A Narrative of the Community Cultural Wealth of a Black Male Engineering Undergraduate Student

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ABSTRACT

Background: Black male students are present but underrepresented in undergraduate engineering programs. They currently make up 2.8% of engineering bachelor's degree earners. Beyond the typical economic framing of underrepresentation in engineering, this lack of diversity is also an issue of social justice and equity that we must address.

Purpose: To address this challenge, we employed an assets-based approach to examine how Barry, a Black male engineering student, acquired and used his Community Cultural Wealth (CCW) to pursue his goal of earning an engineering degree.

Design/Methods: We conducted a single semi-structured interview with Barry. We used Yosso's CCW framework to guide data analysis and retell Barry's story using a narrative approach.

Results: We demonstrated that Barry acquired and used aspirational, familial linguistic, navigational, resistant, and social capital to achieve his goal of earning an engineering degree. We also illustrated the bidirectional and overlapping manifestations of his capital, which gave him the strength and motivation to persist.

Conclusions: Barry's resources helped him become reflective about and enact his CCW. Findings illustrate how the narrative of a Black male engineering student further expands the utility of CCW. As universities seek ways to recruit, retain, and support Black males, assets-based frames provide a perspective to understand how their cultural assets support their educational goals and success and provide a perspective for designing support.

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INTRODUCTION

Despite an ongoing focus on broadening participation in engineering in the United States (US), Black men's representation and degree completion remains critically low (Henderson, Hines et al., 2023). This underrepresentation is well-known and documented. In fact, among engineering undergraduates, only 2.8% of all engineering bachelor's degrees in the US in 2020 (ASEE, 2022) were earned by Black men, compared to their White (41.5%), Latino (8.9%), Asian American (9.48%), and Native American (0.21%) counterparts. However, the US population percentage of men aged 18–24 represented by these groups is 29.18% White, 10.62% Latino, 7.15% Black, 2.5% Asian American, and 0.11% Native American (NSF, 2019).

Further, the trend of limited representation of Black men in engineering has persisted for more than 10 years, with the percentage of Black men earning engineering degrees declining since at least 2013 (ASEE, 2022). The lack of diversity at all segments of the engineering pathway threatens our national well-being (Palmer et al., 2011) and US global competitiveness (Chubin, 2005; Noonan, 2017), but beyond the typical economic framing of underrepresentation, this lack of diversity is also an issue of social justice and equity (Beddoes, 2011). Further, for decades, researchers have pushed the envelope in describing the multiple layers of challenges to the persistence of Black and other underrepresented students in engineering and other science, technology, engineering, and mathematics (STEM). Beyond focusing on deficit-framed orientations that assert that individuals' traits are the source of their failures and that their communities and cultures might be to blame (Harper, 2010; Knight, 2002; McGee, 2020; McGee et al., 2022), researchers have called for more assets-based approaches (Francis & McClary, 2023; Henderson, Junqueira et al., 2023; Henderson et al., 2024).

We employed an assets-based approach, Yosso's (2005) Community Cultural Wealth (CCW) Framework, to understand the experiences of a Black male mechanical engineering student. The CCW framework draws from Critical Race Theory (Delgado & Stefancic, 2023) to demonstrate the need to center cultural attributes as assets that students draw on (Villalpando & Solórzano, 2005; Yosso, 2005). This means focusing on the assets our participant (Barry) possessed to excel despite the structural barriers and obstacles he faced.

The research question guiding this qualitative study is: (a) *How did Barry acquire and use his aspirational, linguistic, navigational, social, familial, resistant, and other forms of capital to earn his engineering degree?*

REVIEW OF LITERATURE

A growing body of literature has sought to investigate barriers and facilitators to the success of Black men along the educational pathway (i.e., K–12 through graduate study; Brooms, 2023; Burt et al., 2020; Collins & Jones Roberson, 2020; J. Henderson et al., 2021; Henderson et al., 2021; Henderson et al., 2022; Holly Jr., 2020; McGee et al., 2022; Sellers et al., 2022; Spencer, 2021; Tolbert Smith, 2002). Though extant literature has linked the lack of representation of Black men in engineering to several challenges, such as isolation, marginalization, and racial bias (Malone & Barabino, 2009; McGee, 2016; McGee & Martin, 2011; Ortiz et al., 2019; Spencer, 2021), hostile educational environments (McGee, 2016; Spencer, 2021), and gendered-antiblackness (Brooms, 2023; Pirtle et al., 2021), this body of research has also galvanized researchers to understand the assets that Black men leverage to succeed in engineering and STEM more broadly (Fries-Britt & White-Lewis, 2020; Henderson, Junqueira et al., 2023; Spencer, 2021).

