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How NSF S-STEM Scholarships Impact Community College Transfer Decision-Making

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How the S-STEM Scholarship Factors into Students' Decision-Making in STEM Degrees and Careers

ABSTRACT

The purpose of the study is to explore how the S-STEM scholarship factors into community college transfer students' decision- making to pursue a STEM degree, how that shapes their experiences in these demanding fields, and informs their aspirations for STEM careers. Responses from 39 community college transfer students, gathered through in-depth interviews and focus group discussions, reveal that the scholarship provides support in various areas, including academic choices, community and social engagement, and providing motivation and persistence. Additionally, the S-STEM scholarship informs participants' future aspirations by offering personal and professional development, educational and research opportunities, career opportunities and access to resources and informational support. Participants highly value the scholarship's role in shaping their career trajectories in the STEM field and contributing to their academic success.

1. Introduction

The demand for STEM professionals continues to grow in the United States, yet the number of graduates in these fields remains insufficient to meet this need. Community colleges (CCs) serve as a vital entry point for a large number of students pursuing STEM degrees, particularly those from low-income families. However, the pathway from community college to a successful STEM career is fraught with challenges. A significant portion of community college students (about 80 percent) intend to transfer to a four-year institution to complete their degrees. Despite these aspirations, less than half of those who transfer successfully earn a bachelor's degree, with outcomes being even more dire among vulnerable student populations, including low-income students, students of color, and older students. These groups face substantial barriers, such as tuition expenses, work-study-life imbalance, and the need to work overtime, which contribute to higher attrition and dropout rates. While there are some forms of institutional support available, such as the S-STEM scholarship, which provides financial assistance to underprivileged students, there is limited understanding of how this scholarship influences students' decisions to pursue and persist in STEM degrees and careers. This paper aims to address this gap by exploring how the S-STEM scholarship shapes students' educational and social experiences, and ultimately, their success in STEM fields.

This paper is a work in progress, based on the preliminary findings of a study aimed at understanding the impact of a National Science Foundation (NSF) funded S-STEM scholarship program on community college students who have transferred to engineering degrees in a 4-year university. The paper draws on qualitative data from a total of 39 community college transfer students who have received the S-STEM scholarship. The research examines how the scholarship has influenced their decisions to continue their STEM education and how it has impacted their overall academic and social experiences. The findings of this study highlight the significant role of the S-STEM scholarship in enabling students to overcome challenges and persist in their STEM programs. While many participants had already decided to pursue an engineering degree, the scholarship provided crucial support that reinforced their commitment and helped them navigate the difficulties associated with their educational journey. This research offers valuable insights into how targeted institutional support can improve degree completion rates among community college students, contributing to broader discussions on equity and success in STEM education.

2. Literature Review

Student Decision-Making in STEM College Degree and Career

Student decision-making has been a significant area of interdisciplinary focus in research on student pathways. Much of the existing literature has concentrated on the socio-psychological and personal factors influencing students' educational and career choices. Specifically, research on decision-making regarding STEM education and careers has identified several key influences.

Personal interest in STEM, motivation, self-efficacy, the influence of family members, passion, the role of educators, and outcome expectancy are prominent factors that shape students' decisions in pursuing STEM careers [1] – [7]. Interest and passion for a STEM career have been found to be critical predictors of students' enrollment in STEM fields [8], [9]. Personal factors and STEM-related behaviors also play a crucial role in forming self-efficacy, interests, and values, all of which significantly impact students' decision-making in STEM [10], [11]. The influence of educators, peers, and family is equally important in shaping students' beliefs about their proficiency in a STEM career [12], [13]. Parental influence, in particular, has been shown to guide students' career choices and contribute to their self-perceptions and encouragement [14], [15]. Outcome expectancy, or the anticipated financial and career prospects of a field, also significantly informs students' decisions and fosters their interest in pursuing a STEM career [8], [16], [17]. While these factors are well-documented in their influence on students' initial entry into STEM fields, the completion rate for STEM degrees remains considerably lower than the enrollment rate. This gap has resulted in a STEM workforce that does not meet the current demands of the U.S. labor market. Research indicates that the students who are most at risk of dropping out before completing their STEM degrees often come from underrepresented minority groups. The dropout risk is particularly high among community college students, with only 16% of those who transfer earning a bachelor's degree [18]. These findings underscore the importance of addressing not only the factors that influence students' initial decision-making but also the support systems that can enhance persistence and completion in STEM education. The S-STEM scholarship is one such institutional support that could play a crucial role in mitigating these challenges, particularly for students from underrepresented backgrounds. Understanding how these scholarships influence decision-making and career aspirations is essential for contributing to broader discussions on equity and success in STEM education.

