Board 328: Lessons Learned from First-time, First-year Startup of ASES S-STEM Program

Dr. Dick Apronti, Angelo State University

Dick Apronti is an associate professor at Angelo State University. He teaches transportation engineering courses, engineering graphics, and plane surveying. His research interests are in transportation safety and planning.

Dr. William A Kitch P.E., Angelo State University

Dr. Kitch is Professor and Chair of the David L. Hirschfeld Department of Engineering at Angelo State University. Before starting his academic career he spent 24 years as a practicing engineer in both the public and private sector. He is a registered pr

Elaine Stribling, Angelo State University
Stephanie Solis, Angelo State University

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Abstract

The Angelo State Engineering Scholars (ASES) program is a track 2 S-STEM project that aims to increase the enrollment, graduation, and workforce participation of low-income engineering students. This presentation highlights the lessons learned from recruiting, mentoring, personal development, and career seminars in the program's first year.

This presentation discusses issues encountered in the start-up year of this S-STEM program including, a late start date, problems with the use of Pell grant eligibility as a measure of low-income status, and the use of student essays in selection of scholarship recipients. Challenges in each of these areas are discussed and mitigations or changes made are presented. The presentation will be beneficial to similar programs in planning their recruitment efforts with a focus on retention and addressing the challenges associated with implementing an S-STEM program in the first year.

1.0 Introduction

The Angelo State Engineering Scholars (ASES) program, initiated through the support of the NSF S-STEM initiative, aims to improve the enrollment, graduation rates, and workforce integration for low-income engineering students. Launched in the fall of 2022, the inaugural cohort comprised eight students, including new first time (NFT) students and transfer students. The following year saw the addition of a second group of 15 students, increasing the total number of students enrolled into the program to 23. Beyond offering financial aid, ASES supports its participants with academic resources, such as a credit-bearing course on engineering leadership and career development, and access to faculty and peer mentorship in a mentorship program. Throughout its first three semesters, spanning from Fall 2022 to Fall 2023, the program successfully retained a significant number of its students.

The literature suggests that bolstering student support systems and fostering faculty-student interactions are crucial for retaining students in STEM fields [1] [2]. This paper evaluates the ASES program's inaugural year, detailing the operational challenges encountered and the insights gained from its implementation.

2.0 Program Description

The ASES program embodies best practices from existing literature to assist academically capable, low-income students in transitioning into the engineering discipline. It aims to foster a sense of belonging and develop a strong engineering identity among participants by cultivating a community through various activities and events. These gatherings allow students to connect, socialize, and exchange experiences. To further support integration into the field, students are

encouraged to enroll in shared math and science courses in their first year and are paired with peer mentors.

Additionally, the program facilitates engagement with Angelo State University faculty and professional engineers, serving as academic and industry mentors. Students benefit from a comprehensive suite of academic support services, including tutoring and supplementary instruction, and opportunities to participate in career and professional development seminars and workshops.

Admission criteria for first-time ASES students include a high school GPA of 3.3 or above and a class rank in the 65th percentile or higher. Transfer students must maintain a GPA of 2.5 or above and meet the prerequisites for enrolling in Calculus I or a more advanced math course. All participants must qualify as low-income by being eligible for a federal Pell Grant.

3.0 Philosophy and Theoretical Framework for Developing the Program

The ASES program targets financially underprivileged yet academically gifted college students. This population group typically includes a huge proportion of first-generation students and those from underrepresented minority (URM) groups. A significant overlap exists among these demographics, facing similar barriers to college enrollment and success, as highlighted in numerous studies [3] [4] [5]. Both first-generation and low-income students enroll and graduate at rates lower than their counterparts, often taking longer to complete their degrees [6] [7] [5]. The challenges faced by first-gen, low-income, and URM students, such as financial instability, lack of mentorship, and difficulty navigating university systems, are well documented [6] [4] [8] [3]. These factors also affect persistence rates among ASU's engineering students.

