Board 386: S-STEM: Creating Retention and Engagement for Academically Talented Engineers - Lessons Learned from a Four-Year Cohort

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Introduction: The National Science Foundation S-STEM project entitled "Creating Retention and Engagement for Academically Talented Engineers (CREATE)" was designed to support low-income, high achieving engineering students achieve academic success, persist to graduation, build self-efficacy, and develop engineering identity. The scholarship-based cohort program is located within the College of Engineering at a large western land-grant university and recruited two cohorts of 16 based on academic talent and demonstrated financial need [1 – 8]. The program has retained 25 of the original 32 students (referred to as scholars) with six new scholars filling vacancies, leading to a current total of 31 scholars in the program. Current scholars identify as 21 male, 10 female, 18 white, 7 Hispanic, 1 Black, and 5 Asian. Program numbers mirror similar enrollment trends to the College with the following exceptions: higher female and students of color enrolled. The scholars in both cohorts participated in curricular and co-curricular activities that included enrollment in a summer bridge program, proactive advising, tutoring in engineering courses, peer and faculty mentoring, career and graduate school guidance, cohort building activities, theme seminars, funded undergraduate research experiences, and goals workshops. The program did not have a comparison/control group.

Cohort 1 started during the fall 2019 semester and cohort 2 started a year later during fall of 2020 and had different first-year experiences as a result of the Covid-19 pandemic. Scholars from both cohorts participated in bi-semester quantitative surveys and end-of-semester focus groups which allowed them to describe how they were using resources provided by the CREATE program, and how they were developing as engineering students. These focus groups were transcribed, group coded using directed content analysis, and underwent thematic analysis where themes and patterns were then discussed with the larger project management team who had close interactions with the scholars.

Lessons learned: We present qualitative findings that illustrate the lessons learned in operating this program for four years and supporting 15 scholars from cohort 1 to graduation. Lessons learned at the end of four years include: (1) Proactive advising should be implemented for all four years as it remained useful in helping scholars stay on track to graduation and reaching their career goals. Scholars always valued the advising sessions with the Director of Academic Success who is part of the CREATE management team, in terms of understanding their options for classes, major changes, minor degree programs, and other ways to pursue their academic and career interests. She often helped them feel agentic in their choices, despite being stuck on a narrow, major degree path due to the credit expectations of their programs. Her impact was particularly impactful later in the program as students started wanting to deviate more from the pre-set paths and she helped them see how they could do so and what were the implications. This cohort had higher rates of enrollment in minor degree programs that allowed them to gather skills in specialized areas of engineering, compared to the College of Engineering average, including late program enrollment. Scholars overall seemed to benefit from the proactive element as it kept their grades on their mind more during the semester rather than realizing they were in a bad spot too late. The only complaint students had about this style of advising was they still had holds on their

course registration late into their semesters which caused them stress and sometimes made course enrollment difficult. They still wanted the advising, just no holds.
(2) Progress reports used as part of proactive advising promoted beneficial interactions between scholars and faculty who taught their classes, and hence reduced barriers to future interactions for the scholars.
(3) Peer mentors offered emotional support and helped scholars navigate their transitions to college. They often were sources of knowledge for how to balance the tasks of college and of what resources were available (for example, the math center or tutoring). This relationship was most helpful early on, especially if the peer mentor was also the scholar's summer bridge program mentor. This relationship was particularly helpful during the first two years but quickly dropped off after that unless the peer mentor shared a major with the mentee, in which case their relationship turned towards specific academic advice pertaining to certain classes, teachers, or major specific options. For first generation scholars, peer mentors did have a prolonged impact through the first three years regardless of sharing a major.
(4) Scholars should have faculty mentors for all four years. Faculty mentorship was valued throughout the four years, although its scope changed over time. Early on, scholars mostly derived emotional support from their mentors as they transitioned to college and encountered new academic challenges. For some scholars this support also came in the form of pep-talks from their mentors that the scholars did belong in engineering and that they could become engineers. In later years, the support from faculty moved to more career and goal oriented as scholars leveraged them for networking, letters of recommendation, and for advice in navigating internships, research, and future jobs. Scholars often mentioned that faculty mentors were people they could turn to for advice that they were unable to get elsewhere (i.e. from family or friends), especially if they were the first to attend college in their families. For some scholars, this relationship with their faculty mentor took a few years to develop enough that it could then be fully leveraged by scholars, which indicated the long-term benefits of the cohort program. In addition to general support and career advice, goals were something scholars felt that faculty mentors helped them think about, hold them accountable to, and work towards. While scholars appreciated having a faculty mentor in the same major as them, this seemed most important to scholars early on and became less so later in their programs as they realized the support they got from their mentor was independent of their major alignment.
(5) Placement in the summer bridge program that facilitated shared, group experiences could be used to support a long-lasting and resilient shared sense of community within the cohort. The one-week summer bridge program, Engineering Freshmen Intensive Training or EFIT, had a huge impact on the sense of community for this cohort. They felt like they started school with a shared experience together which set them up for future community building in their residential halls, classes, and CREATE activities. Scholars in cohort 1 (who replaced those who left the program) who joined the program later specifically noted that they felt not having the shared E-FIT experience set them back in terms of belonging with the cohort. Scholars who lived in the Engineering Living Learning Community (ELLC) residential hall together described a stronger sense of community with CREATE peers and established friendships that lasted the duration of their undergraduate programs. They felt the compounding effect of EFIT and the ELLC in particular helped them establish a strong community that helped them get through the isolation caused by the pandemic and remote learning.

(6) Cohorts could include scholars all from the same major as scholars described challenges keeping in contact with or feeling connected to scholars in different majors once they stopped taking the same common classes.
(7) The College of Engineering career services director who was part of the CREATE program management team could have been involved earlier to better support the scholars as they thought about and worked towards goals early on. One activity that particularly stood out was the long-term benefits of attending the career fair which made it a less intimidating environment later on when they started to more meaningfully look for jobs.

Conclusions: In summary, the qualitative data gathered to date via focus groups and one-on-one interviews of the first cohort with the graduate student of the CREATE program have indicated that the CREATE program has had a strong influence on the educational experience of the scholars who have been retained in the CREATE program and their degree programs. The collection of qualitative data has provided valuable input into what has worked and what has not worked for this cohort of scholars. The management team has learned valuable lessons from the data collected from this cohort, and these lessons learned have implications for future programs looking to develop their own cohort or mentorship programs at their institution.

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