Several assets-based studies on Black men in engineering use community cultural wealth (Burt & Johnson, 2018; Sellers et al., 2022; Tolbert Smith, 2002) to theoretically frame their work. These studies showed that Black men use their aspirational, navigational, social, familial, resistant, and linguistic capital to succeed in engineering. For example, Black men in engineering are driven by their aspirational capital (Tolbert Smith, 2022), interest in engineering and other STEM disciplines (Collins & Jones Roberson, 2020; Flowers & Banda, 2018; Samuelson & Litzler, 2016; Mobley & Brawner, 2019; Moore et al., 2003; Tolbert Smith, 2022), and self-motivation (Burt et al., 2020) to succeed in engineering.

Of all of the forms of capital discussed in the community cultural wealth framework, familial capital has emerged as an essential factor in the success of students of color in engineering, first-generation college students, as well as Black men (Burt et al., 2019; Fleming et al., 2013; Mobley & Brawner, 2019; Puccia et al., 2021; Sellers et al., 2022; Tolbert Smith, 2002), especially through providing early encouragement and exposure to engineering (Burt & Johnson, 2018; Sellers et al., 2022). For example, Burt and Johnson (2018), in their study of 30 Black men in engineering graduate programs, demonstrated that families helped encourage and support early and lasting STEM interest. Families supported interest by stressing the importance of education and coupling that interest with a passion for learning and proficiency in science and mathematics.

Similarly, Tolbert Smith (2022) highlighted, through focus groups with 13 Black male undergraduate engineering students, the diverse forms of support that Black families provided for Black men along their pre-college through collegiate engineering pathways. Familial capital took the form of, for example, providing Black men with strategies to successfully maneuver through society and school settings and the resistant capital to counteract negative stereotypes through academic success. Notably, these forms of capital were bidirectional; these men learned these skills and used them to support their own success and the success of their peers and extended familial networks.

Sellers and colleagues' (2022) narrative work described the experiences of a single Black male engineering student (Moises). Their work demonstrated that his family instilled navigational, social, resistant, and linguistic capital that guided Moises through what he described as a rough high school environment by providing him with opportunities such as a new higher ranked high school and the opportunity to participate in engineering bridge programs.

Social networks, such as peers (Dickerson & Zephirin, 2017; Fleming et al., 2013; Litzler & Samuelson, 2013) and mentors (Henderson et al., 2021; Revelo & Baber, 2018), have also been highlighted as essential for the success of Black men in engineering and other students of color. Meaningful engagement of peers through student organizations, such as the National Society of Black Engineers, NSBE (Dickson & Zephirin, 2017; Litzler & Samuelson, 2013) and teams (Cross & Paretti, 2015), are integral to forming a sense of belonging and success. Mentors (Burt et al., 2019; Revelo & Baber, 2018; Slack et al., 2024), especially mentors acquired during undergraduate years, remained sources of motivation as Black men navigated both undergraduate and graduate studies (Burt et al., 2019).

Several assets-based studies have demonstrated that Black men in higher education, as well as engineering specifically, employ their resistant capital to cope with educational environments (Brooms, 2023; Burt et al., 2019; Spencer, 2021). For example, Spencer (2021) showed that Black men exhibited resistance by tapping into spirituality, resigning from diversity-focused leadership roles, and putting on demeanors that they felt helped them combat racial hostilities. Brooms (2023), in his study of 16 Black men enrolled at a Hispanic-Serving institution, also found that Black male participants made sense of culture, climate, and institutional environment through challenges, namely feelings of invisibility, isolation, and low institutional expectations for their success. However, they activated their resistant capital and agency by acknowledging their Blackness, leaning into peer relationships, and emphasizing their academic performance as essential to their existence—a means to "prove them wrong" as described in Moore and colleagues' (2003) seminal work describing the lived experiences of Black male engineering students specifically.

The reviewed literature points to a need for more understanding of Black men in engineering undergraduate programs, and disaggregated from other STEM disciplines. Several studies have focused on engineering students but have given little insight into how specific majors might impact students' experiences. This work gleans insight into a student within a mechanical engineering program, our work offers insights that both extend current research and fills a gap in several ways: (a) We focus on the experiences of a student attending a minority-serving institution (i.e., HSI), (b) We re-story the account of a single Black male participant in their final year of undergraduate study to "amass more accounts" of successful examples (Burt, 2020, p. 836); and (c) We focus specifically on a Black male mechanical engineering undergraduate with multinational background characteristics and experiences, which further highlights and refutes that Black men are a monolith (Sellers et al., 2022).

