Recruitment Strategies for Master's Degree in AI among High Achieving Low-Income Engineering Students

Dimitrios Pados
Florida Atlantic University, USA, https://orcid.org/0000-0001-8959-6450

Javad Hashemi
Florida Atlantic University, USA, https://orcid.org/0000-0002-3242-8752

Nancy Romance
Florida Atlantic University, USA, https://orcid.org/0000-0002-8449-0187

Xingquan (Hill) Zhu
Florida Atlantic University, USA, https://orcid.org/0000-0003-4129-9611

Stella Batalama
Florida Atlantic University, USA, https://orcid.org/0000-0001-7667-7868

Abstract: The unprecedented growth in the use of AI and its related technologies will put a tremendous stress on US institutions to produce the required number of technologically prepared workers to fill critically important job openings. In the US, low-income and URM students participate less vigorously in STEM-related fields; the problem is even more serious in post-baccalaureate level degrees. To address the future needs of the nation, we must increase the number of low-income students in STEM, with special attention to AI related technologies, to fill the millions of technology job openings. This paper will report on the impact of a NSF S-STEM project in which we combined (a) a mentorship model for talented, low-income students to develop a sense of self-efficacy and belongingness along with (b) a model of curricular and co-curricular supports (e.g., including engagement with AI technologies and research) and (c) limited financial assistance, all of which have increased the low-income student success in completing both their BS degree in engineering and their MS degree in AI, and addressing a national need.

Keywords: Low-Income, High-Achieving, Master's, AI, STEM

Citation: Pados, D., Hashemi, J., Romance, N., Zhu, X., & Batalama, S. (2023). Recruitment Strategies for Master's Degree in AI among High Achieving Low-Income Engineering Students**.** In M. Shelley, V. Akerson, & M. Unal (Eds.), *Proceedings of IConSES 2023-- International Conference on Social and Education Sciences* (pp. 175-186), Las Vegas, NV, USA. ISTES Organization.

Introduction

The STEM workforce size and availability remains a national security issue for the US in its competition with emerging economic powers. According to a 2022 report by the National Science Board, S&E degree production has experienced only a moderate rise in the US and European union compared to rapid rise in China[1]. Over the past decade the US has experienced a 34% increase in the number of jobs requiring STEM expertise[2]. However, the number of women and minorities pursuing S&E degrees significantly lags that of the white male group in the US[3]. The problem is exacerbated when considering STEM participation among children of low-income families, regardless of race and ethnicity[4]. Low-income students are pursuing STEM at a significantly lower rate than their high income counterparts[4]. Accordingly, the workforce shortage issue is becoming more serious in the US especially in industries that require skilled and high-tech labor and to address this challenge we need participation from all socioeconomic groups.

Considering that low-income students make up 45% of the total high school student body in the nation, their participation in the STEM fields becomes of critical importance[11]. However, the participation of students from low-income families in STEM fields is problematic and deficient for a variety of reasons: 1) students from low-income families find the exams associated with entrance to STEM fields stressful and anxiety provoking[7], 2) they have limited access to technology in their homes[4], 3) the families live in poor neighborhoods with schools of lower financial means and lower quality education[4], and 4) they often lack admission requirements. Even with all these impediments to success, some of the low-income students choose STEM fields. However, the success rate of these students who choose STEM field significantly lags their high-income counterparts: for example, only 10% of those students classified as low-income graduate from STEM fields with a 4-yr degree in comparison to 76% for their high income counterparts[8-10]. Therefore, the low-income students are highly likely to make slow progress towards advancing their education, often changing fields, or drop out altogether[4]. Often, because of financial reasons, pursuit of more advanced degrees such as MS and PhD are well beyond the scope of low-income students. Yet, we do believe that the primary objective of a low-income student is to start a career and become financially stable.

