Board 403: The NSF S-STEM Program at a Rural, Hispanic Serving Institution

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The NSF S-STEM Program at a rural, Hispanic Serving Institution

Abstract

The NSF S-STEM program at West Texas A&M University, a minority serving institution provided academic, social, professional, and financial support to academically gifted students from the engineering, computer science, and mathematics disciplines. This project created a pathway for a) underprivileged students from rural areas, b) minority pupils, mainly of Hispanic descent, and c) college students who are first-generation to successfully enter the STEM workforce. There was a total of 49 students served through this S-STEM scholarship program in a five-year span. The overall retention to graduation rate was 71% (41/58). Of the 71 % retained or graduated, 56% were female (23) and 42% (17) were Hispanic/Latino.

Through this scholarship program, students combined into a single cohort received academic support through Peer Led Team Learning (PLTL) study groups, tutoring and mentoring activities. Professional and social activities organized for the S-STEM scholars in an on-campus and online format included technical talks given by subject knowledge experts, project leadership seminars, teambuilding skills workshop, industrial visits, and community service activities. This paper will discuss the overall outcomes of the project including the project design, recruitment and retention strategies used, and the student experiences obtained through the focus groups. The academic success stories of the scholars which predominantly comprised of underrepresented minorities, low-income individuals, and first-generation college students entering a STEM workforce will also be discussed in this paper. A comparative analysis detailing the overall success of the students involved in the S-STEM scholarship program as compared to students who were not a part of this program will also be discussed in this paper to assess the effectiveness of the approaches adopted.

Introduction:

The authors in [1] have described the indicators to measure the effectives of their NSF project in a Rural and Hispanic Serving Institution (HSI) as increasing the 1) degree progress rate, 2) overall GPA, 3) total number of students engaged in undergraduate research projects, 4) job opportunities for scholarship recipients. The initiative has also demonstrated that students who receive scholarships are retained at a higher rate than those who do not, and they are moving forward toward graduation significantly. The authors infer that retention is mostly independent of GPA. As a result, the research demonstrates the importance of S-STEM funds in such communities when deciding whether or not to continue.

According to authors in [2], Hispanic students make up 90% of the country's rural population and are the fastest-growing underrepresented group in rural America [3]. A growing proportion of Hispanic students in rural America receive their education from the 84 rural HSIs and 72 rural institutions that are becoming HSIs with enrollments of 15–24% FTE [4]. In terms of overall degree completion, Hispanic students continue to trail behind other ethnic groups. The authors' reflections on funding, diversity in mentors and role models, outreach, and career development are all included. The study offers a local and macro examination of the pressing need to develop long-term mechanisms of assistance for HSI students in rural areas.

The authors of [5] looked into how Hispanic undergraduate engineering students create their sense of self as engineers. Several identity theories and framework were also studied [6, 7]. The authors have specifically evaluated how extracurricular activities, parental influence, and institutional type affect the engineering identity development of Hispanic students. It is discovered statistically that there was no substantial difference in engineering identification between White non-Hispanic students and Hispanic students within each institution. At the Predominantly White Institution (PWI), the mother's education level was the only significant difference between the two groups. These findings, according to the authors, call for a greater examination of institutional and cultural distinctions. More specifically, at both HSIs and PWIs, institutional programs, frameworks, and cultural practices have the greatest effects on students' interest in engineering and plans to pursue engineering careers after graduation.

NSF TEAMSF Project:

The College of Engineering (COE) at West Texas A&M University strives to create qualified professionals who are prepared to support the nation's workforce's competitiveness and economic growth. The Hispanic student population of STEM majors at West Texas A&M University was 64% in 2014 and has continued to be increasing [8]. COE received funding from the National Science Foundation (NSF) S-STEM program for the project titled “Teaming Engineering and Mathematics Students for the Future (TEAMSF)” during the years 2017 - 2023. TEAMSF has supported at least 25 scholarships on an average per year for entering freshmen or transfer students to address unmet financial need and reduce or eliminate the need for students to seek employment [9]. The Table 1 gives an overview of the demographics of the cohort group. The comparison of male and female graduated/retained in different disciplines is shown in Fig. 1. The mechanical engineering, environmental engineering and mathematics has high enrollment of female students compared to other majors.

