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BOARD # 354: DUE S-STEM: Impact on Confidence in Chosen Major and Persistence to Graduation After Two Years of S-STEM

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Background

The National Center for Education Statistics (NCES) states that two million bachelor's degrees were conferred over the 2021-22 academic year with engineering accounting for 6% of those degrees. While engineering is listed in the top fields for degrees awarded, it falls behind business and health professionals, 19% and 13%, respectively [1]. NCES reports that although many incoming post-secondary students initially pursue STEM degrees, 35% change their field of study within three years [2]. A study by Eris et al. investigated the differences between persisters and non-persisters in engineering programs. They identified factors such as parents, mentors, confidence levels in math and science, financial difficulties, and preconceived notions about graduation potential as key factors influencing persistence. They recommend early strategic interventions to help students make informed decisions about continuing in engineering [3].

Non-persisters who leave engineering programs early often enter college lacking confidence in their ability to graduate with an engineering degree [3]. It can be inferred that confidence in graduating within a specific field may be linked to confidence in a chosen major and/or career. This raises the question, "Why do students choose engineering as a field of study?" One study by Cruz and Kellam explored this question and identified several factors, including influence from family and friends, pre-college course experiences, and lack of awareness of other options [4]. However, the initial reason for pursuing engineering does not always motivate a student to persist. Furthermore, if they do persist, they may not be confident in pursuing a career in engineering. When surveyed about career intentions, 34% of engineering students indicated they were unsure or definitely not intending to have a career in engineering [5]. Targeted planning and interventions from engineering departments or colleges could strengthen the students' confidence in pursuing an engineering career [5]. Students not only need to persist to graduation; they must also foster confidence in their chosen discipline to then pursue a career in that field.

SUCCESS Scholars Program (SSP)

The SUCCESS Scholars Program at Louisiana Tech University is an NSF S-STEM-funded project that provides academic, career, and financial support to low-income, academically talented students. Because the SSP is funded for five years, only two cohorts have been selected for the program, and each cohort will be provided with four years of funding. The SSP focuses specifically on engineering and engineering technology students with the entry point into the program being the Fall Quarter of their first year in the engineering curriculum. The support that the students receive evolves with their changing needs as they progress through their curriculum. Some support is consistent throughout their four years while other resources may be reduced or removed as they make academic progress. In the first year of study, support included cohorting the SSP students into exclusive class sections, meeting an additional class session each week for

their first-year engineering course, and providing supplemental instruction sessions with peer mentors. Support that started in the students' first year and remained in their second year includes faculty mentors, professional development lunches, social activities, guest speakers, career fairs, and industry tours [6]-[8]. The second-year students were provided with an after-hours study space that was available on weekdays from 5PM-9PM along with weekly afternoon professional development sessions curated to their needs [6].

Twenty-four first-time engineering students were selected as the first cohort of the SSP for the 2022-2023 academic year. The first cohort will be referred to as the Red Group for clarity throughout this paper. This group is comprised of students majoring in biomedical (BIEN), chemical (CMEN), civil (CVEN), cyber (CYEN), electrical (ELEN), and mechanical (MEEN) engineering. The second cohort (the Blue Group) was selected in the Summer of 2023 for the 2023-2024 academic year. While twenty-four students were initially selected to participate, two turned down the program, resulting in twenty-two Blue Group students majoring in the same engineering disciplines as the Red Group. Table 1 provides demographic data for both groups.

Table 1. Demographic data for the two cohorts in the SSP at their respective time of program entry.

Cohort	Program Entry	Number	Avg Comp. ACT	Female (%)
Cohort 1 (Red)	Fall 2022	24	27	29
Cohort 2 (Blue)	Fall 2023	22	28	18

Methods

The SSP has identified four direct outcomes (DO) and two indirect outcomes (IO) [6]. This paper will focus on the third direct outcome and the first indirect outcome: DO.3 Persist to Graduation and IO.1 Increased Confidence in their Chosen Career Field. Two primary sources were used to collect data for this study: registrar data and an end-of-year survey. The registrar data provided information on the SSP students' academic progress and retention. The end-of-year survey was distributed to the students during the final weeks of the Spring Quarter in 2024, the end of Red Group's sophomore year and the Blue Group's first year. The survey consisted of questions in various formats, including Likert-scale, multiple choice, closed-ended, sliding scale, and open-ended response questions. It was customized for each cohort while incorporating applicable common questions. Thirty-six valid responses were collected, sixteen students from the Red Group and twenty from the Blue Group. This resulted in a 95% participation rate among SSP students who were still in the program when the survey was administered.

