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Promoting Persistence: Providing Support for HBCU Students from Low-Income Backgrounds

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Introduction

This work-in-progress (WIP) paper will share preliminary insights on the implementation of interventions in STEM learning environments impacting undergraduate engineering degree completion at a Historically Black College and University (HBCU). While HBCUs only comprise three percent of post-secondary institutions in the United States, they enroll a high percentage of minority students [1, 2], and are often criticized for having low graduation rates, especially for low-income students [3]. To combat this concern, a public historically black land-grant university in the southeastern region of the United States was awarded the National Science Foundation (NSF) Scholarships in Science, Technology, Engineering, and Mathematics (S-STEM) grant to increase engineering degree completion of low-income, high achieving undergraduate students. The project aims to increase engineering degree completion by improving student engagement, boosting retention and academic performance, and enhancing student self-efficacy by providing useful programming, resources, and financial support (i.e., scholarships). This work is part of a larger grant aimed at uncovering effective strategies to support low-income STEM students' success at HBCUs. The next section will discuss the background of this work.

Keywords: Historically black colleges/universities (HBCUs), learning environment, undergraduate, underrepresentation

Background

A public historically black land-grant university in the southeastern region of the United States is actively implementing the Promoting Recruitment and Retention of Minority Transfer Students in Science & Engineering (PROMISE) Program. This initiative aims to bolster persistence in STEM disciplines by offering STEM Scholarships. The primary focus is on augmenting recruitment, retention, and graduation rates for economically disadvantaged, academically talented, and historically underrepresented transfer students pursuing Bachelor of Science degrees in engineering or computer science at the institution. In this paper, we focus on reporting metrics from Scholars pursuing degrees in the College of Engineering, given the context and audience at ASEE.

PROMISE strives to develop an innovative model that integrates scholarship support and mentoring specifically designed to assist academically gifted minority transfer students with financial need. Research indicates that these students often encounter challenges in maintaining their academic achievements. PROMISE scholars are granted substantial tuition assistance and gain access to various program activities. Over the course of the program, five cohorts comprising

engineering and computer science students who transferred from community colleges or other institutions will be selected to benefit from these scholarships.

Thus far, the PROMISE program has engaged with three distinct cohorts:

- Cohort 1, established in the 2021-2022 academic year, enrolled eight students in the institution's engineering/computer science programs. Impressively, six of these students have graduated and secured full-time employment, with three choosing to pursue further education in graduate school. Additionally, two more students are anticipated to graduate during the academic year 2023-2024.
- Cohort 2, comprising twelve students recruited in the 2022-2023 academic year, encountered challenges as four scholars chose to depart due to various personal reasons. The remaining eight scholars actively participate in program activities, and engage with student organizations, faculty-led research, and project work.
- Cohort 3, initiated in the 2023-2024 academic year, saw a promising start as none of the eleven students dropped out during the Fall 2023 semester, indicating a positive trajectory for this cohort within the program.

The project's primary objective is to gain a comprehensive understanding of how scholarship support and mentoring influence the success of STEM students at the institution, which holds broader implications for minority students pursuing STEM disciplines. In the following sections, we will discuss the context of scholarship support and mentoring in the PROMISE program.

Scholarship Support Context

Each cohort will be funded for two years and a summer, aligning with the average duration for transfer students to complete their Bachelor of Science programs within the institution's College of Engineering. By the conclusion of the program, 45 STEM students will receive PROMISE scholarships. The amount awarded to each PROMISE fellow can reach up to $10,000 annually, determined based on their demonstrated unmet financial need. This Program specifically targets minority students transferring from community colleges. Having commenced in 2021, the program has been operational for three years and is poised to continue supporting additional students over the subsequent two years.

Mentorship Context

The mentoring program at this public historically black land-grant university in the southeastern region of the United States is designed to provide comprehensive support to the PROMISE Scholars, encompassing various tiers of mentorship. Overall, the mentoring program aims to provide personalized support and guidance to Scholars, fostering academic excellence, professional development, and a sense of belonging within the community. Scholars are paired with faculty mentors for undergraduate research opportunities, fostering meaningful connections and providing valuable academic guidance. Additionally, faculty members offer office hours to provide academic support for students who encounter difficulties in understanding course content.

In terms of mentor selection, faculty mentors are carefully chosen based on their expertise, commitment to student success, and willingness to engage with our Scholars. These mentors meet with their assigned Scholars on a regular basis, typically monthly, to discuss academics, professional development, and research activities. Furthermore, peer mentoring is an integral component, where senior-level Engineering and CS majors serve as mentors to scholars, offering guidance and support throughout their academic journey.

The purpose of this action research study is to investigate academic, social, and cultural experiences that lead to HBCU-STEM student success and results in the enrollment, retention, and graduation of HBCU students in STEM disciplines. The methods used to support this investigation will be discussed in the next section.

Methods

To measure student success, the HBCU-STEM Success Survey [4] was piloted with engineering students at the institution to increase understanding of the experiences of STEM students from low-income backgrounds who participated in the program. The questionnaire incorporated constructs such as school climate, faculty relationships, and personal psychosocial factors related to persistence in low-income students. Before the start of the study, the researchers obtained Institutional Review Board (IRB) approval. Then, a useability test with the target audience (i.e., students participating in the S-STEM program) was conducted before survey administration began in the current study.

