

How Low-income SSTEM Students at Broad Access Institutions Leverage Community Cultural Wealth for Computing Identity

Dr. Sarah Rodriguez, Virginia Polytechnic Institute and State University

Sarah L. Rodriguez is an Associate Professor of Engineering Education and an affiliate faculty member with the Higher Education Program at Virginia Tech. Dr. Rodriguez is co-editor of the award-winning book, *Latin* Students in Engineering: An Intentional Focus on a Growing Population* and new book, *Supporting Latinas in Engineering and Computing: A Chicana Feminist Approach*. She received her PhD in Higher Education Leadership and a certificate in Mexican American Studies from The University of Texas at Austin and holds a master's degree with a focus in College Student Personnel from The University of Tennessee. She holds a bachelor's degree in English and Spanish from Texas A&M University-Commerce and was a transfer student from Trinity Valley Community College. She is also a proud Bill and Melinda Gates Millennium Scholars (GMS) Program Alum, born and raised in rural East Texas with family roots in the Rio Grande Valley.

To learn more about her current projects, visit: <https://enge.vt.edu/People/researchfaculty/sarahrodriguez.html>

Antarjot Kaur, Virginia Polytechnic Institute and State University

Antarjot Kaur is currently a Ph.D. student situated in the Engineering Education Department at Virginia Polytechnic Institute and State University. Antarjot has received her B.S. and M.S. in Bioengineering from George Mason University with specialization in Medical Imaging and Devices. Her research interests include broadening participation in engineering, engineering pedagogy, and developing career pathways for engineering students.

Paul Charles Bigby Jr., Virginia Polytechnic Institute and State University

Paul C. Bigby is a graduate student at Virginia Polytechnic Institute and State University pursuing a Ph.D. in Engineering Education, where he serves as a graduate research assistant. Paul also earned his Bachelor's from Virginia Tech in Mechanical Engineering, and Master's degrees from both the University of Michigan and Indiana University. His research interests are in broadening participation in engineering with a systemic or institutional focus.

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Broad access institutions (BAIs) are institutions that accept at least 80% of their applicants. BAIs, often are more inclusive, affordable, and provide a space for equitable outcomes for diverse students [1]. Some examples of BAIs can include community and regional colleges. These institutions represent important access to educational opportunities, particularly for low-income students [2], [3], [4]. The National Science Foundation (NSF) currently partners with colleges to help create scholarship programs serving low-income students known as Scholarships in Science, Technology, Engineering, and Math (S-STEM) programs. These programs are designed to allow low-income students access to financial and structural support for their academic success. Even though there are a growing number of S-STEM programs at BAIs, there is limited research that discusses S-STEM programs at these institutions and their impact on low-income students. As several of these initiatives support low-income students in an era where computing and AI are ubiquitous in many STEM careers, it is important to study these programs and students in the context of computing and research on this combination remains scarce (e.g., [5], [6]). As many of these low-income students do not have financial leverage in their educational journey, it is important to understand the assets students have that they use to succeed. Prior scholarship demonstrates asset-based approaches like community cultural wealth (CCW) support the success of college students with low-income backgrounds (e.g., [7], [8]), yet few studies have focused on how S-STEM students leverage those assets [9], [10], particularly as it relates to computing identity. This study was framed by the following research question: How do low-income S-STEM students at broad access institutions leverage community cultural wealth to shape their computing identities?

Theory:

This study was framed by two theoretical frameworks, including Community Cultural Wealth [8] and Computing Identity [11]. Community cultural wealth is an assets-based and critical approach that highlights the various forms of capital [12] that students leverage in order to be successful (e.g., navigational, linguistic, social, familial, cultural, resistant). Computing Identity Theory refers to how students see themselves in relation to computing, including their interest, sense of belonging, recognition, and competence/performance. Taken together these theoretical frameworks can help explain how low-income students leverage the various forms of capital to shape their computing identities.

Methodology:

This qualitative phenomenological study interviewed S-STEM students (n=24 at three BAIs in a two-interview sequence. Transcendental phenomenology [13] allowed us to investigate the lived experience and gain in-depth descriptions of the phenomenon. We utilized several

trustworthiness strategies including the use of rich descriptions, memoing, and group consensus-building.

Findings

Consistent with our asset based approach, we found that while low-income students did not lean on financial resources to build their computing identities, they did have many other assets which contributed. In the findings, we use the CCW framework to understand the types of assets students are using in order to build their computing identities. From our study, we see students leveraging navigational capital to get access to computing identity development activities. These activities contribute to computing identity through competence and sense of belonging. Our participants described both leveraging existing familial capital and building familial capital for younger family members, which contributed to external and self-recognition of being a computing person. We also see a complex relationship between forms of capital and identity constructs which is not always as simple as one leading to the other. Students describe leveraging these assets to seize opportunities to mold their professional identities and then using those same opportunities and their enhanced computing identities as capital that support themselves and their families.