The situation of joining the skilled STEM workforce for low-income students is further exacerbated by the diffusion of Artificial Intelligence (AI) applications across all disciplines and career pathways. For instance, in 2022, 19% of the workforce were in jobs that were heavily exposed or impacted by AI while 23% are in jobs that have some exposure to AI. There have been calls to Integrate AI and STEM education[5,6]. Advocates of AI in STEM education suggest that with the increasing prevalence of AI in our society and jobs, AI education should become a necessary aspect of all fields but especially STEM fields. One must look at AI in education the same way that we look at proficiency in language and comprehension; education of AI fundamentals must be integrated in all fields.

To address the abovementioned challenges, in this paper, we report on an NSF supported S-STEM initiative to help high achieving low-income students that have entered our engineering programs at Florida Atlantic University (FAU) to 1) stay with program and complete their degree requirements in a timely manner and 2) pursue an accelerated master's degree in AI or another engineering discipline. In reporting on our S STEM initiative, we hope to show that it is possible to mentor talented low-income students towards advanced degrees in engineering, especially in AI, and address the high tech and skilled workforce needs of the nation. Our hypothesis is that with a combination of limited financial assistance, curricular, and co-curricular support, talented low-income students will complete their degree requirements, pursue and complete their Master's degree in AI, and secure a high quality industry position upon graduation.

Methods

Program Details and Implementation

The project plan involved four major components: 1) identification and recruitment of qualified students, 2) curricular support, 3) co-curricular support, and 4) graduate school or career readiness. These four components comprise the project intervention, address major needs identified in the literature, and were selected to promote student success, persistence, timely graduation, and pursuit of a Master's degree.

1. *Student Identification and Recruitment:* Working with FAU's Financial Aid Office and Office of the Provost, and through extensive advertisement throughout the college, an eligible pool of students within the College of Engineering and Computer Science was identified (students from all departments were considered) each year. The following criteria were applied in order to determine students who were qualified: i) the students had to be classified as low-income as evidenced by their FAFSA application, ii) the students had to show unmet financial need, and iii) the students had to have a GPA of 3.25 and above. The applicant's records were checked within our Division of Engineering Student Services and Advising (DESSA) for completeness and accuracy. The students' academic and financial records including i) level of unmet financial need, ii) number of hours dedicated to outside work, iii) engagement in extracurricular activities, iv) overall academic potential, and v) special needs were checked and recorded. Institutional IRB was secured for access to student information.

2. *Cohort Structure:* In this research, our high achieving, low-income Scholars were organized into Cohorts to promote a goal-oriented and supportive environment that resulted in persistence to complete a BS degree and pursue a graduate degree. Cohort structures much like learning communities improve persistence among low income, underrepresented and FTIC students[48-50]. Effective Cohort configuration models promote social integration and a sense of belonging, two factors which support and amplify student success[49]. The advantages of a cohort structure have been highlighted as belonging to a group of learners with similar goals, positive peer relationships, cooperative learning and peer teaching or tutoring, sense of cohesiveness, social and academic networks, and greater motivation[49].

3. *Development of BS/MS Accelerated Degree Program:* The University has established criteria for all accelerated (5-Yr) BS/MS degree programs within select disciplinary fields. In such programs, students can enroll in up to three graduate courses (9 credits) during their junior or senior undergraduate years that will apply towards both their BS and MS degrees. Because focus on AI is critical for the nation and applicable across all engineering domains[28], we developed a 5-year accelerated BS (in discipline)/MS (in AI) degree program. This was the first such degree program 9BS-MS in AI) approved in Florida. We believe this is the first of its kind that offers a BS in any discipline and MS in AI. Any qualified student from any engineering discipline can apply for this program. For this program, students can enroll in 3 graduate courses of the four courses available during their undergraduate years: Computational Foundations of Artificial Intelligence - CAP5625, Data Mining and Machine Learning - CAP 6673, Artificial Intelligence -CAP 6635, and Robotic Applications -EEL5661. The selected courses will count as technical elective courses in the respective undergraduate programs; thus, students will not exceed the degree requirements in terms of number of credits. The mathematics and programming prerequisites for these four courses are satisfied by the students' general engineering curricula. Students will then be eligible to apply these same credits towards MS degree in AI. This flexibility means that the S-STEM graduate students would need only an additional 7 courses (2 semesters) to complete their MS degree. These additional courses could be selected from a menu of courses available in the college. Focus on AI is critical for the nation and applicable across all engineering domains[28].

