Growing Our PEARLS and ASSETS Through a Support Ecosystem for Low-Income Academically Talented Students

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***Abstract* - This research to practice paper describes two NSF-funded projects: The *"Program for Engineering Access, Retention, and LIATS Success"* (PEARLS) and the *"Academic and Socioemotional Support Ecosystem for Talented low-income STEM Students"* (ASSETS). These initiatives aim to support low-income, academically talented students pursuing STEM degrees, offering academic, socio-emotional, and financial assistance. Both projects provide mentoring, workshops, mental health services, and scholarships. Outcomes have shown increased engagement, retention, and graduation rates among participants compared to non-participants. Retention and persistence rates among PEARLS participants reached 97% and 96.3% respectively, showcasing the model effectiveness in keeping students focused on their studies. Graduation rates saw remarkable improvements, with on-time graduation rates soaring to 4.17 times that of non-participating students. The paper presents a robust framework for an integrated support ecosystem, emphasizing scalability and replicability across diverse institutions. By addressing the challenges faced by underprivileged students during environmental crises, this framework aims to foster equity and inclusion in higher education, ensuring all students have the support they need to succeed.**

***Keywords* —** *Support Ecosystem; Low-Income students; STEM*

I. Introduction

This research to practice paper describes two NSF-funded projects: The "Program for Engineering Access, Retention, and LIATS Success" (PEARLS) and the "Academic and Socioemotional Support Ecosystem for Talented low-income STEM Students" (ASSETS). Navigating the educational landscape for STEM students in higher education institutions is an ongoing journey filled with challenges. The increasing global demand for STEM professionals emphasizes the importance of effective recruitment, retention, and graduation strategies [1]. STEM fields are dynamic, requiring constant updates to keep pace with evolving technologies. Similarly, students' expectations and backgrounds evolve, shaping their educational experiences. To address the complex needs of STEM students and increase enrollment and graduation rates, institutions must continuously adapt their approaches [2]. Hispanic Serving Institutions (HSIs) face unique obstacles, given their substantial number of minority, low-income, academically talented students, many of whom are first-generation. These students often encounter specific barriers for accessing and succeeding in higher education, necessitating tailored support mechanisms within HSIs [3].

The two projects described in this paper were conceived to provide an ecosystem of support to low-income, academically talented students pursuing undergraduate degrees in Science, Technology, Engineering, and Mathematics (STEM). Recent natural disasters, including the COVID-19 pandemic, hurricanes, and earthquakes, have significantly disrupted student learning worldwide. According to UNESCO, the pandemic alone impacted over 1.6 billion students and youth globally, with the most vulnerable learners withstanding the worst of the consequences [4].

Among those hardest hits are low-income, academically talented students, often pioneers in their families pursuing higher education. Numerous studies attest to the adverse effects of these crises on students' academic performance, financial stability, and mental

well-being. Both, PEARLS and ASSETS were projects conceived in response to these crises, and both received funding from the National Science Foundation (NSF).

PEARLS studied the effectiveness of a hybrid intervention model merging socio-cognitive research and departure theories in a quest to answer the question of the model's effectiveness to boost success indicators among low-income engineering students. ASSETS had as research objective studying the socio-emotional and financial challenges faced by low-income science students and address the question of how academic strategies such as peer tutoring, study groups, and personalized academic advising, alongside the provided mentoring, workshops, mental health services, and scholarships were able to impact these students in the midst of adverse situations.

Both projects assess the socio-emotional and financial challenges faced by students and study the effectiveness of academic strategies such as peer tutoring, study groups, and personalized academic advising. The projects additionally evaluate the impact of mentoring, workshops, mental health services, and scholarships. The research objectives delve into understanding the role of key components in an integrated support ecosystem and exploring their potential for scalability and replication across various institutions. Furthermore, we consider the role of these initiatives in mitigating the effects of natural disasters and financial crises on low-income STEM students. The findings of such approaches address profound challenges faced by underprivileged students, to foster equity and inclusion in higher education. This paper contributes to Frontiers in Education (FIE)'s mission by promoting innovative research practices that benefit low-income, academically talented STEM students. The lessons learned from these initiatives can be scaled and replicated nationally and internationally.