THEORETICAL FRAMEWORK

We used Yosso's (2005) Community Cultural Wealth (CCW) framework to examine how our participant acquired different forms of capital and then used these assets during his undergraduate studies. Community Cultural Wealth extends Bourdieu's notion of social reproduction via various forms of *capital* (Bourdieu, 1986) to move beyond the focus on dominant group values (Yosso, 2005). The CCW framework draws from Critical Race Theory (CRT; Delgado & Steffancic, 2023) to demonstrate the need to understand and articulate cultural attributes as assets that students draw on (Villalpando & Solórzano, 2005; Yosso, 2005). Community Cultural Wealth posits that People of Color bring "cultural wealth" to educational environments (Yosso, 2005). Community Cultural Wealth proposes six distinct types of cultural wealth, namely, aspirational, familial, linguistic, navigational, resistant, and social capital (Table 1). People of color may acquire these forms of capital before, during, within, or outside their educational settings. They use these different forms of capital to navigate documented systematic barriers that impede participation or degree completion.

CAPITAL	DEFINITION
Aspirational	Ability of students to pursue their hopes and dreams even in the face of actual or perceived barriers
Linguistic	Communication skills that students possess in multiple languages and styles
Familial	Intersectionality of familial and cultural knowledge with an emphasis on the creation of community and the well-being of that community
Navigational	The sets of skills that students learn to use to help them maneuver through educational institutions with dominant cultural norms and conditions that put them at risk of doing poorly or dropping out of school
Social	Networks of people and community resources that enable students to achieve their goals
Resistant	The skills and networks students use to challenge inequality

Table 1 Descriptions of Yosso's (2005) Forms of Capital.

In this study, CCW provided a vocabulary for articulating cultural assets that the study participant tapped into to navigate his educational path in engineering. Yosso's CCW framework (2005) also provided a way to expand our understanding beyond traditional, i.e., deficit, notions of student support for academic success; that is, CCW focused our attention on external barriers rather than on ways to support and "fix" students (McGee, 2020; McGee et al., 2022). Using CCW as a perspective further allowed us to explore the myriad ways Barry described and measured his success.

METHODS

To advance our understanding of how a Black male mechanical engineering student accumulated cultural wealth and used assets to prevail in an educational setting, we used Narrative Analysis (Polkinghorne, 1995). The intent of narrative analysis is "to reveal the subjective experience of participants as they interpret the events and conditions of their everyday lives" (Coulter & Smith, 2009, p. 578). Accordingly, as we retold the story of how Barry accumulated cultural wealth throughout his life that propelled him to earn his engineering degree, we specifically explored how one senior mechanical engineering student narrated and made meaning of his engineering experiences while pursuing his bachelor's degree.

As a participant in our larger, ongoing investigation of the successes of men in undergraduate and graduate engineering programs (Henderson et al., 2024), Barry (pseudonym) was invited to participate in this study. A single participant was selected as a good informant (Morse, 1991, p. 127) to understand better the experiences of Black male engineering students. Morse (1991) suggests that a good informant is articulate and reflective, has the knowledge and experience the researcher requires, and is willing to talk to the researcher (p. 127). Barry, the single participant in this study, met these criteria. Furthermore, this design is consistent with recommendations for researchers that use narrative analysis, as it is best used when examining the experiences of a small number of participants (Coulter & Smith, 2009, p. 578).

INSTITUTIONAL CONTEXT

This study was conducted at Amistad University (pseudonym), a large public university located in the Southwest region of the United States. Amistad University (AU) is categorized as a Hispanic-Serving Institution (HSI) with very high research activity (Carnegie Classification of Institutions of Higher Education, 2021). According to the most recent institutional data for 2022, the university had an undergraduate enrollment of around 37,000. Seventy percent of students attended full-time, and 52% of students enrolled were female. The College of Engineering enrolls approximately 4,800 students each academic year, most enrolling in the mechanical engineering program—Barry's academic program. At Amistad University, Black males comprise about 4% of the student population and have a six-year graduation rate of around 52%.

RESEARCH PARTICIPANT

Barry had several attributes that made him not only a "good informant" but also a unique informant. Barry self-identifies as a Black male and was a senior mechanical engineering student in his last semester of study at the time of the interview. We found Barry reflective about his pathway to success, thoughtful about what it meant to be Black and male, and enrolled in an engineering program. During the study, we learned of Barry's multinational upbringing. Though born in the United States, he had spent much of his life abroad. His primary and secondary education occurred in the Middle East, and he started his undergraduate mechanical engineering degree in the United Kingdom (UK). He eventually came back to the United States and enrolled in college due to several personal reasons. Specifically, his mother moved to the city where Amistad University is located, and a cousin studied at the same institution. At age 27, Barry is considered a non-traditional-aged student (average undergraduate age is 21.9). Based on the demographic information provided for Amistad University, it is clear that Barry's educational trajectory departs from the "normative" engineering demographics at the studied institution.