The electronic survey was shared with all STEM students (i.e., S-STEM program participants and non-program participants) at the institution. Student consent was requested, and resources were provided before students began the survey. Responses to the survey were collected from February to May 2023. Thirty-two engineering students at the institution completed the survey.

Data were collected using a customizable electronic survey tool, Vovici, and were imported, cleaned, managed, and analyzed using R Studio [5]. Differences between program participants and non-program participants were explored.

Findings

The findings of the pilot survey provide valuable insight into student perspectives and experiences on the institution's campus. Analyses of pilot data revealed that students in the S-STEM program (i.e., students that receive scholarships and attend regularly scheduled program meetings) averaged a higher-grade point average (GPA) than students not participating in the program, with 71% of program participants reporting a GPA over 3.5. Additionally, S-STEM survey respondents shared similar on-campus experiences to non-program participants. Most students also reported plans to pursue a career in STEM immediately following graduation, regardless of program participation.

Additional analysis of open-ended response questions revealed more insight into student STEM interest and experiences. Responses for S-STEM and non-S-STEM students were similar. Survey respondents shared that earning potential and job security were among the reasons they chose a STEM major. When asked about individuals or experiences that encouraged their interest or development in STEM, multiple survey respondents indicated that their interest in STEM was due to their academic preparation or in some way inherent and indicative of their innate abilities and personal input in the area of STEM learning (e.g., "I have always had an interest in engineering even at a very young age."; "I was able to attend a magnet/science middle school and a medical focused high school and that provided the exposure into what college majors were out there").

Similarly, students explained that their interest or development in STEM was influenced by their parents. Some respondents shared that their parents came from a STEM background and some shared general influence or encouragement (e.g., "Working with my dad in his construction business really interested me in engineering, especially civil engineering."; "I would say my mom influenced me the most"). Though survey respondents' expressions of 'family role in education' varied, many agreed that the family played some role in their pre-college educational experiences. Support ranged from general to STEM specific with respondents describing how their family specifically encouraged them to pursue STEM, supported their STEM interest, and/or served a STEM role model. Two respondents also share that their families' lower socioeconomic status or background played a role. However, several survey respondents considered their family to have played little to no role in their pre-college education (e.g., "They play no role I'm in this all alone"; "None, didn't want me to attend college because they didn't go").

Students also shared that they became interested in STEM because of encouragement from teachers in responses to open-ended questions. Respondents described how faculty make the STEM environment feel caring and supportive. Survey respondents varied in their descriptions of faculty relationships (e.g., "The faculty in my STEM major are very supportive and will assist in any way reasonable. They want to see every student achieve the goals they have in mind."; "They are amazing. They always have time to sit down and chat. Whether it be homework, or career advice, they are very knowledgeable and caring"). Most described their relationships as positive and several used more neutral descriptors (e.g., "I have a good, healthy relationship with the faculty in my STEM majors"; "Civil"). There were no descriptions of negative relationships.

In addition to the analysis of survey findings, the PI explored student academic and experiential engagement for each cohort in the S-STEM program based on data collected regularly by the program administrator. Cohort 1 displayed proactive involvement, with all eight scholars engaging in academic year research or internship experiences. Two students from the cohort submitted research papers to the Transportation Research Board conference, presenting their work in January 2023. In Cohort 2, six out of eight scholars (75%) participated in academic year research or internships. One student showcased exceptional research capabilities by presenting technical papers at prestigious symposiums in University of Illinois Urbana-Champaign and San

Francisco in April 2023. Cohort 3 demonstrated growing involvement, with seven out of eleven students (63%) actively participating in academic year research or internships.

Most scholars, regardless of cohort, diligently worked on their academic and career plans in collaboration with supervisors, emphasizing a proactive approach to their educational journeys. All students actively participated in peer mentoring programs and became members of esteemed student organizations (e.g., American Society of Civil Engineers, American Society of Mechanical Engineers, Architectural Engineering Institute, National Society of Black Engineers, and Institute of Electrical and Electronics Engineers). Notably, some scholars actively contributed to events (e.g., concrete canoe competition) and demonstrating their multifaceted engagement beyond academic pursuits.

Implications for ERM community and Future Work

The preliminary findings provide insight into engineering students' academic, social, and cultural experiences at the selected institution. Students participating in the scholarship and mentoring-focused PROMISE program actively engage in campus organizations, research, and other activities. Thus far, the GPAs and graduation rates of students in the program are higher than those of their counterparts. These findings show that the HBCU-STEM Success Survey tool reveals the factors of success for students beyond academic measures. Exploring the social and cultural experiences surrounding HBCU-STEM students' academic performance provides the necessary components of context that contribute to the student's overall well-being.

Future work will capture the perspectives of staff and student experiences at different points of their academic journey. Therefore, data collection will continue over the next two years. In addition to the electronic survey, staff interviews and student focus groups will be conducted to better understand factors contributing to student success for students participating in the S-STEM PROMISE program and their counterparts.

Study findings will be disseminated to the HBCU community, with special emphasis on engineering students from low-income backgrounds. This work can be replicated at other institutions and the findings can be used to influence changes in institutional practices and policies.

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