Results

Since SSP students are selected before starting their engineering studies, some are expected to change their major. With support and resources, the SSP hopes to reduce the number of students

who fall into this category. However, some expected attrition was built into the project. The projected attrition is 20% from first year to sophomore year, 12.5% from sophomore year to junior year, and 0% from junior year to senior year. This results in a projected 70% retention for the program.

The Red Group experienced a 12.5% attrition from year 1 to year 2 and a 19% attrition from year 2 to year 3. This results in an overall 80% retention rate to date for the Red Group. Of the seven students not retained in the program, four students left the university. Two students left the SSP to pursue a degree in a discipline not supported by the program. One student left the SSP due to poor academic performance. For the Blue Group, the year 1 to year 2, attrition is 9% with one student leaving the university to attend community college and the other student electing to leave the SSP to focus on work obligations. Currently, the Blue Group has experienced a 91% retention which is slightly higher than the 88% retention that the Red Group had from year 1 to year 2. Both groups, however, are being retained at higher rates than predicted and higher than their comparable cohorts not in the SSP.

When asked in the end-of-year survey about the likelihood that they will stay in their current major twenty-six out of the thirty-six respondents expressed 90% or higher confidence that they will stay in their current major. Nine respondents reported between 75%-85% confidence and one stated only 60%. The responses to this question also indicate that the students in their second year of the program (Red Group) are more confident in their major selection. Only one student from the Red Group indicated less than 90% confidence.

Students were asked if they attended the Fall Career Fair, Spring Career Fair, or both Career Fairs. Thirty-two out of the thirty-six respondents attended one or both career fairs with the number of companies that they spoke to ranging from two to forty. Sixteen of the students held interviews with companies from the Career Fairs for summer internships and fourteen received offers. A total of eighteen students (11 from Red Group and 7 from Blue Group) reported having an internship or job related to their major planned for the upcoming summer.

When addressing the prompt "*SUCCESS Scholars Program activities made me feel more confident in pursuing a career in STEM disciplines,*" responses from both groups were overwhelmingly positive, 95% and 94% for the Red and Blue Groups respectively. While the survey did not ask specifically which SSP activities help build their confidence in pursuing a career in STEM disciplines, students cited professional development discussions, industry field trips, and faculty mentors (Red Group) as having a meaningful impact on them.

Discussion

SSP students currently demonstrate a positive trend toward graduation, surpassing the predicted retention rates. Indicators point towards this trend remaining positive given a majority of the

students reported at least a 90% confidence in their chosen major. An interesting observation is that the Red Group reported greater confidence in their chosen discipline, which may be attributed to their additional year of curricular and extracurricular experiences. Research indicates that engineering students at Louisiana Tech University who complete their first-year courses by the fall term of their sophomore year are more likely to graduate with an engineering degree [8]. Connecting this marker with the Red and Blue Groups' retention rates suggests that the SSP is trending toward a positive impact on persistence to graduation.

Students indicated that attending SSP events/activities like professional development discussions, career fairs, and industry field trips had meaningful impacts on them. They also reported participating in multiple interviews for summer internship opportunities, with 50% of the students planning to participate in a summer work experience related to their major. This includes 70% of the Red Group securing internships and 35% of the Blue Group. These experiences are invaluable in building confidence in their chosen career field. With 94% of students reporting that the SSP activities made them feel more confident in pursuing STEM careers, it can be concluded that at this stage in the SSP timeline, the program has had a meaningful and positive impact on building their confidence in this career path.

Conclusion

When assessing the SSP on the students' persistence to graduation confidence in their chosen career field, the data indicates positive impacts. The retention numbers for students in the program are greater than anticipated and students have indicated increased confidence in their chosen fields which directly influences two of the project outcomes DO.3 Persist to Graduation and IO.1 Increased Confidence in their Chosen Career Field. The project still has at least three more years of implementation, and thus, this analysis is not conclusive. However, these preliminary results are promising indicators for future positive impacts on the students.

Future Work

The SSP provides a testbed of data to be analyzed, and many studies are planned for this project. However, future work related to the focus of this paper includes continuing the assessment as each year of the SSP progresses. Comparing and contrasting the responses between the Red and Blue Groups to identify trends between them and their experiences. Exploring the reasons behind major changes and the new majors pursued by students who switch out of the SSP is a key focus. For instance, do they remain in STEM but transition out of engineering and engineering technology programs? Investigating the impact of activities such as professional development discussions, career fairs, and industry field trips on boosting student confidence is also of interest. Furthermore, gathering data on internship experiences and their role in fostering confidence in students' chosen fields is anticipated.

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