Community College in STEM Education

Community colleges are a crucial pathway for students pursuing STEM education in the United States, particularly for those from low-income backgrounds. These institutions provide an affordable entry point into STEM fields due to their lower tuition costs and accessibility. Community colleges play a vital role in expanding the engineering and computer science workforce, as they allow students to save money by attending a local college for the first two years before transferring to a four-year institution [19]. Community colleges can broaden access to STEM fields by including more students from underrepresented groups, such as racially minoritized, low-income, and first-generation students [20], [21], smaller class sizes, flexible scheduling for working students, and proximity to home make community colleges an attractive option for many students.

However, community college transfer students face significant challenges when transitioning to a four-year institution. Despite initial motivation to pursue STEM careers, the financial burden of higher tuition, alongside family responsibilities and potential housing and food insecurity,

creates obstacles that many students find difficult to overcome. Research by Baltaci et al. (2015) highlights the impact of financial barriers, noting that students often need to work to cover costs, which in turn reduces the time they can dedicate to their studies. This is particularly common among non-traditional students, leading to lower retention rates and diminished educational outcomes [22]. These financial and academic challenges contribute to the vulnerability of community college students, particularly those from underrepresented and low-income backgrounds, making them more likely to drop out before completing their degrees. Recent data reveals that fewer than half of community college students who transfer to four-year institutions go on to earn a bachelor's degree, with even poorer outcomes among the most vulnerable populations [23]. The rigorous demands of STEM programs at four-year universities add another layer of difficulty, further exacerbating the dropout rates and contributing to the shortfall of STEM professionals in the U.S.

Tinto's (2010, 2012) work on student retention and success underscores the importance of high expectations, support (academic, social, and financial), assessment and feedback, and involvement or engagement in ensuring college completion [24], [25]. The author emphasizes that students' self-expectations, shaped by institutional standards and challenges, play a critical role in their performance. Academic support, particularly during the first year of college, is essential for helping students adapt and succeed. Additionally, financial support is crucial, especially for underprivileged students, as it directly impacts their ability to persist in their studies. Institutions that provide regular assessment and feedback enable students to make necessary adjustments, enhancing educational outcomes. Moreover, engagement with peers, faculty, and academic communities fosters social and emotional support, which is vital for student success [26]. These principles highlight the need for a holistic approach to education that addresses both academic performance and personal development.

The Role of S-STEM Scholarships in Student Retention and Graduation

Institutional support plays a critical role in helping community college students overcome the challenges they face in pursuing STEM degrees. One such support is the NSF's S-STEM scholarship program, which has proven beneficial in alleviating students' financial burdens. The financial assistance provided by S-STEM scholarships not only addresses students' economic needs but also serves as a powerful motivational tool. Research shows that scholarships can positively influence students' commitment to their educational goals and enhance their persistence in challenging academic environments, such as those found in STEM fields [27]. The sense of financial security afforded by these scholarships allows students to focus more on their studies and engage in extracurricular activities that build career-related competencies. S-STEM scholarships are particularly significant for community college students who transfer to four-year institutions. By alleviating the economic burden associated with higher education, these scholarships enable students to prioritize their studies over work obligations, providing a sense of security and stability that helps them navigate unforeseen economic challenges. Additionally, the

scholarships facilitate deeper engagement with academic interests, creating an enriched educational environment that promotes persistence in STEM disciplines.