To address these issues, the ASES program integrates proven strategies like financial support, cohort formation, academic assistance, and mentoring to enhance enrollment, retention, and completion rates among low-income engineering students. The program welcomes low-income, first-time students directly admitted to ASU, transfer students from regional two-year colleges, and current ASU students shifting to engineering majors, with a focus on the former two groups. Eligible students will benefit from mentoring and guidance resources aimed at navigating the challenges associated with their backgrounds.

The ASES program is based on the ecological model that focuses on three key areas of student recruitment and retention: capacity, interest, and “belongingness” [9]. This is achieved by encompassing five main components: (1) scholarship funding for new, continuing, and transfer students; (2) the creation of a scholar community through cohorting; (3) the establishment of mentoring 'familias' including scholarship recipients, peer, faculty, and industry mentors; (4) support through the Engineering Hub learning community offering tutoring, supplemental instruction, and faculty office hours; and (5) mentorship training to ensure the program's effectiveness. Students will be grouped into academic cohorts and mentoring familias, fostering a supportive environment. Cohorts for new students are determined by math level to facilitate

appropriate course sequencing, while transfer students receive specialized support to ease their transition. Peer mentors will offer weekly support, with faculty and industry mentors providing academic and professional guidance, respectively.

Incorporating transfer students aligns with the ASES goals to boost enrollment, retention, and graduation among low-income URM students. Historical data show disparities in transfer student outcomes [10] [11], which the ASES program aims to mitigate by leveraging existing networks from the Ram Ready—Engineering initiative. This initiative facilitates community college students' access to engineering courses not available at their institutions, with the ASES scholarships incentivizing participation and supporting their transition to ASU.

Retention in STEM fields remains a national issue, particularly for HSI institutions like Angelo State University, which face additional challenges in retaining first-generation and low-income students. The ASES program underscores the importance of mentoring, with research affirming its positive impact on underrepresented students' grades and persistence in STEM [12] [13] [14] [15] [16]. ASU's commitment to this program is supported by fifteen regional firms and agencies, promising a comprehensive framework for student success in engineering.

4.0 Program Implementation

This section of the paper outlines the challenges and the lessons learned from implementing the ASES program in the first year by first describing the initial program implementation plan and then describing the issues that came up during implementation. Below is a step-by-step process for implementing the ASES program.

4.1 Recruitment

The first recruitment for the ASES program began with the ASES scholarship program being publicized on the school scholarship webpage and in outreach programs. Students applying for general engineering scholarships were made aware that they will be considered for the ASES scholarship if they are eligible. All applicants to the engineering scholarship data are reviewed by the Angelo State University scholarship office and students who met the basic requirements of income and GPA were selected and submitted to the engineering department’s scholarship committee.

The committee reviews the essay submissions of students and ranks students for selection based on a scoring system that considers student’s academic experiences, interest in engineering, and past academic performance. The highest ranked candidates are selected and submitted to the scholarship office for final review for eligibility and approval. Students that accept the scholarship are enrolled in a one credit course and are informed of the date for their orientation.

4.2 Orientation

A welcome and orientation meeting is organized to welcome the new ASES scholars to the program. During this meeting, program directors, facilitators, peer (students) mentors and faculty mentors are introduced to the scholars. The students are presented with an overview of the expectations for students and the support services for students enrolled in the program. Social activities or games are carried out to help get the ASES scholars to interact amongst themselves, with mentors (both faculty and peer) and co-PIs of the program. The purpose of the meeting is to make the participants aware of the programs for the semester and to create a welcoming environment for students to feel comfortable in interacting with faculty and begin building a relationship with their mentors.

4.3 Support System

The engineering department has an Engineering Student Hub to provide student success services such as peer mentoring, tutoring, and on-site faculty office hours. These services are enhanced for ASES Scholars with each scholar required to check in weekly with their assigned mentor to discuss challenges and provide updates on their general wellbeing. Students are encouraged to build and strengthen their relationship with their assigned faculty mentor by requiring them to meet at least twice during the semester and document these meetings. At the end of the academic year, students are requested to provide feedback on the program and to suggest improvements to enhance their experience.