Leveraging Navigational Capital to Access Identity Shaping Activities

Participants were found to be leveraging navigational capital to work within institutional systems to access resources and activities, understand procedures, and obtain computing internships. Our participant Kristina discusses how the S-STEM program “put nice informational things about networking, careers, Zoom meetings you can join to find out good opportunities.” Essentially, students are able to leverage the program to navigate college-going challenges and to connect with those in the computing field. to be presented with computing identity development activities. Another student, who was planning to transfer from her community college to a local university, told us:

Before I attend[ed] this scholarship, I kind of lack of information ... I don't even know when is the transfer festival... or workshop is going to happen in this place... I never received that information, but after I attending this scholarship, I could get, uh, so [much] information. So, that is a great point. (Sadie)

Having access as low-income students to identity-shaping activities (e.g., coding camps, transfer fairs and other opportunities), allowed students to embody their roles as computer scientists, develop their interests and education paths and build competence/performance.

Creating Familial and Aspirational Capital for the Future and Recognizing themselves

Students also viewed their own computing journeys as possible sites for future familial capital for their family members. A young African-American man majoring in electrical engineering and minoring in computer science, discussed:

I feel like I'm setting an example for my three little sisters that I have, to go to college whenever they go in the future. All my little sisters really want to go to college. My little sister actually wants to go to the Air Force, then go to college after. And my parents feel like me going to college and me doing what I'm doing now is definitely making them feel as if [they] want to do [it] in the future or something that makes them happy. (Craig)

He discusses how he is building familial capital by being the first in his family to navigate the college pathway and how his parents and sisters are looking to him as an example to decide whether and how to go to college. We can also see how developing this capital allows students to recognize themselves as computing people with the potential to lead others to pursue and develop their professional identities.

[Javier] I've... when I... when I had labs and projects and stuff in my computer classes, I would show it off to my family members... the initial response of, like, wait, you did that? And I'm just like, yeah, I did this. it felt so good... them being proud of me also, like, them being amazed at what I can do, and I was just like, this is just the beginning, just imagine what I could do in the future.

Javier goes on to explain that these same family members did not conceive that a person could sit down create complex functions on a computer. This example setting both creates recognition for him and aspirational capital for his family members.

Aspirational and Resistant Capitals interact with Recognition, Interest

Students also discussed how they utilized aspirational and resistant capital for nurturing their computing interests and recognizing themselves as computing people. One first generation student shared:

It's a give-and-take thing. I... these women are empowering me, and so in return, I should be doing something to empower them. A face of a Muslim woman, a hijabi woman, out there, is going to resonate, is going to motivate the young girls of today that feel like, I can't achieve that much, or I can't be out there. ... it's never been done before, so you should do it first thing is such, like, a motivation to me. (Ana)

This resistant capital served as motivation for her, which is closely related to both aspirational capital and the interest construct of computing identity. Some participants saw being low income as an advantage as it developed resourcefulness because they were not in the habit of turning to money to solve problems.

Like, the laptop I have now, if it were to break for some reason, I just can't get a replacement. Um, so it kind of taught me to, like, instead of uh, like, just kind of being very... I guess, reckless with things, being a lot more, like, um, like, if my laptop were to break, I will figure out, like, a way to fix it... I don't have the money, and I know my

parents don't have the money, [to] go out and get a new one. [So] I think that kind... I guess, kind of set up my personality to first focus on fixing the thing before going to replacing it, because I didn't really have that other option. (Jason)

Several participants described how the S-STEM program enabled them to continue their education when they otherwise would not have. Kim told us “I, like, don't have a job right now in any way, so having, like, them pay for my semester, that was, like, a huge thing. I'm like, okay, I can actually continue my degree right now.” Others described how the recognition of receiving the scholarship inspired them to work hard to overcome difficult coursework and take full advantage of the opportunities the scholarship has provided them.

Discussion/Significance:

Our findings demonstrate that low-income S-STEM students at BAIs leverage several forms of CCW to shape their computing identities. While prior work has mainly focused on more selective institutions, this project centering BAIs illuminates the importance of how navigational and familial capital are leveraged towards computing identity competence/performance of low-income S-STEM students who are more likely to attend broad access institutions. We can see that low-income students may not have financial backing, but they do have other assets they leverage towards developing their computing identity. Findings in this study are limited by not fully understanding if assets were brought from the participants home or learned through activities at the institutions. We also can not always determine if resources or activities at their institutions are available to all students or specific to the S-STEM program. This difficulty in differentiation extends to the challenges students experience, which could be attributed to being low-income, to the computing curriculum, or to college-going in general. This study is limited by a relatively small sample size and difficulty differentiating the sources of students' assets and their challenges. The research team also has limited information about how far the students are in their degree path or which courses they have taken. This study highlights several opportunities for further research. We see that the relationship between CCW and computing identity is not always one directional. In some cases, identity building experiences help build forms of capital, and in others existing capital contributes to building computing identities. This warrants future research on the relationship between disciplinary identity and CCW to understand if the influence is bi-directional, cyclical, or some other pattern. In addition, this data was collected over several years which presents opportunities to study the evolution of the program which may provide valuable insights for both launching new programs and sustainment or improvement.

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