Moreover, targeted scholarship programs play a crucial role in supporting underrepresented groups within STEM. Research suggests that scholarships aimed at minorities, women, and low-income individuals can significantly improve retention rates in STEM disciplines by enhancing access and promoting inclusivity [28]. These initiatives contribute to creating diverse and representative STEM fields, which are essential for encouraging creativity and addressing barriers and challenges. The study by Espino & Meza (n. d.) highlights the need of research to understand how the NSF S-STEM program – a 'unique grant funding'- supports community college students as there have been limited studies on the influence of S-STEM programs on student outcomes [29]. So, there remains a significant gap in understanding how institutional support structures, like the S-STEM scholarship program, influence students' decision-making processes, particularly in their persistence in demanding STEM degrees and their pursuit of STEM careers. While the program's interventions and various support services have shown promise in improving student retention, the specific mechanisms by which they achieve these outcomes require further exploration.

3. Research Questions

Q1. In what ways do S-STEM scholarships influence students' decisions to pursue STEM degrees?

Q2. How has participation in S-STEM programs informed students' aspirations?

4. Methodology

Qualitative Method

The study follows a qualitative research design. Its main aim is to understand how the S-STEM scholarship factors into students' decision-making to pursue a STEM degree and supported their decision-making along their career trajectory. Therefore, we collected data through in-depth interviews and focus group discussions to capture students' experiences and perspectives.

Participants

This research is focused on students who have transferred from a community college to four-year university engineering program and enrolled in the S-STEM program. In total, 39 students participated in the study. We interviewed 23 S-STEM scholars and conducted four focus groups with 16 students.

Data collection

The data were collected during the Fall semester of 2023. One of the primary components of the S-STEM program is bi-weekly meetings on Fridays that scholars are encouraged to attend.

S-STEM program leadership encouraged the research to schedule interviews for an off-Friday in which scholars did not have a meeting because scholars are in the habit of coming to campus to meet with advisors on Fridays. The focus groups were scheduled two weeks later on another off-Friday. The research team attended a bi-weekly meeting and explained the project and recruited students to sign up for an interview or focus group slot using a shared Google sheet. S-STEM program leadership also encouraged students to sign-up.

Interviews were approximately thirty minutes and focus group sessions lasted an hour, both using semi-structured interview guides. Individual in-depth interviews were used to gather insights about their personal and educational backgrounds, decisions to major in engineering, their experience of transition from the community college to the university, and how the S-STEM scholarship and activities aid their academic and personal growth. The focus groups were used to examine shared experience and peer influences among students. This was particularly valuable for understanding how students collectively navigate challenges and offer mutual support. To compensate for their time, the participants received a $25 gift card.

Data analysis

The data were recorded with the informed consent of the participants. Audio recordings were transcribed and analyzed using thematic coding and analysis. Data from the interviews serve as the primary focus of analysis in this paper, while insights from the focus groups are used to complement and support the interview findings.

5. Findings

Q1: How the S-STEM Scholarship Shapes Students' Academic and Career Choices

The findings show that the S-STEM scholarship has played a significant role in influencing students' decisions to pursue STEM degrees and persist in the program. While many students were initially inclined to study engineering due to various early interests, the scholarship has helped them overcome barriers related to enrolling in and transitioning to university-level STEM programs. In responding to how the S-STEM scholarship influenced students' choices the following themes emerged: *academic choices and support, community and social engagement, and motivation and persistence.*

Academic Choices and Support

The S-STEM program enabled participants to connect with mentors, alumni and fellow students in the program and help them to make informed academic choices. The support from advisors help them navigate the rigorous structure of the program and find something that is best fit for them according to their academic strength and interest. As a participant (Luna, 22) shared her experience about such academic support she got in the program, "the professor, they help you get

into the program that you want to be. If you think that engineering is very hard, then they will find something in engineering that you love". Similarly, Myra (21, female) emphasized the holistic support provided by the program, which went beyond financial assistance. She noted: "whenever I'm struggling, or I feel like I need someone to talk to, I can go to them and they give me advice." Additionally, the program regularly invites professionals to conduct workshops on various topics. Listening to their experience and learning about their work helps students to choose the right academic path and also affirms when they are on the right track. This is evident in the participant's response, "they bring in multiple speakers. And that actually helped me a lot when deciding, okay, this is what I want to do" (Rasel, 21).