4. *Curricular Supports:* The Curricular Support components applied during the study serve as a comprehensive package to support student success, retention, and graduation. These include hierarchical mentoring, undergraduate research (optional), industrial internships (optional), success seminars, and workforce/career development. Curricular Support activities are known to positively impact student intrapersonal competencies which is a project outcome. For each Cohort group, active engagement will be a key benchmark for all activities.

5. Success Seminars: The mechanism for communication with the scholars and the implementation and coordination of curricular supports were the Success Seminars which occurred on a weekly basis, every Monday. In the success seminars, industry speakers, faculty, community leaders, ethics experts, workforce development experts were invited to share their thoughts on diverse topics of interest. In many of these seminars, there were active conversations about the topic challenges of graduate school participation and impact of a Master's degree on one's career from both a career opportunity point of view and from a financial point of view. These S-STEM Cohort-based curricular interventions are known to positively impact high achieving - low-income student persistence and degree completion[6-11]. The Success Seminar Series served as the context to engage Scholars in both the curricular and co-curricular support activities. As such, the seminars provided a forum for discussion, communication, teamwork, and consideration of alternative ways of thinking about how best to address their individual or group needs (e.g., balancing studying with working and the financial consequences)[13-15].

6. *Co-Curricular Support:* Research clearly indicates that student success in postsecondary education is a function of both academic factors (i.e., Curricular Support components) and non-academic factors (financial literacy, intra and interpersonal competencies).

The Selection Process

The recruitment procedure involved coordination across offices/departments i.e., Institute of Educational Effectiveness (IEA), Office of Student Financial Aid (OSFA), the Division of Student Services and Activities (DESSA) in the College of Engineering and Computer Science (COECS), and finally the S-STEM team. Both IEA and OFSA are able to clearly identify the largest eligible pool of potential S STEM Scholars (i.e., low income/high financial need; cumulative GPA 3.25). Electronic announcements were disseminated to all students through the College's Director of Communications, so that notices are received by all potential participants. Applicants completed an interest survey as well as the project application, both of which are used in the selection process. In each round of search for qualified candidates, we had a large number of applications; however, we only considered those who had Free Application for Financial Student Aid (FAFSA) filed with the institution. Once the applicant's applications, including their student numbers, were received, a list was provided to IEA and OFSA for verification of income status and the level of applicant's unmet financial needs based on the students FAFSA applications. Those applicants that were not classified as low-income or were classified as low income, but their unmet financial needs were very small or zero, were excluded from the list. The list of students that met the low-income classification and had significant unmet financial need were then sent to DESSA for determination of their most recent GPAs. Finally, the students that qualified based on both academic performance and income classification were ranked based on their level of unmet financial need (UFN) and academic potential (GPA). The scoring weight for UNF was approximately twice as large as the weight given to GPA, Eq. 1. This will address the concern of helping those with greater needs. The PIs selected this ratio because UFN influences GPA and students with greater financial need may have a lower GPA because they have less time to dedicate to their studies.

$$Rank = \left(\frac{Student\ UFN}{UFN\ MAX} \times 0.66\right) + \left(\frac{Student\ GPA}{GPA\ MAX} \times 0.34\right) \qquad \textbf{Eq. 1}$$

Thus, a student with an UFN equal to maximum and a GPA equal to maximum observed in the pool received the highest ranking of 1. This strategy enabled us to create a rank-ordered pool. If possible, the pool was further ranked based on their disciplines/departments to achieve an equitable distribution of interest. Based on NSF requirements, the maximum *annual amount* of individual scholarships could not exceed $10K, and the total amount of support for the duration of the program could not exceed $30K.

Results

Florida Atlantic University's NSF S STEM project which began in the Fall of 2019 has completed its third year. Up to now, the project has thus far served a total of 39 students in 4 cohorts (i.e., 11 in Cohort 1; 12 in Cohort 2; 8 in Cohort 3; 8 in Cohort 4). The project began at the start of the Covid-19 pandemic. All the S STEM Scholars in Cohort 1, however, did very well, maintained a high GPA, completed sufficient credits to progress toward and/or graduate with their BS degree in engineering and enroll in the MS in AI.