The rest of this document has been organized as follows. Sections II and III describe PEARLS and ASSETS's objectives, theoretical frameworks, and structures. Section IV analyzes the initiatives' commonalities, approaches, and how they contribute to the support ecosystem, spotlighting the populations each serves. Section V highlights the results obtained so far in applying the initiatives. Section VI discusses lessons learned and focuses on the dos and don'ts of these experiences. Section VII provides concluding remarks derived from the application of these models.

II. THE PEARLS INITIATIVE

The Program for Engineering Access, Retention, and LIATS Success (PEARLS) is a comprehensive initiative established in 2018 in the College of Engineering of the University of Puerto Rico Mayaguez (UPRM) sponsored by the National Science Foundation (NSF) under the S-STEM program. PEARLS aimed at narrowing the socioeconomic status (SES) achievement gap of low- income engineering students by improving success indicators that included retention, persistence, graduation rates, time to graduation, and successful insertion in post- graduation life [5]. The program directly impacted 92 students from nine bachelor's level and three master's - level programs grouped into four cohorts. It also indirectly benefited over 2,000 others through open activities and dynamics. It implemented a longitudinal approach based on a hybrid model that addressed socio- cognitive factors of students via institutional interventions inspired by departure theories. PEARLS interventions adopted integral elements from Lent's Social Cognitive Career Theory (SCCT) and Tinto's Departure Model into a hybrid framework denominated the LIAT College Access and Success Model (L-CAS) [6]. SCCT elements provided insights into cognitive factors influencing LIATS' success, while Tinto's concept of institutional interventions enabled specific activities. Their combined implementation enabled experiences impacting students' decisions. The entire model was framed in a merit-based scholarship model aimed at mitigating the student hardships associated with their unmet portion of the cost of attendance. Figure 1 illustrates how the L-CAS incorporates such elements.

Through the L-CAS model, PEARLS LIATS' academic and personal development were guided through five development stages that included LIATS Background Experiences, Belonging, Formation, Growth, and Graduation.

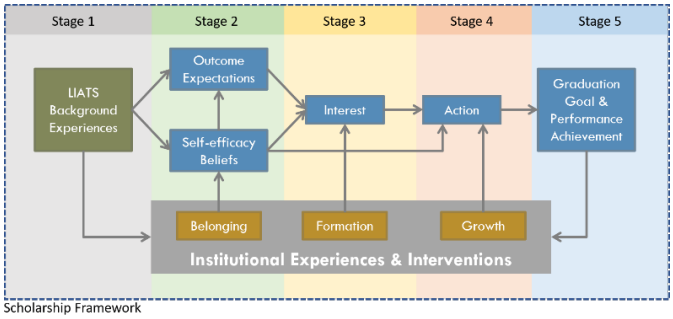

Figure 1: L-CAS elements.

LIATS Background Experiences considered pre-established factors influencing perceived self-efficacy and outcome expectations of students, including demographics, learning experiences, and outreach

interventions. Activities in this stage included study program awareness dynamics, and post-graduation pathway discussions.

The Belonging stage focused on interventions for creating a sense of belonging among LIAT to their chosen study programs and reinforcing their self-efficacy beliefs. The creation of Engineering Learning Communities (ELCs) fostered community ties while faculty mentoring promoted a supportive environment for first-year LIATS.

In the Formative stage, LIATS engaged in experiences such as Affinity Research Group (ARG) workshops and information literacy courses to enhance research skills and social integration. A series of directed curricular and co-curricular activities defined the interventions in this stage, allowing for shaping LIATS' professional skills.

The Growth stage involved LIATS participating in undergraduate research, special projects, leadership, and Co-op/internship opportunities to develop practical skills and industry connections. Lastly, in the Graduate Development stage, LIATS received training in leadership, communication, and mentoring skills to support their success in graduate programs. Jimenez et al. Provide a detailed list of all PEARLS activities and their alignment with different L-CAS stages [7].