DATA COLLECTION

We collected data via a single, semi-structured interview conducted by the corresponding author, which lasted approximately 90 minutes. Within the interview protocol, we did not mention "community cultural wealth" or "capital" to ensure the participant described his cultural wealth without having our provided terminology as a prompt. We iteratively developed the protocol within our research group. The research team provided feedback on the protocol before conducting the scheduled interview. Specifically, a postdoc and an undergraduate engineering student provided suggestions for improving the clarity and reducing the length of the first iteration of the protocol. The final protocol included 12 questions centered on the participant's lived experience. The protocol was informed by the previously highlighted literature related to community cultural wealth, underrepresentation, broadening participation, and Black males in engineering. The corresponding author conducted the single interview, which was audio recorded and transcribed verbatim via an external transcription service. The participant received a $25 Gift Card at the end of the recorded interview. After writing the first draft of the manuscript, we conducted a member check by sending the manuscript to Barry and asking him to provide feedback, updates, and suggestions for improvement. Barry had no changes that he wanted to make.

DATA ANALYSIS

As the first stage of reliability, the first and third authors reviewed and updated the transcript to eliminate transcription errors (Creswell & Poth, 2018). We used an iterative process that included deductive (Patton, 2002) and inductive processes (Strauss & Corbin, 1998) to code the transcript. First, team members (first and third authors) individually read through the transcript for instances of Barry describing the six forms of capital described in Yosso's (2005) CCW framework as *a priori* codes (e.g., aspirational capital, social capital, etc.).

After deductive coding, we approached the data with open coding methods (Strauss & Corbin, 1998), resulting in the emergence of inductively determined codes. As an additional layer of confirming what we saw in the data, we assembled team meetings (i.e., times of calibration) to interrogate

and discuss findings (Henderson et al., 2022). After each read of the transcript, we discussed our reflections and instances of disagreement until all our codes aligned. We created a matrix in Excel to illustrate our deductive and inductive themes with direct excerpts from the participant's transcript.

Last, we used a narrative approach to re-story Barry's account of the cultural capital he used to complete his undergraduate engineering degree. The nature in which Barry recounted his lived experience took shape in the form of a narrative, and how he told his story illuminated a cultural wealth practice of storytelling. Immersing ourselves in the data to deeply understand the content was our first step in the narrative analysis approach. Next, early work from Polkinghorne (1995) indicated that narrative analysis data comprises actions, events, and occurrences, yet the analysis yields narratives (Polkinghorne, 1995). Barry delivered his narrative in a non-sequential manner, mirroring the fluidity of conversation (Reissman, 2008). We chose to chronologically re-story Barry's accounts, from his early childhood memories to his college years, to provide a comprehensive time-oriented illustration of his capital.

QUALITY

In "handling the data," we first used a professional transcription service to transcribe the audio recording of the interview verbatim. The corresponding author updated the interview transcription (Creswell, 2018; see process reliability in Walther et al., 2013). We also engaged in frequent peer debriefs throughout data analysis and communication of findings (refer to communicative validation in Walther et al., 2013). We were reflexive about how our identities and potential biases might affect interpretations of data (Milner, 2007; see ethical validation in Sochacka et al., 2018). We frequently discussed our similarities and differences with Barry and were careful not to oversimplify his lived experiences or anticipate his responses based on our experiences. Our conversations, as we call them, "times of calibration" (Henderson et al., 2022), were used to help mitigate our influence on the experimental design and data analysis.

LIMITATIONS

We made study design decisions that make this study unique. A limitation in our work was that using a narrative approach meant that we made determinations about what part of Barry's story appeared. We made every effort to select rich, thick descriptions and examples to mitigate this limitation. Also, though we aimed to explore the experiences of a single undergraduate engineering student, caution must be taken against assuming that Barry's experiences represent all Black males in engineering or of other genders or racially minoritized students in engineering. Lastly, we acknowledge the corresponding author's prior relationship with the study participant. The individuals initially met through professional organization involvement at Barry's institution. As such, the research team was careful to use team deliberations to help ensure that findings were grounded in Barry's responses and not a pre-established understanding of the social reality under investigation (Walther et al., 2013) or the team's relationship with the participant.

POSITIONALITY

Secules and colleagues (2021) noted how positionality impacts six fundamental aspects of research (i.e., research topic, epistemology, ontology, methodology, relation to participants, and communication). Accordingly, before and during this study, we considered how our positionalities impacted these study aspects. All three authors identify as Black males and have each earned at least a master's degree in their chosen fields. Two authors hold PhDs, while the other is pursuing a PhD. Two of the authors associated with this work have backgrounds in the social sciences, while one is an engineer. Here, we share additional parts of our identities and positionalities that we judged relevant to this study.