Table 1. Demographics

Demographics		Year 2018		Year 2019		Year 2020		Year 2021		Year 2022	
		No.	%	No.	%	No.	%	No.	%	No.	%
Gender	Male	4	36.36	12	48	15	50	10	37.03	8	42.10
	Female	7	63.63	13	52	15	50	17	62.96	11	57.89
Ethnicity	Hispanic	6	54.4	10	40	16	53.3	14	51.81	13	68.42
	White	4	36.36	14	56	12	40.0	11	40.74	5	26.31
	African American/ Alaska Native	1	9.09	1	4	2	6.6	2	7.41	1	5.26

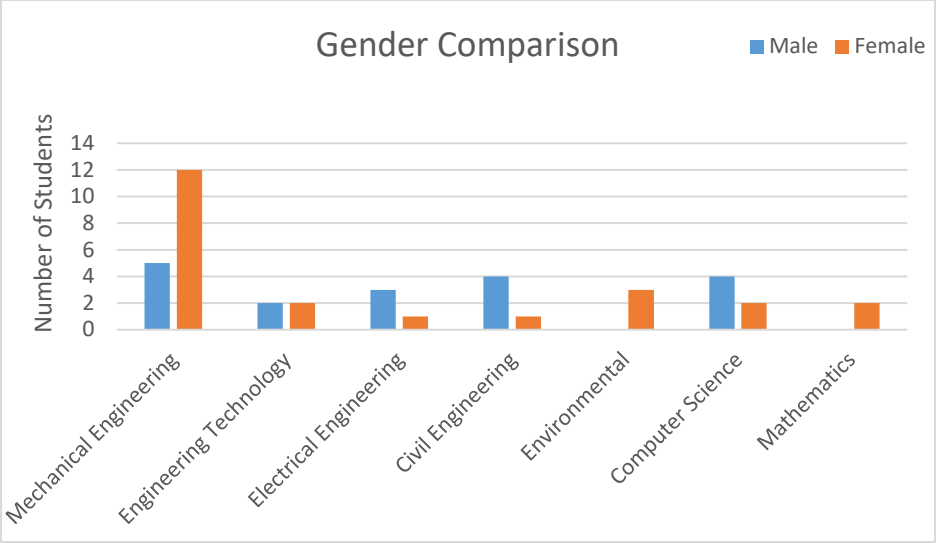

Fig.1 Comparison of Male and Female student population in different majors

Recruitment Strategies:

The following criteria were used to recruit students into the TEAMSF program: they need to be US citizens, permanent residents, nationals, or refugees; they need to have submitted the West Texas A&M Scholarship Application Form; they must be eligible for financial aid and have unmet financial need as determined by the West Texas A&M Financial Aid office; and they must show scholastic potential in engineering and mathematics. The Table 2 gives the distribution of scholarship funds during 2017-2022.

Table 2. S-STEM Awards

Academic Year	Number of S-STEM Awards	Amount
Year 1 (2017-2018)	12	$23,528
Year 2 (2018-2019)	25	$ 122,988
Year 3(2019-2020)	48	$ 133, 359
Year 4 (2020-2021)	41	$ 115, 674
Year 5 (2021-2022)	26	$ 89, 959

Retention Strategies:

i.Academic Support

Peer-led team learning (PLTL) was formally included into the classrooms to improve retention and academic achievement while also enhancing student involvement in STEM learning. This program allowed students in the NSF S-STEM cohort to receive additional support through the

Supplement Instructor (SI) sessions that were organized for challenging courses in the curriculum. These sessions were organized to go over certain challenging topics outside class, practice additional problems, and to form study groups. These SI leaders were trained and received adequate support to mentor these students towards academic success.

ii. Professional Support and Social Support

Carefully planned events were organized through the NSF TEAMSF program to offer professional and social support to the cohort of students. These events include: visits from experts to the campus, site visits to companies, technical speaker events, joining and taking part in professional clubs/organizations, practical learning activities like working on a social service community project, and potluck events hosted by the project supervisors.

Discussion of results:

The following results are obtained from the overall TEAMSF cohort group which consisted of 58 students. Out of the 58 students in the cohort, 29 students have graduated and there are 12 students who are yet to graduate in the upcoming semesters. These 12 students have successfully enrolled in the engineering, computer science, and math classes for Spring 2023 and will continue to receive the financial, academic, and social support until graduation

Site visits, conversations with active engineers, and experiential learning were seen as valuable by the TEAMSF participants. TEAMSF participation has helped the students develop friendships, establish study groups, and motivated them to pursue leadership roles in on-campus organizations. The study groups (PLTL) that were frequently facilitated by the mentors offered advice from their own experience that was perceived as beneficial for SSTEM students.