4.4 Career Development Events

Two seminars were held in the Spring of 2023 – 1) a workshop on time management, and 2) a talk by the Career Development office. The workshop on time management was aimed at equipping students with a valuable skill important for their success as students – time management. Students were presented with strategies for developing schedules and meeting targets in a timely manner. The career development event introduced the students to the Career Development office. Staff from career development were invited to provide a presentation on the resources students could access in their search for internship or other employment opportunities. The event involved presentations to show students where they can get help in reviewing and writing their resumes, interview preparation, and how to sign up to Handshake, an online job advertisement platform.

4.0 Lessons Learned in Program Implementation

The challenges for the program began during the candidate recruitment. This was because the award period began on October 1, 2022, and the timing of the award announcement and funds was late in the academic semester. Identifying an application process, setting a university landing page, and coordinating university account funds was a timely process. This caused a delay in identifying viable candidates for year one. In this first year, eight students were recruited into the

program. Moving forward, the program planned to promote the scholarship opportunity a year in advance for the next academic year and identify candidates early to help increase the number of scholarship applicants. In implementing these changes, the program managed to recruit 15 additional students in the second year.

Another challenge during the recruitment that impacted on the recruitment process was regarding the definition for low-income applicants used to identify eligible students. A review of the scholarship applicants identified students who were not Pell eligible but who had significant needs and who were potentially promising candidates for the ASES program. However, our criteria of Pell eligibility meant such quality candidates were not considered for the scholarship. The PI and co-PIs are in discussions with ASU's scholarship office to explore the possibility of amending the criteria for low-income eligibility in the hope of improving the quality and number of the application pool that is eligible for consideration to join the ASES scholars.

Beyond recruitment, another challenge the program faced was attrition. At the end of the first semester of the program, fall 2022, a student dropped out of the engineering program, resulting in an attrition rate of 12.5 percent. Midway through the second year, four students dropped out of the program resulting in a combined attrition rate of nearly 22 percent over the 1.5 years the program has been active.

The PI and co-PIs found that challenges with passing mathematics combined with a change in interest of students were the main reasons for 80 percent of the students giving up and dropping out of engineering. One of the students (the remaining 20 percent) could not be reached for an exit interview. Overall, fewer transfer students were leaving engineering compared to the new first-time students as shown in Figure 1.