The first author, Marcus, is a Black man from the Midwest pursuing a doctoral degree in Social Work. He has experience as a clinical social worker working with children, youth, and adults in outpatient and inpatient mental health settings. His experiences and views of his cultural identity

and experience as a research assistant shaped how he engaged in this study. In addition, while his race identifies him as an insider with the study participant, he recognizes that, in some respects, he still exists as an outsider. For example, he does not have an educational background in engineering. He led data analysis and team discussions about the data analysis.

The second author, David, identifies as a Black male and is an assistant research professor in the College of Engineering. He holds an undergraduate and graduate degree in History and a doctorate in Higher Education Administration. His work as a university faculty and researcher whose scholarly and service interests center on Black male excellence and his identity as a Black male and college degree holder contribute to his insider status. His two oldest brothers completed engineering degrees and worked in the industry for many years. His insider status provides a relatedness and vested interest in the topic. Though author two started his academic career as an engineering major, this major was never completed, thus giving him outsider status as having a non-engineering academic and professional background. These insider and outsider experiences assisted in analyzing transcripts and in retelling Barry's story. This author co-led manuscript revisions and data analysis discussions.

The third author, Jerrod, initiated this study. He identifies as a Black male and is employed as an engineering professor at the studied institution. He holds undergraduate and graduate degrees in engineering. His research interests include Black and Latino male engineering identity development and their success in engineering. He led data collection, provided project guidance for the first author (a student), and dissemination of results. We used our insider (e.g., author two being a Black male engineer) and outsider statuses (e.g., author one's non-engineering background) and our shared familiarity with being Black men who bring our cultural wealth to navigate our disciplines to respectfully challenge each other's perspectives and interrogate our understandings of Barry's experience. This process kept us closely engaged with these data to ensure that the findings were rooted in the participant's experiences rather than our own (refer to theoretical validation in Walther et al., 2013). Ultimately, assembling a team of insider and outsider perspectives and some shared identities with the participant was a strength of the study.

FINDINGS

Throughout Barry's interview, we saw evidence of how he acquired and used his capital. In re-storying Barry's story, we highlight how he acquired and used his capital. Barry's narrative begins with his experiences in elementary, middle, and high school, and then we transition into his college days at Amistad University. A considerable part of his narrative focuses on how he used his capital. We narrate his experiences by demonstrating how the different forms of capital overlapped, intertwined, and built on one another. His narrative ends at the time of the interview in 2022, a few weeks before his graduation day.

ADOLESCENT YEARS

As we retell Barry's story, we begin during his adolescence. During his reflection and discussions of his story, he shared how his upbringing played a significant role in helping him acquire the various forms of capital that empowered him to pursue and achieve his goal of majoring in and earning an engineering degree. For example, he said, "I grew up with a firm belief in core values from my father, who taught me what it takes to be a better human being first before being a better man or a professional." Barry points to the familial and expressive social capital that his father poured into him with the expectation to "be a better human being." Barry's father also instilled in him the value of education. For example, Barry reflected on a lesson from his father: "he told me that the main thing that you want to know is I want you to be passionate about what you want to do in college. That's the bridge that my dad gave me growing up." Barry described the expressive social capital that his father provided as a bridge.

This illustration demonstrates how Barry's familial capital helped him build bridges from one phase of his life to the next. The value of education that he acquired from his family manifested in his aspirational capital. For example, he said, "I always was determined to get A's only." Barry's aspirational capital also manifested as a future orientation of where the bridges he learned from

his father might take him. For example, he said, "I used to always think about the future. Every time I'm done with something, I'm thinking about the next step." Barry's father also imparted navigation capital to Barry by providing him with learning experiences at his job as a way to see the next steps. For example, Barry mentioned, "I started with going to work with him [father], seeing his day-to-day job and how he provides for us, his family, and his vision for the future." In essence, Barry was learning how to navigate institutions by observing his father.

Barry's expectations about his future as an engineering major were also shaped by his uncle, whom he identified as an engineer. Barry said, "My role model in engineering is actually my uncle, who is a petroleum engineer." The relationship and the forms of capital that he acquired from his uncle also played out in later parts of his story.

People beyond his blood relatives were also instrumental in Barry's capital acquisition. For example, Barry highlighted having a nanny (social capital). He said, "My nanny, who was from the Philippines, was a kindergarten teacher, but also a teacher for people over 60 who have not had any school experience." Likely because of her experience as a teacher, Barry's nanny provided valuable support, ensuring he was prepared for the subsequent phases of his life. For example, he said, "She [nanny] was also my tutor."

