BOARD # 474: Years 1 & 2: Investigating the Computer Science as a Career (CSAC) S-STEM Program and Computing Identity Development for Students with Financial Need

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Years 1 & 2: Investigating the Computer Science as a Career (CSAC) S-STEM Program and Computing Identity Development for Students with Financial Need

Introduction

In the past decade, there have been many efforts to diversify the computing field, particularly focused on increasing participation of students with financial need [1], [2], [3]. The National Science Foundation (NSF) Scholarships in Science, Technology, Engineering, and Mathematics (S-STEM) program is one such initiative that is focused on supporting low-income science, technology, engineering, and mathematics (STEM) students in the United States in their pursuit of a STEM degree [1]. As stated by Kar et al [1], it is not enough to provide financial support for students to pursue their degrees, but there must be intentional and targeted program design and support to help students succeed. S-STEM programs have provided opportunities for students with financial need to receive support and develop professionally, academically, and individually in their pursuit of higher education. This research provides additional information on the impacts of S-STEM programs on students with financial need and provides a deeper look into potential areas of improvement in the implementation of S-STEM programs and, more specifically, computing S-STEM programs.

Program Details

The program is an S-STEM Computer Science and Information Systems (CSIS) program held in partnership between three institutions. East Texas A&M University (previously known as Texas A&M University-Commerce) is a public, regional comprehensive university, Collin College and Dallas College are public community colleges, and offer a range of credentials, including certificates, associates, and bachelor's degrees. This program aims to provide 170+ scholarships to students pursuing CSIS degrees who have demonstrated financial need, as defined by each of the participating institutions. In addition to the financial award of the scholarship, the S-STEM program provides co-curricular and professional development activities to promote the computing field and connect students with professionals in their desired fields of study. With these activities and holistic support of the students, the programs aim to positively contribute to the recruitment, retention, and graduation of students from diverse backgrounds, and enhance computing education to implement effective academic and career pathways for CSIS.

Research Project Details

The research project is guided by the following research question: How does participating in an S-STEM program impact students' computing identity? To answer this question, the research team conducted phenomenologically-informed interviews with a semi-structured protocol to ask participants about their educational background, computing identity, guided by Lunn et al's [4] Computing Identity Framework which encompasses multiple components of computing identity, including (1) interest, (2) recognition, (3) competence/performance, and (4) sense of belonging, and their financial need and employment situation. In the first round of data collection, we had five interview participants -- two students from East Texas A&M, two students from Collin College, and one student from Dallas College. All students interviewed thus far were first-generation college students, had earned at least 60 academic course credits by the time of the interview, and worked at some point throughout the calendar-year.

Findings from Year 1 and Year 2

In the first round of preliminary data analysis, the research team further investigated participants' experiences with the S-STEM program and juggling employment, given that all of the students in the sample indicated that they worked in conjunction with their participation in the S-STEM program. In this analysis, an overarching theme emerged in relation to the participants' need to work and their computing identity development.

Participant's Academic and Work Commitments Hindered their Participation in Computing Identity Development Events and Activities

Overall, participants reported that their need to work often conflicted with opportunities for increasing computing competence and opportunities to demonstrate newfound computing knowledge. For example one of the participants who attended Collin College, Noelle, reported that she had difficulty completing the S-STEM program requirements, such as joining and participating in computing organizations on campus, because of her work schedule. In the interview, when asked about her experiences with the S-STEM program, she stated:

> Yeah, I guess one of the more negative experiences [of the S-STEM program] is just trying to find time to get in like the requirements for the scholarship, which is doing club activities, being in a club. Going to all the meetings and things like that it's a little bit hard. Because I work until like 5 or 6:30 sometimes and then I have class, and then I have homework. It's just like hard to find time to fit those in… And it's the thing where like the events, especially club events and things always take place on weekdays or in the morning or in the afternoon kind of like during work hours so it's really hard to get to them… Sometimes I really try to work with my manager and explain to her what I need. And of course they've been really nice about it. Sometimes I try to leave work a little bit early to try to catch those events and then work overtime the next day so that I can catch up on my work hours.