Participants described how the scholarship made it easier to pursue a STEM degree, as the academic support they received throughout the program enabled them to make informed choices. One such support mechanism is the organization of study groups, which serves multiple purposes. One way these study groups help students is by supporting their academic success. Students collaborate to study and solve coursework-related problems. A participant Flora (26, female) shared how the scholarship contributed to her academic success: "it did influence my academic choices. I've joined study groups because of it, so it's helped me academically." Another participant Rasel (21, male) shared the experience of study groups, "We can study together, get knowledge from each other, which is amazing… And a lot of times they're good in also explaining stuff to you". The academic support from study groups have helped students do better in the program, thereby encouraging them to remain engaged in their STEM programs.

Community and Social Support

The community building and social support provided by the S-STEM program to the scholars have been valuable in deciding their continuity and advancement in the STEM program. The organized study groups and meetings not only facilitate academic collaboration but also serve as social gatherings where students can connect, support one another, and share their experiences. These interactions help students navigate challenges and reinforce their commitment to their STEM studies. Harry (25, male) highlighted how the community aspect of the S-STEM program was instrumental in his academic success, stating, "the S-STEM program has enhanced my involvement in the community, and thanks to them… Their motivation has been key to my success". The connection with people in the program allowed them to learn from others' experiences, providing hope and encouragement for their future. As Adams (23, male) stated:

> It reinforced my decision to pursue my degree…They bring in professionals to talk about important things, and it gives you hope. In the end, when you get your degree, you feel like you're going to do something with it. That's why it encourages you.

Similarly, Oliver (22, male) during a focus group discussion expressed, "Being part of this community made me feel less alone". Another participant (Liam, 25, male) echoed similar sentiment by saying, "we support each other, share stories, and learn from past graduates. This

sense of teamwork and shared experience has positively influenced my decision to continue in the program". These findings underscore the importance of the S-STEM community and its positive impact on participants' academic lives. They felt supported by fellow students who share similar aspirations and found solace in a collective environment during challenging times. The communal support and shared learning from alumni and peers were crucial for their perseverance. Overall, the community and social support provided by the S-STEM scholarship play a critical role in helping students navigate their educational journeys, reinforcing their commitment to STEM fields, and fostering a supportive network that enhances their overall experience and success.

Motivation and Persistence

The participants affirmed that the S-STEM scholarship not only offers academic and social support but also significantly enhances their motivation and persistence in the STEM programs. This support fosters a sense of camaraderie and encouragement among participants, which drives their commitment to continue despite challenges. Julie (22, female) highlighted the motivational impact of being surrounded by driven, like-minded peers, "Being surrounded by ambitious, hardworking people who understand the difficulties outside of school has bonded us and encouraged me to push harder". Similarly, Sam (21, male) noted that:

> The S-STEM program has been a crucial push to stay on track. Although I have doubts about my major, the support from S-STEM helps me overcome these doubts by providing backup options and reinforcing my confidence in my abilities.

Financial aid from the scholarship was also cited as a significant motivator. Bella (22, female) explained: "The financial aid was a major factor in my decision to continue pursuing a STEM degree. It provided a sense of security and encouraged me to put more effort into my studies." Conversely, Jack (23, male) admitted that while the scholarship did not influence their initial decision to pursue a STEM degree, it played a motivational role to continue or persevere in the program after he had enrolled: "I was already enrolled in the STEM program before receiving the scholarship. However, the scholarship has motivated me to continue, even though it wasn't a factor in my initial decision." Thus, the findings reflect that this scholarship has provided motivation to many participants in their decisions to pursue the STEM program, and for those who were already in the program, it helped them with their persistence.