Evidence of Barry's linguistic and expressive social capital took the form of what Barry identified as side conversations. These side conversations appeared to be a style of communication that involved discussions that included advice and navigational lessons. For example, Barry described one such conversation:

> Another influence that I had was my dad's friend. He is an aeronautical engineer, and he worked for Tuskegee (pseudonym) Airlines. Every time I used to go to my dad's job on Fridays, I used to have side conversations with him about aeronautical engineering or aerospace engineering, in general, which is my passion.

Engaging in conversations at his father's job provided him with meaningful engagement and opportunities for socialization in engineering and likely impacted his aspirational capital.

IN SCHOOL

Next, we provide examples of how Barry acquired and enacted his capital in educational spaces. Barry shared how a teacher (social capital) inspired him (expressive social capital), which imparted to him navigational capital. He said:

> I remember one of my teachers growing up was like, you know, being an engineer, you've got to work in a company, so you have to have the social skills with your team, and you're going to attend meetings. You're going to work on and develop solutions as an engineer. You need to be a quick thinker and critical thinker. I think that you have all of that. So maybe that's something you want to explore. He was the first person to actually open up my mind about that certain field.

Barry's teacher sowed positive seeds that motivated him to believe in the endless possibilities he could achieve. This reassurance from his teacher contributed to how he would use his capital in the future. His teacher told Barry that he had what it took to become an engineer and gave him something to aspire to become. This conversation with his teacher reminded Barry that he had the characteristics to become an engineer. Barry also reflected on how overhearing his fifth-grade teacher and parents was a source of capital for him.

> What really amazed me was that his comments lined up with my uncle's thoughts whenever they talked. He [the teacher] used to talk with my mom and dad, and he tells them about me. I used to hear those conversations.

These affirming messages served as sources of recognition and validation for Barry's familial, social, and navigational capital. The conversations he overheard helped fuel his confidence and motivation to pursue a career in engineering. He said, "I was like, "That's [engineering is]

something I can consider from now." Barry's social and familial networks boosted his confidence and future engineering trajectory.

Barry also pointed to other sources of his social capital through his experiences with his educational environment and peers. He said,

> We have a celebration, and that's at the end-of-year ceremony where the honor students are celebrated. So, I'm so used to being on the stage every single year. If there is a competition, it's healthy competition with some of my best friends who are also on the same level as me, but I always wanted to be number one and number one only.

His peers seemingly created a culture of what he describes as healthy competition among each other. Barry also attributes his aspirational capital to being "number one" to his familial and social capital. He said:

> I think that's due to the mentorship from my dad, my uncle, and my nanny, too, growing up. They didn't tell me that I needed to be number one, but I felt like I needed to be so I could prove to myself that I was capable enough of overcoming anything from a young age.

In his interview, Barry also described several instances when he took ownership of the direction of his studies. In these instances, we observed his process of both acquiring and using navigational capital. For example, in the following quote, Barry describes a decision he made in high school in the Middle East that set him on the path to becoming an engineer.

> When I grew up, my school, from kindergarten up to middle school, taught us science, but then it branched off to be biology, chemistry, and physics separately. ... Until eighth or ninth grade, that's when I did my all-level exams. Then, I transferred to a high school that was in an American curriculum. There are two branches. You go to the science branch or the business branch. ... It kind of goes into what you want to go to university and what path you wanted to take. If you think about it here, it's more like AP classes. When you approach high school, yes, that's when you make the decision if you want to go to the science branch or you want to go to business. Obviously, the two pathways that I had in mind were just engineering and medical school. Both would align in science, and that's why I chose that.

Selecting between the two branches in high school enabled Barry to learn and practice decision-making and navigational skills that would prove helpful in his engineering success journey as a college student. Barry had aspirational capital, i.e., the hope and dream to become an engineer (or doctor), which enabled him to make this decision confidently. His familial capital also supported his aspirational capital, as he said, "I was fortunate enough that my parents did not force me to get into a certain degree, but it's something that I wanted to do." Barry's upbringing empowered him to enact his aspirational and navigational capital to make informed educational decisions. Barry's familial capital also supported his navigational capital when making decisions about his future career. For example, Barry explained, "If I had any questions in relation to colleges or the application process or anything, I also asked him [his uncle] how his experience was being an engineer." Conversations with his uncle foreshadowed what was to come for Barry in college. For example, he said, "he did tell me that your first year is going to be the year where you discover which discipline you want to go into." These conversations gave him the navigational capital he needed to maneuver his education.

When reflecting on the early years, Barry said, "I was fortunate enough growing up to have all these resources to be a successful student." His reflection points to the value of recognizing one's lived experiences as a resource for success.