Although Noelle noted that she has a manager that is flexible and tries to work with her schedule and scholarship program requirements, she still found herself leaving work early and working extra hours to make up for the time spent at scholarship programming.

The Barriers to Entry for Computing Related Jobs Impeded Participant's Computing Identity Development

Many of the participants had jobs unrelated to computing, such as food service and working in banking. Participants also noted the importance of computing internships in further developing computing skills and gaining exposure to real-world applications of computing. However, students noted the barrier to entry for such opportunities, and how applying to positions is a time commitment, and that it was better to keep their current jobs for the time being. For example, in his interview, Saleem, one of the interview participants from East Texas A&M, stated:

> One of my professors advised me to get an internship instead of the part-time job because you get more experience like that in my field, but I haven't gotten around to actually applying for the internships as yet…I am increasing my hours, although not too much because I wanted to work on my portfolio before I graduate in December with my thesis…Currently, I am working 25 hours… I really want to improve what I am capable

> of doing. I want to learn more stuff. And you basically get the skill set so I can do what I want to do. With my current job, I learned more about the hardware instead of the software, but there is a way to transfer internally to the software department. But although that is full-time, I can't do that currently. But once I do get close to my graduation date, I'll apply for the internal transfer.

Although Saleem acknowledges that an internship is a valuable opportunity that can help him develop his computing and software skills, he feels as though his current job could transform into an opportunity to demonstrate his computing skills eventually. However, he is unable to work full-time while completing his degree, so he decided to delay applying for a more desirable and applicable computing position until he is finished with his degree requirements. For Saleem, the potential gains from a unit transfer in the next year outweighs the desire to navigate the barrier to entry for an internship position in the computing field, so he will wait for an opportunity to apply his computing knowledge in his role at work.

These findings illuminate an interesting intersection of work and study for S-STEM students. Additionally, it highlighted the difficulties with implementing program activities, which can serve as great experiences for computing identity development, that interfere with working students' schedules. Although all participants in our study so far mentioned the impact of the scholarship and the offered program activities on their experiences in computing, we noted the tension that students faced in juggling their work, school, and life responsibilities. For our study, we found that our participants noted that the S-STEM scholarship was very beneficial financially, but there were not enough funds to eliminate the need to work entirely. To continue, the CSIS program activities created additional time constraints and responsibilities on the participants' schedule. Additionally, we found that multiple of the students in our sample have family caretaking responsibilities that the scholarship funds and wages from their jobs go towards, which further complicates the time conflicts between academic responsibilities (i.e., homework, group projects, and student organizations meetings) and work commitments. In future work, we hope to better understand how the S-STEM program activities, such as student organizations and coding bootcamps, students participated in impacted their computing identity development.

Lessons Learned from Year 1-2

In Years 1 and 2 of the research project, we have noted a few improvements to make in the data collection processes. Although the sample size was small for Spring 2024 data collection, we aim to collect data earlier in the upcoming semesters to ensure ample participation from students before midterm and final exams create time conflicts with scheduling interviews. Additionally, we have modified the interview protocol to create more space and time for participants to explain how program activities have impacted their computing identity development more specifically, and added in additional probing questions to better understand their experiences with the S-STEM program. Finally, the research team hopes to continue data collection in the Spring 2025 semester and pursue follow-up interviews with the five participants from Spring 2024 to ask about their continued involvement in the S-STEM programs, and to better understand how their involvement with the S-STEM programs has impacted their time as undergraduate students and their computing identity development. The research team hopes that this next round of data collection provides ample data to interrogate how each of the three institutions within this S-STEM grant implement the program activities unique to each institution

type (i.e., regional comprehensive university and community college), and how program activities have changed over the past year of the program.

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