III. ASSETS Initiative

The Academic and Socioemotional Support Ecosystem for Talented low-income STEM Students (ASSETS) was initiated in 2023 at UPRM, in the College of Arts and Sciences, funded by the National Science Foundation's S-STEM program. Designed to bolster STEM scholars' academic and socioemotional well-being, ASSETS employs a comprehensive approach tailored to biology, chemistry, and psychology students and a unique case of the physics program. Currently supporting 24 scholars, with an additional cohort of 18 students slated to begin in fall 2024, the program draws from evidence-based strategies and interventions to empower students to thrive in their academic pursuits and beyond. Financial aid forms the cornerstone of ASSETS, addressing the critical need for support among low-income students. Through merit-based scholarships, the program mitigates the economic barriers associated with higher education, allowing scholars to fully engage in their academic pursuits and alleviate the burden of the cost of attendance.

Building on the success of the NSF-EECOS project, which achieved a remarkable 98% graduation rate and provided essential support to STEM scholars affected by catastrophic events such as Hurricane Maria and the seismic event of January 2020, UPRM-ASSETS continues this legacy. The NSF-EECOS project saw 49 out of 65 scholars graduate within three years, with the remaining students graduating in the following two years. This success was due to its multi-faceted support structure, which included financial aid, mentoring, academic advising, and socio-emotional counseling.

ASSETS builds on these insights by adopting similar strategies and introducing undergraduate research opportunities. These hands-on experiences develop critical thinking skills and prepare students for post-graduation endeavors. The program also integrates tailored socio-emotional interventions, offering workshops on self-care skills. The activities range in themes from effective time management and study techniques to online modules on growth mindset and social belonging. The modules used were from PERTS-ASCEND on Growth Mindset and Social-Belonging for College Students. The Growth Mindset for College Students was created at Stanford University and the University of Texas at Austin, including the work of Drs. Carol Dweck and Dave Paunesku among others [9,10]. As described on their website (perts.net) "*Growth Mindset for College Students is an evidence-based program designed to increase college students' academic motivation, resilience, and achievement. It takes aim at the common misconception that intelligence is fixed — a pernicious misconception that erodes students' motivation and makes them less likely to persist and succeed when they encounter academic difficulties. In previous randomized controlled studies, Growth Mindset for College Students has led to improved academic performance and persistence — including higher student retention and graduation rates.*"

Researchers at Stanford University, the University of Texas at Austin, Indiana University, and the University of Waterloo, created the module of Social Belonging for College Students [11]. The program is described as follows: "*All incoming first-year students are likely to experience challenges and setbacks as they transition to college. In the face of challenges and setbacks, negative stereotypes and under-representation can cause members of socially disadvantaged groups to wonder if they – or people like them – belong in college"*. It continues expressing "*...Social-Belonging for College Students is an evidence- based program designed to instill in students an adaptive mindset that normalizes difficulties experienced in the transition to college and*

helps students feel a greater sense of belonging at their school. By exposing students to stories portraying challenges and setbacks as normal, improvable with time and effort, and not indicative of a lack of belonging, students are more likely to remain socially and academically engaged (e.g., attending office hours, joining student groups, etc.) and demonstrate greater academic persistence and achievement.

In previous randomized controlled studies, Social-Belonging for College Students has led to both greater social and academic engagement on campus as well as improved academic outcomes—including higher GPAs and greater student retention—among students from socially disadvantaged backgrounds." The online modules take 30 minutes each for students to complete and consist of brief reading passages, writing exercises, and survey questions. All 24 ASSETS scholars participated.

All scholar's socio-emotional wellbeing was evaluated resulting in referrals to clinical counselors and psychologists to address mental health issues in those students who need it. Based on the results of the February administration of the PHQ9 and GAD7 [14] forms to identify depression and anxiety symptoms and the needs assessment survey, 19 of the 24 (80%) Scholars were referred for psychological counseling during the 2024 spring semester.

Also, ASSETS groups students were organized into cohorts, allowing them to interact, form study teams, and benefit from a collaborative learning environment. This structure enables students from related sciences to enrich each other's academic experiences. Increased financial assistance further supports students, ensuring a coordinated effort to foster resilience, persistence, and a supportive community. These initiatives highlight EECOS's lasting influence on subsequent projects and underscore the importance of an integrated approach to student success.