COLLEGE YEARS

The experiences of Barry's upbringing (e.g., shadowing his father and early school experiences) helped prepare him for future success at Amistad University (AU). He arrived at AU with cultural

assets that he used to achieve success. Barry's collegiate journey started with challenges that he had to enact his resistant and navigational capital to overcome. As he transitioned to Amistad from a university in another country, he said:

> I got admitted into the College of Engineering directly, but none of my credits that I took in the [other country] were considered. That meant I had to start my journey all over again. The whole transition, transferring credit situation, was the first hurdle, I would say. The second one was the change of systems. Now, because I was in the [country 1], it's two years of my career as a university student, right? The system was different there. First of all, I was not allowed to enroll in classes myself. Everything was set for me. Here in the US, it's all about you and you picking your classes and talking to the advisor, but the whole environment was different, too.

Rather than give up, Barry described how he used his navigational and aspirational capital to get through what he described as his "first hurdle." In an example from Barry's interview, he explained how he leaned on his peers (social capital). He said:

> I was also very dependent on the advisors here on what they do, and they gave me the green light to actually do that, but later on, I realized the best person to actually talk to is a fellow student who actually has been through these courses or someone in the faculty.

Barry learned that for him to navigate the college, he was also successful in getting guidance from students who had been through the process he aspired to go through or faculty who had walked in his shoes. He further explained how he would navigate this part of his journey. Barry stated, "My cousin, Kwasi (pseudonym), was actually a member of NSBE. … He was kind of like my tour guide or my guide to engineering. I'm glad that I had him as a resource." Barry describes his cousin as his "tour guide." Barry's cousin as a tour guide is powerful when we think about the role of a tour guide, which is to teach others about spaces for which they might be more knowledgeable, pointing out the essence of important landmarks or junctures (Stoddard 2022). When asked to explain, Barry further illustrated:

> My game plan for the semester after that, after consulting my cousin and fellow engineering students who are juniors and seniors, typically from my org, NSBE, the National Society of Black Engineers. During study nights, that's where I used to ask them for advice on what I should take.

Through his social capital, Barry learned essential strategies for making decisions about his educational journey. Peer support effectively helped Barry transition and thrive in his educational environment. Barry did not end with only consulting his peers; he concluded by saying, "So, I dropped that course, and after consulting my teacher and everything, he agreed that it was actually a good choice." Barry demonstrated how relying on a few resources (i.e., his peers and professors) benefited his journey.

Barry's collegiate journey also involved failing a course. He said, "it was my second and last attempt at this course." After failing the course, he described how he enacted his resistant capital when he experienced discouragement from a university advisor. Barry said:

> I will never forget that name. Not for the right reasons, but she was one of the advisers that I went to, and she let me down because when I needed someone to actually help me, she actually just degraded me in a way where she was like, "This is it for you? I don't think you're going to get another attempt at it. You probably need to pursue something else."

After all of his navigation toward an engineering degree, Barry came up against opposition that threatened his aspirations. Here is how he resisted. Barry said, "I never stepped in that office again. I just heard that she's not there anymore. I really wanted her to be there because when I graduate—I told her I was going to come back with my degree." Barry decided that speaking up and avoiding that advisor was the best thing he could do to accomplish his goal. To Barry, having his degree in hand was tangible evidence that he had the knowledge and skills to be successful.

Though he had failed a course, Barry's resistant capital was anchored in the belief that he owed it to himself. He said, "I just needed to prove it to myself first before proving to others that I can do it. For me to prove everyone wrong and prove to myself that I can actually do it."

In addition to avoidance, Barry used his social and navigational capital. First, he found a professor that he trusted to discuss his situation. He said:

> I remember talking to Dr. Kingston about my situation because that was my second attempt. I had to perhaps explore different options, going to a different college here at the [the city], or going to a different university or changing my major, right? That was a very devastating moment in my career. I would say that was probably the lowest moment.

Even in sharing his journey, Barry reflected his resistance. He would not give up on his engineering degree, even if it involved attending another university. Barry also demonstrated the power of Dr. Kingston on his journey. He said:

> It was very different than when I came to his office, and he actually gave me hope. Actually, I was very emotional coming to his office because I was lost. I got lost, and I needed someone to guide me because all of us, as human beings, deserve another chance.

Barry talked about the navigational strategy with which he left Dr. Kingston's office; he said, "I went to [local community college], and I took two courses there. I got an A and transferred them here." Even in his pivot, Barry exhibited much resistance and navigational capital. He also exhibited his aspirational capital. He said, "I remember telling Dr. Kingston that I had no intention of leaving engineering. It was my mission to graduate as an engineer." Having such a powerful motivation for his aspirational capital helped fuel his success.