GPA and Unmet Need

The average GPA and the average unmet financial need of the S-STEM Scholars students in each cohort who were supported by the program, are presented in Table 1. The standard deviation in unmet financial need was around $6,000. The data clearly shows that there are many academically strong students who are in need of financial assistance. Providing this assistance will reduce the need of the students to work while they are studying and therefore graduate earlier.

Table 1. Average GPA and unmet financial need of four cohorts supported by the S-STEM program.

Cohort #	# of Students	Avg. GPA	Avg. Unmet Need
1	12	3.71	$ 12,192.00
2	12	3.43	$ 7,233.00
3	8	3.77	$ 10,194.00
4	8	3.62	$ 10,115.00

Average Award Distributed

In Table 2, we present the average amount of assistance provided to each cohort based on the limitation that no student can receive more than $10,000 per year and no more than $30,000 in total across multiple years. The data for cohort #4 is partial because the funds are distributed in two installments, and this is our most recently started group meaning that we have currently only distributed the first half of the available stipends. The level of support presented in Table 2 was considered very important and impactful by the students receiving the support.

Table 2. Average financial award given to four cohorts supported by the S-STEM program.

Cohort #	Yr1	Yr2	Yr3	Yr4 (partial)
1	$ 7,727	$ 8,719	$ 6,236	
2		$ 2,579	$ 7,899	$ 3,442
3			$ 5,417	$ 3,055
4				$ 3,011

Disciplines Engaged

As described earlier, students from all engineering departments and programs were considered for financial support under our S-STEM program. The distribution of students across departments in each cohort is presented in Table 3. It is not surprising that Computer Engineering and Computer Science fields had the largest number of applications as these fields are very large across the nation and the interest of such students in the field of AI is high. However, students from Mechanical and Civil Engineering also showed interest in the program.

Table 3. The disciplinary programs of the scholars that participated in the S-STEM program from each cohort and the corresponding total**.**

Cohort #	# of Students	Computer Eng.	Computer Sci.	Mechanical Eng.	Civil Eng.	Data Sci.
1	11	6	3	1	1	
2	12	4	3	3	1	1
3	8	3	3	1	1	
4	8	2	5	1		
Total	39	15	14	6	3	1

Impact of Regular Meetings and Cohort Structure

Use of digital technology (Zoom, Webex, and TEAMS virtual platforms) proved to be very effective not only during the pandemic but also in the recovery period after the pandemic as participation of scholars was high. The features of the technology (e.g., breakout rooms) enabled us to vary our weekly format to make the sessions maximally interesting to the students. Selection of topics for the Seminar series became increasingly more sophisticated as Scholars advanced in their degree program and shifted focus to the AI trends across industry-government sectors, the trends across south Florida, and the job market potential and noted industries that have relocated to south Florida. In our Monday Morning success seminars, many topics were discussed. We used this Monday morning seminars to discuss important topics, invite speakers, and raise awareness about the importance of Graduate School. The Success Seminar series helped to build a sense of community among the Scholars as they shared their perspectives on various topics. The topics of discussion included 1) discussion of retention and timely graduation, 2) importance of grad school participation, 3) best practices for success in classroom, 4) emergence of AI and its impact on the job market, 5) importance of undergraduate research, 6) importance of internship experience, 7) Ethics and AI, 8) Industry speakers, 9) faculty speakers, 10) financial decisions and outcomes, 11) resume building, 12) meeting the advisors, 13) Career planning, and 14) meeting the industrial advisory board. The Project PI Team served as the main advisors to the Scholars for all matters related to the project.