IV. Approach and Commonalities

The research design for these projects consisted of a quasi-experimental approach due to the lack of full control of potential confounding variables [10]. The students were selected using a rubric to assess scholarship applications in three categories: financial need, graduate index from high school and/or GPA, and essay approach. The rubric considered not only academic performance and financial need but also the student's overall potential.

PEARLS and ASSETS have created an ecosystem of support that promotes students' success. The academic and socio-emotional support provided by mentors, and six academic counselors, allows the team to tailor their interactions with students based on students' personalities, expectations, and needs. Figure 2 includes the ecosystem of support provided to students. Figure 3 summarizes the academic, financial, and socioemotional components of the support provided by this ecosystem.

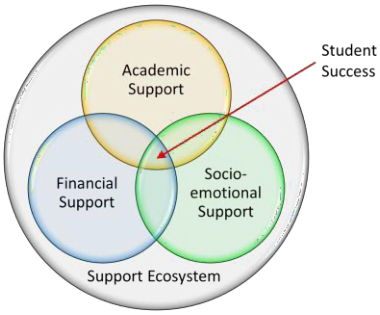

Figure 2: PEARLS and ASSETS Support ecosystem

Support Ecosystem			
	Academic Support	Financial Support	Socio-Emotional Support
PEARLS	- Individual mentoring - Group mentoring - Seminars - Workshops	$3,000 per year	-Professional counseling
ASSETS	- Individual mentoring - Group mentoring - Seminars - Workshops	$11,000 per year (average, based on unmet need)	-Professional counseling - Growth mindset modules - Sense of belonging modules

Figure 3: Support Ecosystem by Type of Support and Program.

V. Results and Discussion

PEARLS outcomes after four full years of application of the L-CAS model have been significant. Intervened students were tracked in their development using their individual development plans (IDPs). Table 1 lists samples of observations collected from students, the recommended course actions given by their mentors and the observed outcomes. López et al. documented dozens of similar cases illustrating student observations, mentor recommendations, and observed outcomes in student development [12].

Tables 2 and 3 show the number of students directly impacted by PEARLS and ASSETS by academic program. Retention and persistence rates among participants reached 97% and 96.3% respectively, highlighting the model effectiveness in keeping students focused on their studies. Graduation rates saw remarkable improvements, with on-time graduation

rates soaring to 4.17 times that of non-participating students.

Table 1: Samples of mentoring interventions and observations.

Program & Student	Student observations from IDP	Mentor Recommendation	Outcome
CvE Student 1	Interest in participating in academic competitions and internships. Improve my fluency in English.	Visit and explore the different student competition teams and apply to become a member. Participate in summer undergraduate research and internships.	The student participated in a summer internship with a construction company in the continental US, where he was able to practice and improve his English. He also held a leadership position in the Associated School of Construction student competition team.
CE Student 1	Interest in improving networking and advancing knowledge in embedded systems and cybersecurity. Wanted to practice leadership skills and develop strategies to accomplish goals	Take a leadership role in associations, attend coding club activities, take a role as an advocate to improve networking, and distribute academic workload based on priorities to have time to work on important goals.	The student has taken the role of advocate. This helped him in networking with students and company members. Actively coordinated activities to develop skills of others. Has taken VP role in a student association. Learned to manage time and balance workload.
ASSETS Student 1	Interest in participating in under-graduate research. Improve math skills.	Explore different opportunities to participate in undergraduate research both at our institution and in REUs at other institutions. Reference to a tutoring math program.	The student applied to work in a research project at the campus and planned to apply for a REU next summer. Participated in the math tutoring program and passed the Pre-calculus course with an A.
ASSETS Student 2	Interest in improving daily study habits and developing a sense of belonging	Attended several meetings with psychological counselors and explored student organizations.	The student found a spot in the library to study during the day when not in class, joined the pre-medical association, and secured a research position for the following semester.