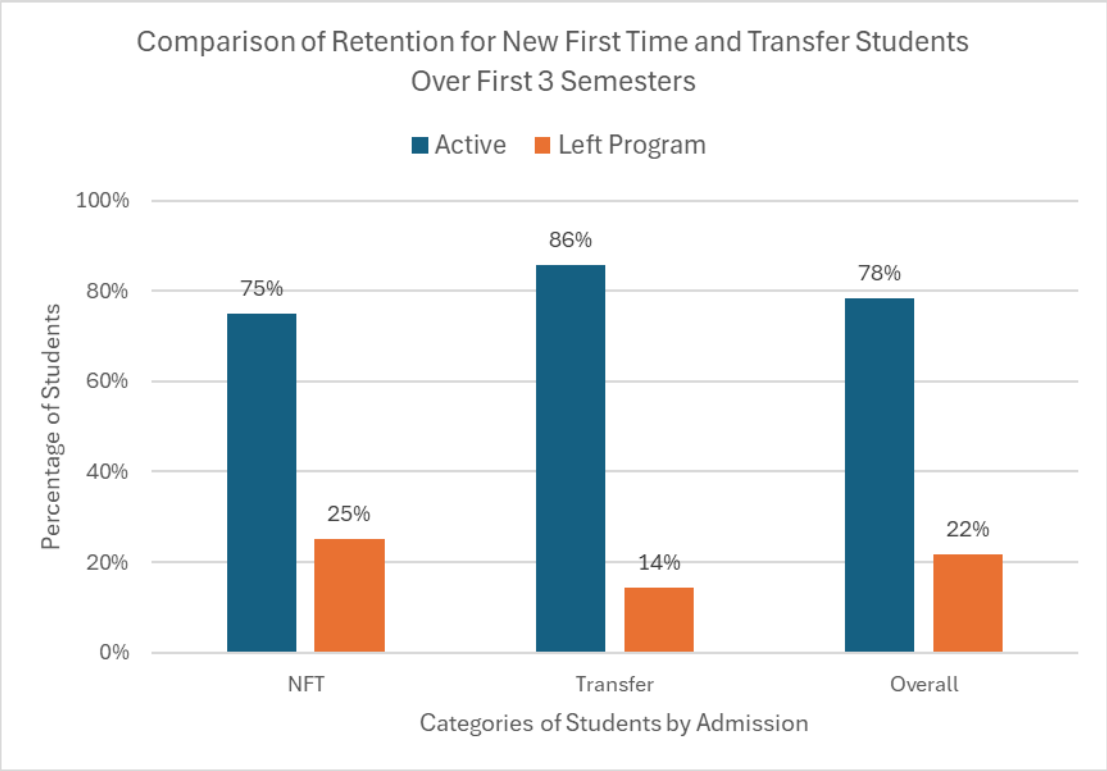

Figure 1. Percentage of students that remained in the program (active) versus those that left the program in the first three semesters.

Going forward, the ASES program intends to improve retention rates by extending their outreach to more regional two-year institutions to attract quality transfer students who may be more likely to stay in the program as indicated by our data over the past three semesters. The program will also improve the application review process to try and identify students who have a persevering attitude or who demonstrate a strong interest in engineering since this factor is demonstrated by Robin et al to be a determinant in a student's likelihood to stay in the program [17].

During the review of scholarship applicant essays for selecting candidates to join the ASES program, an initial challenge with the evaluation was that some students were not writing essays relevant to the rubric for scoring and ranking applications when the essay prompts for the general engineering scholarships was utilized. The scholarship committee therefore reviewed the criteria for selecting scholarship recipients and suggested the following improvements.

1. Refining the application process by separating the general engineering scholarship application from the ASES scholarship application.

2. After consulting with other S-STEM programs during a two-day conference in Washington DC, the ASES scholarship essay prompts were made to include the following questions. The questions provided enough prompt for students to provide a more precise response.

a. What interests you about a major in STEM? What career path are you thinking about right now?

b. If someone told you that you could not be the major you listed, what would be your second choice and why?

c. What would your friends/family say about you if they were asked to describe your personality and interests? What would they say about your strengths and insecurities?

d. Give an example of a setback you have experienced and how you dealt with it.

e. Considering the work you did in high school; do you think there was a need to change your habits in college? If yes, how so? If not, why not?

3. The scoring rubric was modified to include a criterion that rated a student's perseverance based on the answers supplied in response to the prompts.

These modifications were targeted at helping to select students with some grit who would persevere when faced with challenges in some difficult engineering and mathematics courses.

5.0 Conclusion and Future Work

The ASES program in its inaugural year implemented a strategy that provided support for low-income, academically capable students pursuing engineering degrees through financial aid, academic resources, mentoring, and career development opportunities. The implementation phase provides valuable lessons, particularly in recruitment and retention. The challenges encountered, such as some attrition among the scholars, the timing of award announcements, and the definition of low-income eligibility are discussed with a presentation of how these issues are being addressed, including the refinement of the application process and the adaptation of selection criteria to emphasize perseverance and interest in engineering.

Attrition remains a significant challenge, with a notable percentage of students leaving the program. This outcome underscored the need for ongoing evaluation and enhancement of support mechanisms. The modifications affected to address this challenge included improving the selection process to identify candidates with a strong commitment to engineering and the ability to overcome academic hurdles.

In conclusion, the ASES program's experiences during its first year offer valuable insights for similar initiatives. The program's comprehensive support structure, tailored to the unique needs of low-income, academically capable engineering students, is a model of how to address the persistent challenges of diversity, equity, and inclusion in STEM education. Continuous evaluation and adaptation of recruitment and retention strategies are crucial for enhancing the effectiveness

of such programs. Future directions will focus on expanding the program's reach in outreach efforts and revising the definition of low-income students to attract quality applicants. This paper has outlined the ASES program's structure, implementation, challenges, and adjustments based on experiences from its inaugural year that similar programs may find insightful when initiating the implementation of their program.

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