Q2: The S-STEM Program's Role in Shaping Students' Aspirations

Findings show that the S-STEM scholarship significantly influenced students' career aspirations by providing robust support in several key areas: *personal and professional development, access to essential information and resources, career guidance, educational and research opportunities.* These themes emerged during the conversations with participants and highlight that the scholarship not only provides financial assistance but also empowers students to pursue a degree and career aligned with their interests.

Professional and Personal Development

In some instances, due to the high expenses associated with education, students often find themselves working in fields unrelated to their passions, only to meet the financial demands of tuition. The scholarship made it possible for the participants to develop professionally in their field, moving from early practical experience to explore more advanced academic interests. For example, Siam (23, male) shared, "… since joining, I was able to switch from being an intern to being an undergraduate researcher in a field that I am interested in". Another participant Levan (21, male) expressed how the scholarship provided him with the opportunity to pursue a subject he is genuinely interested in, which may not have been possible otherwise, "Well, it's what helped me keep going on chemical engineer, something that I've always wanted to do… Otherwise, I would've had to study something different, something else".

The S-STEM scholarship program significantly influenced participants' career aspirations by encouraging self-reflection and personal growth. Julie (22, female) shared how an assignment in the program prompted her to discover her career goals:

> I think it contributed to my aspirations... But by introducing myself, I first have to discover myself. And then, I took the time to realize, "This is what I want to do." And it's all because of an assignment S-STEM gave us out to present in class.

This response highlights how seemingly simple program activities, such as reflective assignments, can have profound impacts on participants' self-awareness and clarity about their professional aspirations. The scholarship has also been identified as a crucial factor influencing students' decisions to pursue a university STEM degree, particularly for those facing challenges in covering tuition expenses. Some might not have been able to pursue a university-level STEM degree, while others would have faced difficulties in managing the costs and working full-time. By creating an environment of self-discovery, the S-STEM program helps students align their educational journey with their long-term career goals.

Access to information and Career Guidance

The S-STEM scholarship program played a pivotal role in connecting participants with diverse opportunities and broadening their awareness of potential career paths. Ray (22, male) mentioned how the program provided valuable information, "They give us a lot of information about internship and how to get them, how to do good in USF." Similarly, Leo (25, male) reflected on how internship notifications expanded his understanding of available career options, "there are some jobs they post where I didn't even know that's a job. Just bringing that exposure and those new titles and stuff like that is nice". This is evident from students' responses that the way S-STEM communicates essential information about their career opportunities have been immensely valuable for them which they may not have received from anywhere else or probably may not have even considered. The improved access to information and resources about STEM

careers has been noteworthy in expanding students' professional horizons by guiding informed decision-making regarding STEM careers.

In addition to providing students with information about internship and career opportunities, which can otherwise be challenging to access without guidance, it also enhances their career prospects. Milan (22, male) appreciated the valuable information and guidance provided by the program regarding internships and academic success: "The S-STEM program offers extensive information about internships and how to excel academically at USF. This support has been instrumental in navigating career opportunities." They also provided participants with structured guidance and equipped them with practical advice to navigate their career paths effectively. Bella (22, female) emphasized the clarity and consistency of the guidance she received,

> Honestly, they put it in the black and white format. This is what you need to do, this is what needs to be done, and it's like a constant reminder in the back of your head, things that you need to accomplish.

Thus, findings highlight how the program provides more than academic support; it also delivers essential career-oriented guidance. By offering insights into networking, internships, certification requirements, and employer interactions, the program ensures that students are well-prepared to transition from academia to professional STEM careers.

Educational and Research Opportunities

The S-STEM scholarship not only provided financial support but also broadened students' access to educational and research opportunities and encouraged them to pursue advanced degrees and explore new academic avenues. For many students, the scholarship helped them realize that pursuing a graduate degree was a viable option, rather than something reserved for the wealthy or out of reach. Dane (26, male) shared, "I don't think I would've thought about a master's even being a possibility straight away, versus going to an industry and then getting a master's". Similarly, Rasel (21, male) also reflected on the importance of the program in making graduate education more accessible:

> Well, they basically told me that there's options to go to grad school, which I thought you have to be rich to go to grad school, but it's not really true… they basically kept me informed about the options that I have to go to grad school, and that's very helpful.