Some specific topics of discussion in our success seminars are listed below:

a. National Science Foundation’s Strategic Plan for AI
b. Strategies for Learning in CS and AI – Research Best Practices for Learning in Complex Domains
c. Challenges - ‘Landing the Right Job” presented by a Scholar who had graduated.
d. Trends in AI – across governmental, industry/business, and academic sectors including areas such as computer vision, natural language processing, cybersecurity, law enforcement, cloud technology.

e. Exploring the Career Center Resources – Handshake, career fairs, creating business accounts (e.g., LinkedIn), practice sessions, document preparation, and other resources.
f. Exploring Industry Trends – Scholars explored key regional industry websites (e.g., Tech Hub of South Florida) and chatted with the Director of Innovation and Policy.
g. S STEM Scholars had opportunities to participate in college sponsored Boot Camps (e.g., Cybersecurity, Artificial Intelligence, Programming in C and Python).
h. Most Scholars engaged in industry experiences (e.g., internships e.g., Hewlett-Packard; FPL) and/or research experiences (e.g., Autonomous vehicles; robotic arms).
i. Communication skills were a key feature of all activities.

We also selected special reading assignments for team discussions. The objectives of the reading assignments and the follow-up discussion with scholars was to enhance their general knowledge and awareness of issues facing today's graduates. A list of some of these topics is presented in Table 4:

Table 4. Sample reading assignments shared with the S-STEM Scholars and discussed in groups during the Monday morning success seminars.

National Academies of Science, Engineering, and Medicine (NASEM, 2016) – *Developing a National STEM Workforce Strategy* [21]	**Report 1** addressed the need to embrace diversity, equity and inclusive practices in the recruitment and retention of the next generation of engineers, computer scientists, and STEM professionals across all domains of knowledge. Given the diversity of the Cohort, this topic made for rich conversations including a description of how each of them became interested in enrolling in a computer science degree program since most did not have college-educated parents, did not come from high-performing STEM oriented high schools, and honestly, did not think that they could tackle such a rigorous degree program. For the female students, the barriers they encountered were even more extreme and reflected what the literature has been reporting for quite some time.
National Research Council (NRC, 2000). *How People Learn Vol I* [7]	**Report 2** provided for rich discussions about how and under what circumstances people learn the best. Cohort members shared how they coped during the lock-down and pandemic with studying and maintaining good grades. Of interest, many noted that their preferred style of learning did align with the findings from this National Research Council (2000) report by John Bransford et al., (2000).
NASEM, (2018) – *How People Learn II* [24]	**Report 3** was an addition to How People Learn some twenty-years later. Cohort members noted with interested the broader view of how learning occurs as highlighted in this report. https://www.nap.edu/catalog/24783/how-people-learn-ii-learners-contexts-and-cultures
NASEM, (2018) – *Frontiers of Engineering: Reports*	**Report 4** was important because it introduced Cohort members to cutting edge topics not addressed as part of the curriculum in computer science curriculum (e.g., BlockChain Technologies, Digital Twins).

on Leading Edge Engineering from the 2019 Symposium (2020)	
Office of the President of the US and the Select Committee on Artificial Intelligence (AI) of the National Science and Technology Council Report: *The National Artificial Intelligence Research and Development Strategic Plan: 2019 Update*. [25]	**Report 5** resulted in the most in-depth series of conversations as the report, NSF's Strategic Plan for Artificial Intelligence, was of great interest as some Cohort members were currently enrolled in their first set of graduate courses in AI. The Strategic Plan outlined 8 specific recommendations, each of which became a topic for the week due to their inherent importance and relevance to the Cohort's MS in AI degree program. Topics included: (a) How NSF is making long-term investments in AI research, (b) Developing effective methods for Human-AI Collaboration, (c) Understanding and addressing ethical, legal and societal implications of AI, (d) Ensuring safety and security of AI Systems, e) Developing shared public datasets and environments for AI training and testing, (f)Measuring and evaluating AI technologies through standards and benchmarks, (g) developing better understanding of the importance of a national AI R&D workforce, and (h) Expanding public-private partnerships to accelerate advances in AI. Each of the 8 sessions produced a level of conversation often attributed to faculty, not students. Cohort members related their experiences, coursework, internships, and actual industry jobs to the conversations. Perhaps, most importantly, they had increased understanding as to why the NSF actually funds programs such as the one they are currently participating in. Such broadening of perspectives expanded Cohorts' knowledgebase and career readiness. https://www.nitrd.gov/pubs/National-AI-RD-Strategy-2019.pdf
Burning Glass Technologies and Labor Insights. (May, 2020-2021). [8]	**Report 6** provided an extensive overview of the current job market potential in the greater Miami (Dade County), Ft. Lauderdale (Ft. Lauderdale), and West Palm Beach areas. Combined, the total tri-county regional population is approximately ~6.5 million. *Regional Analysis of High-Tech Job opportunities-Miami-Fort Lauderdale-West Palm Beach*, FL and BGTOCC Family. https://www.burning-glass.com/products/labor-insight/. https://www.burning-glass.com/research-project/bcg-trending-jobs-skills/
ASEE: *2020-survey-for-skills-gaps-in-recent-engineering-graduates*. [3]	**Report 7** linked industry-based employment trends and recommendations to student development while completing the BS-MS in AI program. . https://www.asee.org/documents/cmc/2020-SURVEY-FOR-SKILLS-GAPS-IN-RECENT-ENGINEERING-GRADUATES.pdf