There is a 71% (41/58) retention or retention to graduation rate through fall 2022 and is shown in Fig.2. Of the 71 % retained or graduated, 56% are female (23) and 42 % (17) are Hispanic/Latino. There are 2 students who left WT are found to continue their education in STEM field. The rest left the program due to several reasons such as poor academic performance, switched to non-STEM program and are no longer full time. There are 4 students who are pursuing non-STEM majors in WT. Few are pursuing certification courses at community colleges.

Long-term impacts of the S-STEM program: The TEAMSF program has enabled students to develop professional, industry-related, and academic knowledge that they can apply to pursue careers in STEM fields after graduation. As an evidence of the program's impact on the students' life trajectories, two students are currently pursuing higher education in STEM fields, one student is pursuing higher education in Business Administration, and seventeen students have secured jobs in STEM fields. Overall, the S-STEM program has equipped its participants with the skills and knowledge needed to succeed in STEM careers and has contributed to their academic and professional success.

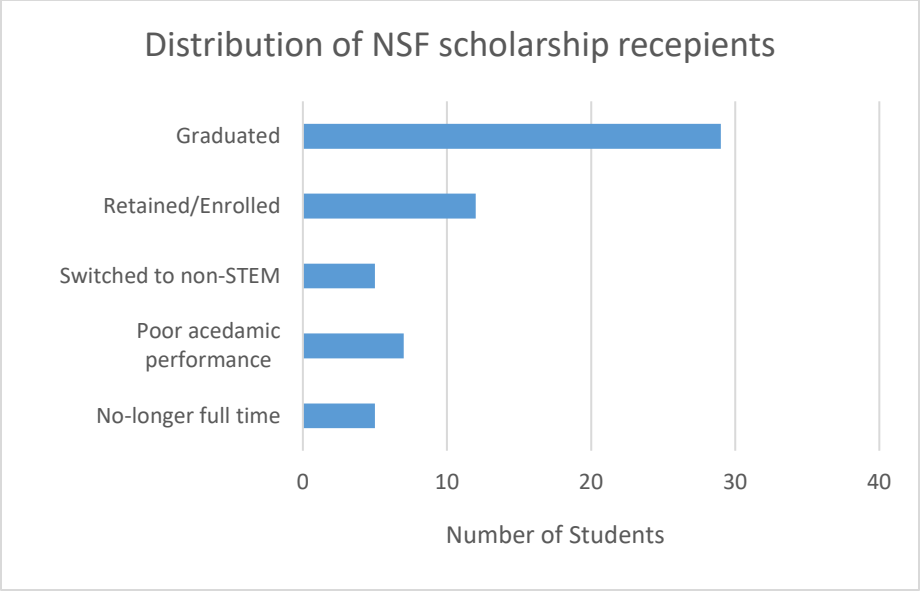

Fig.2 Summary of scholar retention rates

Comparative Analysis:

A comparative analysis detailing the overall success of the students involved in the NSF S-STEM scholarship program as compared to students (non-NSF) who were not a part of this program is shown in the Fig.3. The sample size for both the groups was 58. The non-NSF cohort group was chosen/matched based on the following elements in the order of priority: Gender, Race, Major, ACT, SAT, Graduation, Graduation Major, Semester of attendance, and Graduation date. It is observed that NSF cohort group has 74.13 % of retention rate in STEM field when compared to the non-NSF group which is 51.7%. Also, the average GPA was 3.19 for the NSF cohort while the non-NSF group was 2.77. The average numbers of years taken to graduate for both groups was approximately 4 years but with a difference by a semester.