Orson (23, male) shared that, prior to receiving the S-STEM scholarship, he had never been awarded a major scholarship. His involvement in the program led him to shift from internship in a government agency to engaging in academic research. With the additional support from the scholarship, he was able to reduce his work hours from 25 hours per week to just 10 hours, which allowed him to devote more time to his studies and research. He stated, "The S-STEM scholarship has allowed me to focus more on my school because of working fewer hours, but also on my advancement towards a higher degree".

The participants' responses underscore how the scholarship informed them about the possibility of pursuing a master's degree in a field of his interest, rather than one dictated by industry demands. This shift in focus from internships to research, made possible by the S-STEM scholarship, highlights the transformative impact of the financial and academic support that students received, enabling them to explore more advanced academic endeavors. It has informed them about various graduate school options, dispelling the misconception that graduate education is only accessible to those with significant financial resources. Additionally, participants' responses demonstrate how the S-STEM scholarship not only facilitated their academic pursuits but also opened new pathways for personal and professional growth in the future. Overall, the participants' responses reflect how the S-STEM scholarship served as a catalyst, guiding students to explore educational pathways they may not have initially considered and providing the necessary information to make informed decisions about their academic futures.

6. Discussion and Conclusion

This qualitative research provides valuable insights into how the S-STEM scholarship influences students' decisions, not only to pursue a STEM degree but also to persist in their programs and shape their career aspirations. While many students initially chose to study engineering due to early interests, the scholarship has been instrumental in helping them overcome barriers related to enrolling in and transitioning to university-level STEM programs. The findings highlight the scholarship's impact across several key areas: academic choices and support, community and social engagement, motivation and persistence, and access to career opportunities. The findings of this study align with Tinto's model (2010) on student retention and success. He emphasizes the importance of both academic and social integration in students' persistence and completion, and the results of this research show how the S-STEM scholarship plays a critical role in both areas. First, the academic support provided by the scholarship directly corresponds to Tinto's notion that students need strong academic support to succeed in higher education. As many participants noted, the S-STEM scholarship offers not just financial relief but also academic guidance, such as mentorship and access to resources that help students persist in their STEM programs. This is consistent with his assertion that institutions must provide high expectations coupled with academic support, particularly for first-year students who may face the most significant challenges in adapting to college-level coursework. In terms of social integration, the scholarship program's emphasis on community-building through peer networks and engagement with faculty members speaks directly to Tinto's claim that social integration is essential for student retention. The students in this study highlighted the importance of connecting with other S-STEM scholars and faculty members, which provided them with a sense of belonging and social support. This community engagement fostered their emotional and psychological resilience which allows them to overcome challenges and remain committed to their academic goals. Moreover, the scholarship's role in offering career guidance and internships aligns with Tinto's idea that students benefit from institutional feedback and involvement in extracurricular

activities. These opportunities help students assess their progress, set future goals, and make adjustments, all of which contribute to their persistence and success in STEM programs.

Students' perceptions of the value of S-STEM scholarships extend beyond financial assistance. Many students view the scholarship as a recognition of their hard work and potential, which enhances their confidence and reinforces their dedication to their academic and professional journeys. The findings of this study further support the idea students who perceive their scholarships as supportive and validating are more likely to pursue STEM career pathways, highlighting the significant role of psychological and emotional factors in shaping educational decisions [30]. This underscores the broader impact of scholarships on students' professional and civic engagement. Additionally, that financial aid plays a crucial role in enhancing students' continued enrollment, and successful completion of degrees in STEM fields, particularly for low-income populations. The S-STEM scholarship, therefore, serves as a critical tool in improving students' academic outcomes and encouraging their persistence in STEM careers. The S-STEM program extends its impact beyond financial aid, offering personalized academic guidance and emotional support. This multifaceted approach offers a supportive environment, enabling students to stay on track and persist through the challenges of pursuing STEM degrees.

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