Board 291: Final Year of an S-STEM Summer, Sophomore Bridge: Successes of Three Cohorts

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Louisiana Tech University has completed its sixth year via a no-cost extension of an S-STEM Scholarship Program to serve as a Sophomore Bridge for engineering majors [1-6]. The Fast-Forward Scholarship program supports engineering majors in the summer between their first and second years to take one engineering and one mathematics course in their major, along with a professional development (PD) course that includes a spatial visualization curriculum and opportunities to visit regional companies employing engineers. The purpose of the program is to provide students with scholarships and support as they transition into more challenging sophomore engineering and mathematics coursework. Additionally, completing this coursework early allows for more enriching experiences later in the curriculum, such as minors, internships, and undergraduate research. The professional development course content helps students develop a stronger engineering identity and prepare to search for internships.

The first three cohorts of Fast-Forward students from Summers 2017, 2018, and 2019 respectively, have now had sufficient time to achieve a four-year graduation. This poster will examine the four-year graduation rates and job/post-baccalaureate placement of these cohorts, to the extent that information is available from post-graduation surveys. The fourth cohort of Fast-Forward students from Summer 2020 are presently enrolled in their senior design courses if they have remained on-track in their engineering majors. This poster will also examine the on-track success of this cohort.

Program Overview

The Engineering Fast-Forward Scholarship program provides scholarships and support to engineering majors in the summer between their first and second year, during which they take one engineering and one mathematics course in their major, along with a professional development (PD) course. Scholars also have opportunities to visit regional companies employing engineers and develop closer relationships with faculty. These components of the program, as well as additional student support services and interventions provided through the grant, are described below:

Strong cohort experience with increased faculty interaction: The S-STEM Scholars are enrolled in the same sections of Statics and Calculus III in the summer. This also allowed us to schedule the Professional Development course and related activities around their coursework and exam schedules. The course instructors, as well as other faculty from the college, participate in the industry tours to facilitate out-of-class interaction with faculty.

Professional development course: The project team designed a two-credit hour professional development course for the S-STEM Scholars. The course included curricular components in spatial visualization (Developing Spatial Thinking by Sheryl Sorby [7]), Gallup Clifton StrengthsFinder [8], team-building activities, job search skills, interview skills training, resume design, and professional conduct before, during, and after industry visits.

Dedicated peer tutor: Each cohort has a dedicated tutor for calculus, statics, and spatial visualization (a component of the PD course). Since the program's second year, the tutor has

been a former S-STEM scholar. This provides current students with peer support from someone who has been through many of the same program experiences they have. Tutoring is available in the evenings and weekends.

Cohort 1 Student Outcomes

Eighteen rising sophomores participated in the first cohort of the Engineering Fast-Forward Program in 2017. All eighteen students were retained in a STEM degree program in the years following the program (100% STEM retention). Seventeen of the eighteen have now graduated, sixteen with an engineering degree and one with a mathematics degree (83% 4-yr graduation, 89% 5-yr graduation, 94% 6-yr graduation rates). One student, who changed their major to biology, withdrew from the university in the Winter 2020-21 term. While the timing of the student's decision to leave the university coincides with the start of the pandemic, it is not possible to determine the impact of COVID-19 on their decision.

Cohort 2 Student Outcomes

Seventeen students participated in the second cohort of the Engineering Fast-Forward Program in 2018. Five students left the institution, while eleven students have been retained in a STEM degree program and one transferred to a non-STEM degree (65% STEM retention). Ten of the original cohort have graduated with engineering degrees (53% 4-yr graduation, 59% 5-yr graduation rates).

The project team was surprised to find that five students left the university after the Fast-Forward Program since this was in such stark contrast to the strong student retention from the first cohort. The project team investigated these departures more closely. Two students left the university in the first half of their junior year (Fall 2019) for medical reasons. The remaining three students left the university between Spring 2020 and Winter 2021-22. Although the team is unable to conclude with any certainty, the timing does raise questions about possible COVID-19 impacts on their decisions to leave the university.

Cohort 3 Student Outcomes

Nineteen students participated in the third cohort of the Engineering Fast-Forward Program in 2019. One student transferred to a non-STEM degree (95% STEM retention). One student graduated with an engineering degree in three years, and fifteen students graduated with engineering degrees in Spring 2022 (84% 4-yr graduation). The project team was particularly encouraged by the strong retention and engineering graduation of this cohort, especially in light of the COVID-19 pandemic and its possible impacts on retention observed in Cohort 2. The strong retention rate of Cohort 3 does raise questions about the reasons three students from Cohort 2 left the university. It is possible that these departures were anomalies.

Cohort 4 Student Outcomes

Eleven students participated in the fourth cohort of the Engineering Fast-Forward Program in 2020, which was held virtually due to the COVID-19 pandemic. All eleven students have

remained in STEM majors at the university (100% STEM retention), with two of the students transferring out of engineering majors (one to math and one to biology, 82% engineering retention).

Cohort 6 Experiences

After a remotely-operated program in Year 4 (2020) and a hybrid program in Year 5 (2021) due to a rise in Delta variant COVID-19 cases, Cohort 6 (2022) students were eager to return to a fully face-to-face program. Students made four on-site visits to area companies and manufacturing facilities, and one local government agency visited students on-campus. Three additional remote sessions were held for students to learn about companies and graduate school programs from leaders outside of the region.

The spatial visualization curriculum was taught in a flipped format, as had been done the previous year. Students were provided access to videos of the lessons, and students had access to faculty assistance for questions about the content. Students were given multiple attempts to submit homework, and the spatial visualization assignments were assessed through mastery-based grading. Most students performed well on their initial homework submissions, but a few students did occasionally take advantage of the resubmission opportunity. All other program elements described above were implemented over the two credit hour professional development course specifically designed for the program.

Conclusions

Having concluded the execution of the summer program, the team has started to reflect on NSF project outcomes. The stated goal of the program was for 80% of the S-STEM Scholars to graduate with a STEM degree within four years. The 4-year graduation rates in STEM for Cohorts 1 through 3 were 83%, 53%, and 84%, respectively. Program goals were met in two of the three years for which data is available. As mentioned above, the extent to which COVID-19 had an impact on retention and graduation is unknown.

Program sustainability is a significant challenge given that the scholarship funding covered full cost of attendance for students, i.e. tuition, fees, books, housing, and meals. Sustaining the program will require significant financial resources from donors to fund the scholarships as well as the personnel time to manage the program. The professional development course described in this paper was essentially co-taught by engineering and industrial/organizational psychology faculty and graduate students. Maintaining the course in its current form for a future program offering would require the involvement and coordination of multiple faculty from different colleges. That said, the student outcomes have been largely positive in terms of graduation rates, peer interactions, and faculty mentorship.

This project additionally sought to address the technical challenges of engineering software installations as well as computer configurations because the team found these to be major hurdles for incoming engineering majors, especially those without the means to secure a reliable laptop before financial aid refunds. Since the time of project launch, these challenges have largely been

addressed through 1) university-operated virtual machines and 2) electronic downloads of all engineering software packages. These practices were institutionalized to have lasting impact.

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