promising outcomes. Notably, findings from student surveys highlight the positive impact of various enrichment activities on academic success and the sense of community within the cohort. Specifically, supplemental instruction sessions, additional Friday class meetings, weekly lunches, and cohorting were frequently cited by students as particularly beneficial. However, it is important to acknowledge that many direct and indirect outcomes can only be partially assessed at this intermediate stage. Nonetheless, current results suggest that the program is meeting or progressing towards its objectives. Notably, one measurable outcome is the improvement in academic performance. The program's enrichment activities have received positive feedback from students, reflected in measurable improvements in their academic performance compared to non-program peers during their first year.

Future Work

In the Fall of 2023, the SSP transitioned into its second year of implementation. The first cohort advanced to sophomore status and twenty-two new scholars were selected for Cohort 2. As the program navigates the second year, continual assessment and reflection will guide future enhancements and adaptations. Evaluating the effectiveness of the evolving program elements, addressing challenges faced by both cohorts, and fine-tuning strategies to align with the scholars' advancing academic and professional journeys will be central to ensuring the sustained success and impact of the SSP. Figure 5 outlines SSP Program implementation plans for Year 2 and projections for Year 3, Year 4, and Year 5.

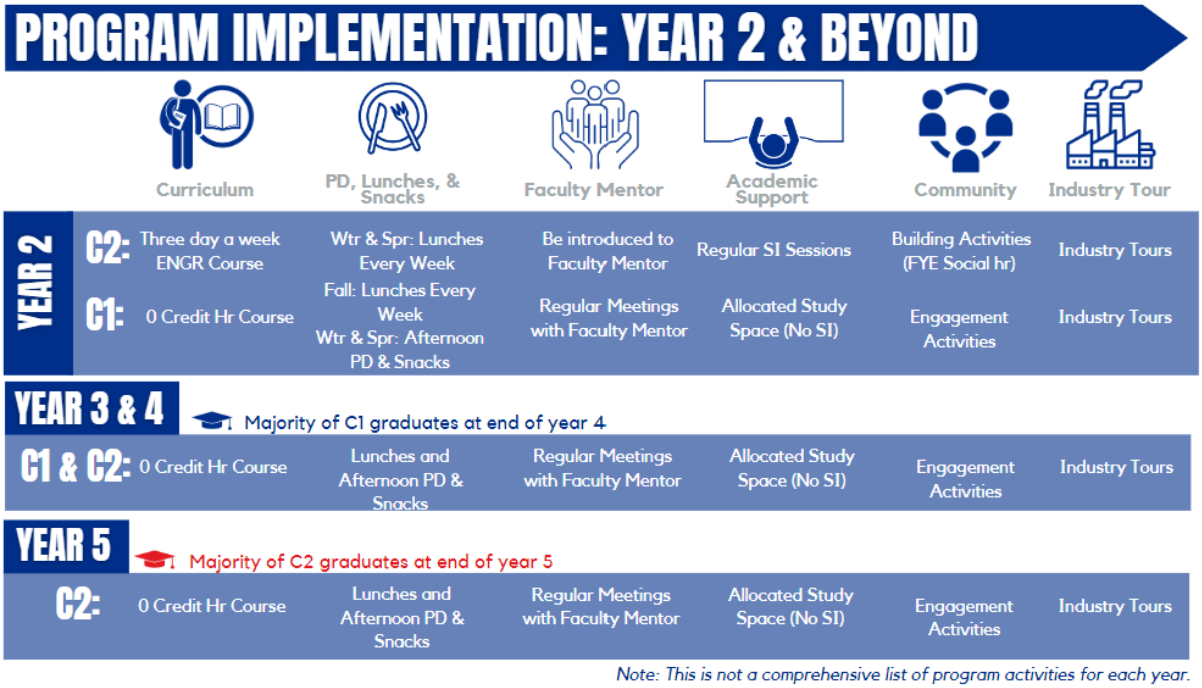

Figure 5. SSP Program implementation plans for Year 2 and projections for Year 3, Year 4, and Year 5 (C1 = Cohort 1 & C2 = Cohort 2).

Acknowledgement of Support and Disclaimer

This material is based upon work supported by the National Science Foundation under Grant No. (2221638).

Any opinions, findings, and conclusions or recommendations expressed in this material are those of the author(s) and do not necessarily reflect the views of the National Science Foundation.

References

[1] National Science Foundation Scholarships in Science, Technology, Engineering, and Mathematics (S-STEM). [Online]. Available: https://new.nsf.gov/funding/opportunities/nsf-scholarships-science-technology-engineering. Accessed: January 23, 2024.

[2] Ellestad, R. M., & Keffer, D. J., & Retherford, J., & Kocak, M. S. (2023, June), *Board 355: Outcomes & Observations in the Transfer Success Co-Design in Engineering Disciplines (TranSCEnD) Program at the University of Tennessee, Knoxville* Paper presented at 2023 ASEE Annual Conference & Exposition, Baltimore, Maryland. https://peer.asee.org/42994

[3] Babcock, M. J., & Vannelli, T. A., & Hanley, D., & Davishahl, E. (2021, July), *The SEECRS Scholar Academy at Whatcom Community College: Three Cohorts of S-STEM Scholarships Later* Paper presented at 2021 ASEE Virtual Annual Conference Content Access, Virtual Conference. https://peer.asee.org/37894