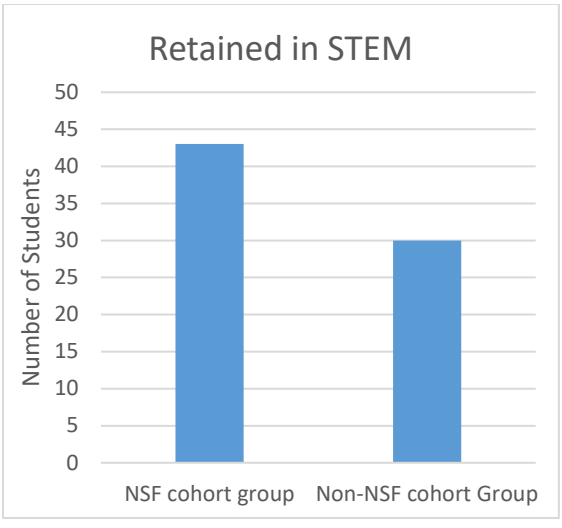

Fig. 3a) Retained in STEM

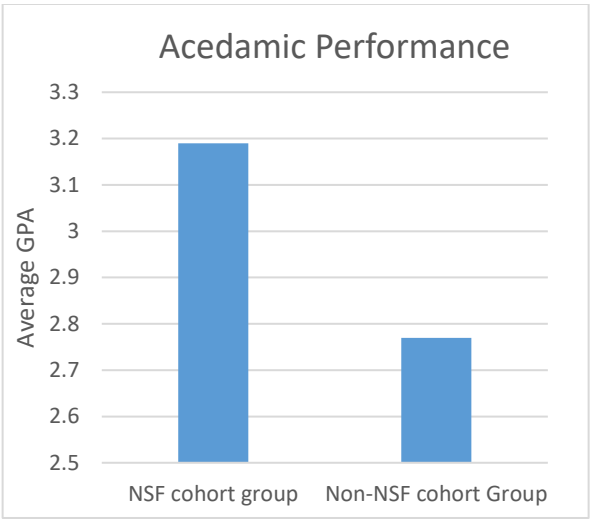

Fig. 3b) Acedamic performance

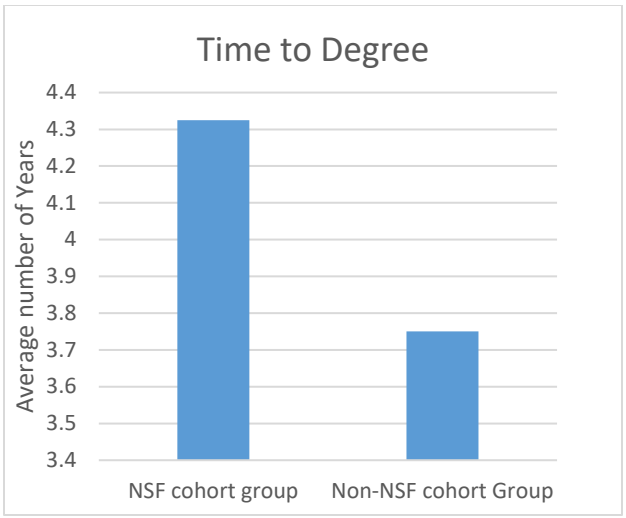

Fig. 3c) Time to Degree

Fig 3. Comparative analysis between NSF and non-NSF cohort groups

Following are a few direct quotes from students who were a part of the NSF S-STEM TEAMSF program:

"I would not feel successful if I was not in the program. I don't have anything besides the grant that connects me to the College of Engineering. Information about companies and opportunities were given to me through the grant, so I didn't have to go look for that exposure myself."

"I wouldn't know as many people as I do now. I would feel overwhelmed."

"I would have taken out more student loans because I'm only able to work 20-30 hours a week or find a different scholarship. I would have ended up having to work more. The grant makes me want to get good grades. First year, I worked really hard to get good grades. I was able to get into the industry, so I didn't care too much about my GPA after that. I was able to meet peers through the program."

"I wouldn't be as familiar with peers and mentors. The scholarship helps relieve financial stress, not having to worry too much about having to work more or finding other funding. I was able to learn more about the engineering department, the different opportunities it offers, and possibilities to network."

"I know more about the mechanical engineering community. Industry partners are invested in the success of WTAMU students. They want students to gain experience and knowledge. I don't want to leave the Panhandle, so I'm glad I was exposed to opportunities in the area."

"Networking lets us find out about different events and I am able to tell my friends who are not in the program about those opportunities they haven't heard about. I was able to make friends through the program. The program pushes me to keep my grades up, especially since I do not like to disappoint."

Conclusion & Future Work:

The NSF S-STEM TEAMSF program at West Texas A & M University has brought a profound impact in the lives of underrepresented minorities, low-income individuals, and first-generation college students at College of Engineering. The students who were supported through the program have reported that by being a part of the cohort group, they not only enjoyed the financial benefit but also the professional and social support that helped them obtain a broader perspective about the program they were in and also about the future opportunities in the STEM field. The overall retention rates were improved among the cohort of students who were a part of the program, and the academic success of the students who were involved in this program is also evident by the overall average GPA.

The lead investigator has been assisted in identifying areas for improvement by an external evaluation of the entire program. The success of this program depends heavily on the careful design of diverse events and a mentorship model that can be sustained. As a part of the future work, it is intended to compare student achievement, advancement, and post graduate success in STEM between the cohort of students who earnestly participated in the program and a cohort of students who were not a part of this program and conduct the quasi-experimental comparison research study.

Acknowledgment & Disclaimer

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Any opinions, findings, and conclusions or recommendations expressed in this material are those of the author(s) and do not necessarily reflect the views of the National Science Foundation."

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