PEARLS graduation rates at 150% time or less increased by 62% with respect to non-program students. So far, 87% of students have graduated with about 62% of them joining the labor market, 36% entering graduate school, and about 2.5% creating their own businesses. The 20% SES achievement gap observed in the general population reduced to 4%. These outcomes highlight the effectiveness of PEARLS in supporting low-income engineering students through their academic journey.

Besides the direct impact on students, PEARLS has also helped them to gain a better understanding of factors and strategies helping to boost LIATS success. It has provided insight into the success expectations of engineering students in a large HSI, has innovated with a learning community model for commuting students, created a cognitive apprentice framework proven to boost leadership among students, adapted effective tools for individual student development, established a sustainable model for mentorship, and developed strategies for student resiliency and adaptability [7]. Moreover, PEARLS exploited industry-academia ties that helped bridge the SES gap for LIATS and established replicable servingness model for low-income students [8], [12]. With such a comprehensive set of interventions and knowledge generation, PEARLS has become an exemplary model for driving LIATS to successful careers in engineering.

Within the Arts and Sciences student population, ASSETS fosters collaborations across disciplines like chemistry, biology, and psychology, creating an environment where students benefit from the synergies between fields, enriching their academic experience. These interdisciplinary interactions deepen students' understanding of real-world challenges and prepare them for the complexities of today's STEM workforce. By integrating knowledge from various disciplines, ASSETS customizes its support strategies to effectively address the diverse needs of low-income STEM students, ensuring comprehensive support encompassing both academic and non-academic aspects of student success. Table 4 lists the activities of the academic and socio-emotional support components in ASSETS.

At the beginning of spring 2024, participants were tested on various socio-emotional aspects. In the Post-Test surveys completed in May 2024, participants demonstrated slight improvements in their anxiety and depression levels as shown in Tables 5 through 7.

Table 2: Distribution of PEARLS students by academic program.

Academic Program	No. of Students	Percent
Chemical Engineering (ChE)	14	15.2%
Computer Engineering (CE)	14	15.2%
Mechanical Engineering (ME)	14	15.2%
Electrical Engineering (EE)	13	14.1%
Industrial Engineering (IE)	12	13.0%
Software Engineering (SE)	9	9.8%
Civil Engineering (CvE)	7	7.6%
Surveying & Topography (ST)	5	5.4%
Computer Science (CS)	2	2.2%
Grads (M.S.)	2	2.2%
Total	92	100.0%

Table 3: Distribution of ASSETS students by academic program

Academic Program	No. of Students	Percent
Psychology	7	29.1%
Chemistry	4	16.6 %
Biology	12	50.0%
Physics	1	4.1%
Total	24	100.0%

Table 4: Activities of the Academic and the Socio-Emotional Support Components

Academic Component
• Mental Health & Exercise - February 29, 2024 • Neuropsychology of Drugs - March 26, 2024
Socio-emotional Support Component
• Cohort 1 Welcome Meeting - December 5, 2023 • Kick-off Meeting 2nd Semester - February 8, 2024 • Survival Skills Webinar - March 5, 2024 • Semester Closing Meeting - May 16, 2024 • Counseling & psychological referrals: 17 participants (58%)

These results are encouraging, even though the t-tests were not significant based on an alpha value of .05, ($t(23) = 1.76$, $p = .954$ for the Anxiety Levels and $t(23) = 3.02$, $p = .997$, for the Depression Levels).

Table 5: Lower-Tailed Paired Samples t-Test for the Difference Between Pre- and Post-Test_Anxiety

Pre-Test		Post-Test				
M	*SD*	*M*	*SD*	*t*	*p*	*d*
7.38	3.65	6.17	2.88	1.76	.954	0.36

Note: N = 24. Degrees of Freedom for the *t*-statistic = 23. *d* represents Cohen's *d*.

Table 6: Lower-Tailed Paired Samples t-Test for the Difference Between pre- and post-test depression levels

Pre-Test		Post-Test				
M	*SD*	*M*	*SD*	*t*	*p*	*d*
7.92	4.83	6.36	4.97	3.00	.997	0.60

Note: N = 24. Degrees of Freedom for the t-statistic = 24. *d* represents Cohen's *d*.