[4] Scholarships in Science, Technology, Engineering, and Mathematics (S-STEM) Engineering Scholars Program at a Two-Year College: Preliminary Interventions and OutcomesElizabeth A. Adams, Fresno City College; Carol Haden, Magnolia Consulting, LLC; Claire L. A. Dancz, Clemson University; Yushin Ahn, California State University at Fresno; Karen Willis, Fresno City College

[5] Evans, K., & Desselles, M., & Orr, M. K. (2021, July), *Successes and Lessons in Year 4 of an S-STEM Summer Sophomore Bridge during the COVID-19 Pandemic* Paper presented at 2021 ASEE Virtual Annual Conference Content Access, Virtual Conference. https://peer.asee.org/37782

[6] Besterfield-Sacre, M., Atman, C.J. and Shuman, L.J. (1997), Characteristics of Freshman Engineering Students: Models for Determining Student Attrition in Engineering. Journal of Engineering Education, 86: 139-149. https://doi.org/10.1002/j.2168-9830.1997.tb00277.x

[7] Veenstra, C. P., Dey, E.L., Herrin, G.D., "A Model for Freshman Engineering Retention." *Advances in Engineering Education* 1, no. 3 (2009): n3.

[8] Cline, E., & Abraham, M., & Alaei, S., & Dillon, H., & Dinglasan-Panlilio, J., & Heller, J. B., & Kmail, Z., & Lee, S., & Ma, E. Y., & Nahmani, M., & Sesko, A. K., & Yeung, K. Y. (2023, June), *Board 207: ACCESS in STEM: An S-STEM Project Supporting Economically Disadvantaged STEM-Interested Students in Their First Two Years* Paper presented at 2023 ASEE Annual Conference & Exposition, Baltimore , Maryland. https://peer.asee.org/42618

[9] Chatterjee, I., & Scalaro, K., & Vollstedt, A., & LaCombe, J. C., & Williams, J. M., & Kirn, A. (2021, July), *S-STEM: Creating Retention and Engagement for Academically Talented Engineers* Paper presented at 2021 ASEE Virtual Annual Conference Content Access, Virtual Conference. https://peer.asee.org/37694

[10] de la Rosa-Pohl, D. G., & Horn, C. (2021, July), *The Endeavour S-STEM Program: A Multi-College Collaboration to Increase Engagement and Retention in STEM* Paper presented at 2021 ASEE Virtual Annual Conference Content Access, Virtual Conference. https://peer.asee.org/37859

[11] Santangelo, J., & Albers, L. A., & Hunter, M. A., & Weingartner, K., & Elijah, R., & Cohen, R., & Lefurgy, S. T., & Agarwal, R., & Filippi, L. (2023, June), *Board 213: An Expanded Integrated Achievement and Mentoring (iAM) Program to Promote Access to STEM Professions* Paper presented at 2023 ASEE Annual Conference & Exposition, Baltimore , Maryland. https://peer.asee.org/42630

[12] Cruse, K. C., & Boyet, C., & Savercool, L., & Holloway, H. J. (2023, June), *Measuring the Impact of an Enrichment Program for First-Term Undergraduate Engineering Students in Mathematics and Engineering Curricula* Paper presented at 2023 ASEE Annual Conference & Exposition, Baltimore, Maryland. 10.18260/1-2—43592

[13] Tinto, V. (1993). Leaving college: Rethinking the causes and cures of student attrition (2nd ed.). Chicago, IL: The University of Chicago Press.

[14] Nelavai, N., & Ramesh, S. (2020). An Insight into the challenges faced by First Year Engineering Students: Poor Foundational Knowledge. *Procedia Computer Science*, *172*, 823-830. https://doi.org/10.1016/j.procs.2020.05.118

[15] K. Meyers, J. Uhran, C. Pieronek, C. Bundy, J. Ventura, P. Ralston, J. Estell, B. Hart, C. Slaboch and R. Ladewski, "Perspectives on First-Year Engineering Education," in American Society for Engineering Education Annual Conference and Exposition, Pittsburgh, PA, 2008.

[16] Ohland, M.W., Yuhasz, A.G. and Sill, B.L. (2004), Identifying and Removing a Calculus Prerequisite as a Bottleneck in Clemson's General Engineering Curriculum. Journal of Engineering Education, 93: 253-257. https://doi.org/10.1002/j.2168-9830.2004.tb00812.x

[17] M. Kopparla, "Role of Mathematics in Retention of Undergraduate STEM Majors: A Meta-Analysis," *Journal of Mathematics Education*, vol. 12, no. 1, pp. 107-122, May 2019.

[18] J. Gardner, P. Pyke, M. Belcheir, and C. Schrader, "Testing Our Assumptions: Mathematics Preparation and Its Role in Engineering Student Success," presented at 2007 ASEE Annual Conference & Exposition, Honolulu, Hawaii, June 2007. DOI: 10.18260/1-2--2314.

[19] J.E. Van Dyken, "The Effects of Mathematics Placement on Successful Completion of an Engineering Degree and how One Student Beat the Odds," All Dissertations, 2016. [Online]. https://tigerprints.clemson.edu/all_dissertations/1693

[20] STEM Students & Their Sense of Belonging: S-STEM Programs' Practices & Empirically Based Recommendations (S-STEM REC American Association for the Advancement of Science, 2023).

[21] V. Tinto, From Retention to Persistence. High. Ed (2016), (available at https://www.insidehighered. com/views/2016/09/26/how-improve-studentpersistence-and-completion-essay).