Most students showed great interest in having an internship and engaged in identifying and selecting a company by themselves. Some students were already working as interns in local industries.

Given that most students decided to pursue an accelerated BS-MS, the PIs trained a DESSA advisor who was assigned to the scholars to ensure a streamlined transition from BS to accelerated MS programs. Each Scholar developed an academic plan of study with the help of the advisor. Any scholar that showed interest in pursuing undergraduate research, was introduced to faculty with research in the area of interest to the scholar.

Current Status of Scholars

Finally, the current status of the scholars in each cohort is presented in Table 5. For instance, in cohort 1, two students completed their BS degrees and did not pursue an MS degree, 6 students completed an MS degree, 1 is currently enrolled in a Master's degree, 1 is still pursuing a BS, and 1 dropped out of the program. In cohort 2, 8 have completed their BS degrees and 4 completed their MS degrees. In cohort 3, 3 completed their BS degrees, 3 are still enrolled in their BS program, 1 completed an MS degree and one is enrolled in an MS degree. In Cohort 4, all students are engaged in their BS degrees and their status is in progress. Overall, from 31 students in the first 3 cohorts, 24 have completed either their BS or MS degrees (77%), 11 have completed their MS degrees (35%), 6 are still enrolled either in BS or MS programs (19%) , and 1 has dropped out (3%). Of the students that have completed their MS degrees, 8 have completed their MS in AI and 5 are currently enrolled in MS in AI.

Table 5. The completion/graduation status of the S-STEM scholars in each cohort.

Cohort #	of Students		Graduation Status	
1	Total	**11**	BS completed	**2**
	Male	**10**	MS Completed	**6**
	Female	**1**	Enrolled in MS	**1**
			Enrolled in BS	**1**
			Dropped out	**1**
2	Total	**12**	BS completed	**8**
	Male	**11**	MS Completed	**4**
	Female	**1**	Enrolled in MS	
			Enrolled in BS	
			Dropped out	
3	Total	**8**	BS completed	**3**
	Male	**6**	MS Completed	**1**
	Female	**2**	Enrolled in MS	**1**
			Enrolled in BS	**3**
			Dropped out	
4	Total	**8**	BS completed	
	Male	**7**	MS Completed	
	Female	**1**	Enrolled in MS	
			Enrolled in BS	**8**
			Dropped out	

Employment Trends

Upon graduation, the S STEM Scholars have been steadily successful in securing high quality jobs. Also, two in cohort #1 are pursuing PhD programs. Table 6 below illustrates the quality job placements of some students enrolled in Cohort 1. These companies represent important industry leaders.