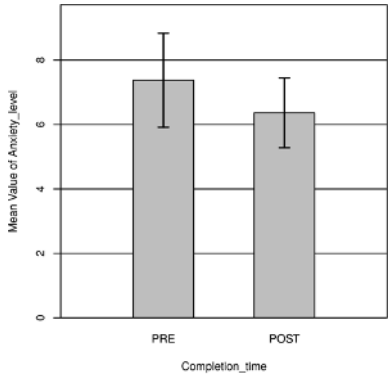

Figure 4: Pre- and post-test anxiety levels.

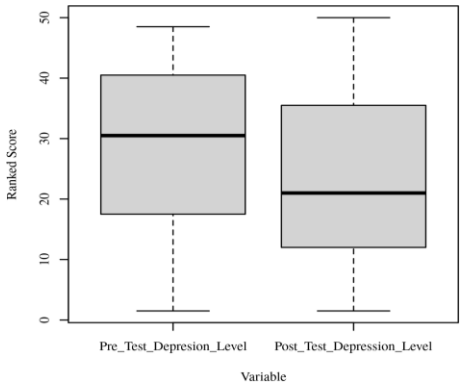

Figure 5: Ranked scores for pre- and post-test depression levels.

Using the PERTS ASCEND surveys [13] to measure, the cohort improved in self-efficacy, social belonging, and identity safety. However, the results also revealed decreases in social connectedness, institutional growth mindset, and belonging certainty.

Table 7: Pre- and post-test ASCEND survey results.

ASCEND Surveys	Pre-test	Post-test
Self-efficacy	79%	85%
Social Belonging	86%	90%
Identity Safety	86%	88%
Social Connectedness	74%	72%
Institutional Growth Mindset	85%	83%
Belonging Certainty	88%	79%

The ASSETS team will take these results into account to review successful strategies and reevaluate, adjust and correct those activities and strategies that will

improve the socio-economic conditions of the participants during the second year of the project. For example, activities will promote more social connectedness among participants and directly address social belonging concerns.

VI. Lessons Learned

The PEARLS and ASSETS projects have offered valuable insights into developing effective support ecosystems for low-income, academically talented STEM students. Through the lens of mentors and students, these initiatives have emphasized the importance of personalized mentoring. Mentors have played a crucial role in coordinating one-on-one and group meetings with students, where they have helped identify students' strengths and areas for growth. From the student's perspective, these interactions have been instrumental in understanding their personal, academic, and professional goals. Moreover, the flexibility and adaptability of support programs have been evident as mentors tailor their guidance based on students' personalities, expectations, and needs. This approach has increased student engagement, retention, and graduation rates.

In a more holistic view, PEARLS and ASSETS have directly impacted students and provided valuable insights into factors and strategies contributing to the success of low-income, academically talented students (LIATS). Through PEARLS, a better understanding of the success expectations of engineering students in Hispanic-Serving Institutions (HSIs) has been gained. Additionally, innovative approaches, such as the learning community model for commuting students, have been introduced. PEARLS has also developed a cognitive apprentice framework that enhances leadership skills among students and adapted effective tools for individual student development. Moreover, the initiative has established a sustainable model for mentorship and developed strategies to promote student resilience and adaptability. Furthermore, PEARLS has leveraged industry-academia ties to bridge the socioeconomic gap for LIATS and established a replicable model for supporting low-income students. With its comprehensive interventions and knowledge generation, PEARLS has emerged as an exemplary model for guiding LIATS toward successful careers in engineering.

In the case of ASSETS, drawing inspiration from the remarkable success of previous NSF-funded projects, the initiative is determined to replicate and surpass these outcomes as it embarks on its inaugural year. Leveraging the valuable lessons learned from PEARLS and EECOS, ASSETS is poised to refine and enhance its strategies, leveraging its interdisciplinary approach and comprehensive support ecosystem to propel low-income STEM scholars toward more extraordinary achievement and success. Through ongoing assessment, adaptation, and innovation, ASSETS is committed to forging new pathways for student success and making a lasting impact in the STEM education landscape. Moreover, the incoming cohort of students faces unique challenges, having endured the disruptions caused by the COVID-19 pandemic and the aftermath of natural disasters that have affected the island. These experiences led to gaps in their knowledge and skills, necessitating tailored support to help them thrive academically. Addressing these challenges is crucial for ensuring equitable access to educational opportunities for all students.

However, these projects have also highlighted several pitfalls to avoid. Primarily, it is crucial to avoid adopting a rigid, one-size-fits-all approach to mentoring and support. Each student brings unique needs and circumstances, requiring personalized attention and interventions. Additionally, neglecting socio-emotional support can hinder student success. Initiatives should develop a comprehensive support framework that addresses students' academic, socio-emotional, and professional development needs. Personalized approaches to mentoring and support should be implemented, considering each student's unique needs and circumstances. Innovating and adapting strategies to meet evolving student needs and institutional contexts is essential for long-term success. Forge partnerships between industry and academia to provide students with real-world experiences and bridge the socioeconomic gap. Establishing sustainable models for mentorship and support ensures long-term success and impact. Conversely, initiatives should avoid implementing rigid, one-size-fits-all solutions that do not account for individual student needs and circumstances. The importance of addressing students' socio-emotional needs alongside academic support should not be overlooked. Short-term approaches that do not consider the long-term sustainability and impact of support initiatives should be avoided. Do not hesitate to innovate and adapt strategies to meet the evolving needs of students and institutions. Lastly, adequate resources, including funding, staff, and infrastructure, should be ensured to support the initiatives effectively. By following these "do's" and avoiding these "don'ts," initiatives can effectively support low-income, academically talented students in STEM, promoting

their success and bridging the socioeconomic achievement gap. Institutions must address students' well-being and emotional needs alongside academic support to foster a supportive and inclusive learning environment. Longitudinal support is another critical aspect. Institutions should provide sustained support throughout students' academic journeys, from enrollment to graduation and beyond, to ensure consistent progress and achievement. Lastly, underestimating resource needs can undermine the success of support initiatives. Effective support ecosystems require adequate resources, including funding, staff, and infrastructure.

In summary, the lessons learned from the PEARLS and ASSETS projects emphasize the importance of personalized mentoring, comprehensive support, flexibility, and adequate resources. By avoiding a one-size-fits-all approach, addressing socio-emotional needs, providing longitudinal support, and ensuring sufficient resources, higher education institutions can create effective ecosystems of support, increase student retention and graduation rates, and promote equity and inclusion in STEM education. PEARLS and ASSETS have shown that it is crucial for university faculty and administration to take proactive action when providing resources for vulnerable populations. One of the long-term impacts of these initiatives on the broader educational community that has potential policy implications is that universities need to proactively provide coordinated academic, financial, and socioemotional services to at-risk students.

VII. Conclusions

The PEARLS and ASSETS projects have provided mentoring and developed student growth and have created an ecosystem of support that has been effective in assisting low-income academically talented students pursuing degrees in STEM. PEARLS and ASSETS mentors coordinate one-on-one meetings and group meetings with students. These meetings have helped students identify areas of strength and opportunities to achieve their personal, academic, and professional goals. These meetings have allowed the project team to tailor the mentoring interactions based on students' personalities, expectations, and needs. The lessons learned from these initiatives hold promise for scalability and replication across diverse higher education institutions. By addressing the profound challenges faced by underprivileged students amidst environmental crises, the framework presented in this research aims to foster equity and inclusion in higher education. Higher education institutions that serve underprivileged students can adopt this ecosystem of support framework to increase student retention and graduation rates and to promote student success. Future research will focus on assessing the long- term impact of these initiatives on career success, and further education of our participants. Future research will also focus on investigating the challenges and success factors in scaling and replicating our support model in diverse institutional settings, including community colleges.

Acknowledgment

This research was supported by the National Science Foundation under Awards No. 1833869 and 2322189. Any opinions, findings, conclusions, or recommendations expressed in this material are those of the authors and do not necessarily reflect the views of the National Science Foundation.

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