Table 6. Post-graduation employment trends – Cohort 1&2

Students	Industries or Government Agencies Employing S STEM Scholar Graduates	PhD Program
7 (Cohorts 1-2)	**L3 Harris**: An American technology and defense contractor specializing in command-and-control systems and surveillance solutions. (2 students). **General Motors**: A major manufacturer of automobiles and pioneer in vehicle safety and automation. (1 student). **NextERA Energy**: The World's largest storer of energy with both existing and renewables portfolios and the adoption of emerging technologies to achieve Real Zero carbon emissions. (2 students). **Northrup Grumman**: A major US defense contractor who pioneers new technologies and breaks barriers to protect and advance safety systems from outer space to cyber space. (1 student). **FPFX**: Technology firm specializing in custom technology solutions for trading firms and brokerages. (1 student)	2 – enrolled in the PhD in Computer Science with AI and Data Science Specialization

Conclusions

Based on the outcomes of our program, we conclude that NSF's S-STEM program in support of academically strong low-income students is an effective program that produces the following results:

1) Participating in this program stay the course and complete their degree requirements in a timely manner.
2) A significant majority of Scholars took advantage of the opportunity to pursue an accelerated BS/MS program in Artificial Intelligence.
3) The BS in any engineering discipline combined with accelerated MS in AI was found to be attractive to all participants. Of the students that have completed their MS degrees, 8 have completed their MS in AI and 5 are currently enrolled in MS in AI. This combination promises to be a way of the future for many engineering professions.
4) Major focus on AI and related areas (e.g., autonomous systems, machine learning, deep learning, applications across industries such as cybersecurity, ethical and societal implications for AI) resulted in a great deal of excitement about knowledge in the field.

5) Increased focus on career development, employment trends, job-related skill sets, regional advances in AI/CS employment opportunities, and essential skills to acquire a high-quality job in the tech sector.
6) Scholars actively contributed to weekly discussions and enhanced their communication skills, the development of their fluency of ideas, and interacting and inquiring about topics their peers may have been more knowledgeable about.

Acknowledgement

The investigators gratefully acknowledge the support of NSF through S-STEM program, Award # 002196.

References

Boggs, G. R., Dukes, C. M., Hawthorne, E. K., et al. (2022). Addressing the STEM Workforce Shortage. Center for Education and Workforce. *US Chamber of Commerce Foundation*.

Cosman, B. (2014). The high school graduation rate is great, unless you're Poor. *The Wire.*Salgado, L., Artis, S., Lee, H. R., et al. (2020). The Motivation of Low-Income Engineering Transfer Students that Influences Choosing and Pursuing a baccalaureate Degree Attainment in Engineering. *ASEE's Virtual Conference.* Paper ID #29800.

Donaldson, K., Lichtenstein, G., & Sheppard, S. (2008, June). Socioeconomic status and the undergraduate engineering experience: Preliminary findings from four American universities. In *2008 Annual Conference & Exposition* (pp. 13-1091).

Engle, J., & Lynch, M. (2009). Charting a Necessary Path: The Baseline Report of Public Higher Education Systems in the Access to Success Initiative. *Education Trust.*

Kochnar, R. 2023. *Which US Workers are More Exposed to AI on Their Jobs?* The Pew Research Center. https://engineering.cmu.edu/news-events/news/2021/10/15-integrate-ai-stem.html

Lynch, M. (2017). *Why Low-Income Kids are Nowhere to be Found in STEM*. The Edvocate.

National Science Board, National Science Foundation. (2019). Higher Education in Science and Engineering. *Science and Engineering Indicators 2020*. NSB-2019-7. Alexandria, VA. Available at https://ncses.nsf.gov/pubs/nsb20197/.

Pearson, J., Giacumo, L.A., Farid, A., & Sadegh, M. A. (2022). Systematic Multiple Studies Review of Low-Income, First-Generation, and Underrepresented, STEM-Degree Support Programs: Emerging Evidence-Based Models and Recommendations. *Educ. Sci., 12*, 333. https://doi.org/10.3390/educsci12050333

Rozek, C.S., Ramirez, G., Fine, R.D., & Beilock, S.L. (2019). Reducing socioeconomic disparities in the STEM pipeline through student emotion regulation. *Proc Natl Acad Sci U S A., 116*(5), 1553-1558. doi: 10.1073/pnas.1808589116. Epub 2019 Jan 14. PMID: 30642965; PMCID: PMC6358706.