Barry ultimately got the opportunity to retake the course that he had failed at his home institution. He said, "All these attempts later, the light at the end of the tunnel was this."

Barry, exhibiting his spiritual capital, stated when describing getting this opportunity to retake the course that he had failed, "I took that as a message from God as another attempt in pursuing my career." Throughout the interview, Barry gave homage to God, highlighting his belief that his career plan aligned with what God had in store for him. Barry's relationship with God, his spiritual capital, also helped him navigate difficult situations and find meaning in the face of adversity. He summed it up by saying, "God already has a plan for us." While Barry acknowledged that his cultural networks (e.g., social, familial) believed in him, it was also crucial that God also believed in his plan of becoming an engineer. The support from God was valuable in helping Barry recognize that his career plan was in line with what God planned for him.

Last, Barry demonstrated how the opportunity to retake the course also fueled his future aspirations and success. He said, "From then on, I would gladly say, and I am very proud to say that from that semester, which ended with a 4.0 semester, dean's list from then until right now."

LOOKING TO THE FUTURE

Barry described how his experiences continued to influence how he acquired and used his capital. We got glimpses into his future aspirations and how he might use his capital. First, after retaking this course, Barry recounted: "He [Professor at Amistad] called me a week later to tell me that I got the highest score in the class, and he wanted me to TA for the course." Barry's aspirational, resistant, navigational, familial, linguistic, and social capital culminate in his desire to pay it forward. He described it as "Me serving as a mentor to a lot of students now; it's something I always wanted to do." He also expounded on why he used, and looked forward to using, his capital to help others. He said, "Another thing is I always like to seek knowledge, but also provide knowledge to the generation that's coming up because I am a firm believer that knowledge is always passable." Throughout the conversation with Barry, paying it forward through mentorship was a passion that seemed to drive his success in that he was not only earning his degree for himself but also for the community around him (e.g., his peers and his family). He talked about how his capital as a Black engineer will be used someday. He said:

> I think to be successful, we need to show examples, examples of people who actually did it. People who look like you. People who come from the same background. I'm not just saying by showing pictures, no. Having people talk about their success. I would gladly do that when I graduate. Tell people that they have a chance at doing this.

In telling his story, and in our retelling of it, we draw attention to his commitment to not leaving others behind and serving as an example to others. This illustrates the power of ensuring that examples of Black success, such as the case with Barry, are available for others to see, hear, and observe. In this, Barry embodies the powerful bidirectional nature of cultural wealth as he acknowledges his plans to use his success to help impart aspirational and navigational capital to others. In his words, Barry explains, "Again, it will be great for students to have that goal set for themselves, but also have someone that can show them that it's achievable." Considering the cultural assets Barry brought with him to the educational space and seeing how they played out is a testament to the power of capital acquisition in a young Black male's life. By developing and using the forms of capital, he prepared himself for college and became a force for positive influence in his community.

DISCUSSION AND RECOMMENDATIONS

In retelling Barry's story using a narrative analysis approach with CCW as the framework, we shed light on parts of Barry's life that may have been missed using thematic analysis. For example, the critique by researchers (Denton et al., 2020) has been that studies that have employed CCW have been limited in shallow interpretations of the forms of capital or neglecting the overlap of the different types of capitals. Narrative analysis, however, allowed for the exploration of Barry's stories and experiences within context and with depth (Creswell & Poth, 2018) and to not be bound by simply categorizing and naming the frequency or the types of capital that showed up in his life. The narrative analysis approach helped us unveil the intricate interplay between various cultural resources and personal agency in achieving academic success.

In moving the conversation forward using CCW to describe the experiences of Black men in engineering, like recent researchers, we also observed that Barry had multiple forms of capital that were not siloed and that overlapped (Denton et al., 2020; Mobley & Brawner, 2019; Sellers et al., 2022; Yosso, 2005). Through Barry's story, we saw an overlap in familial, social, and spiritual capital and how this overlap fueled Barry's navigational, resistant, and aspirational capital and engineering degree attainment. As is evident from his story, the sources of these forms of capital stem from his upbringing in the United States and abroad and the experiences and people he engaged with throughout his life.

Consistent with previous research, we saw that aspirational capital was essential to Barry's success (Brooms & Davis, 2017; Martin et al., 2013; Tolbert Smith, 2022). We expand current research by not only pointing out the sources of capital (i.e., familial capital) and what Barry's hopes and dreams were, but we also illustrate the internal motivation behind his aspirations. Barry thought of his aspiration as a purpose or mission for his life. This kept him returning to his aspirational capital even in the face of adversity. Barry's parents helped cultivate his engineering interest by providing him with other forms of capital and experiences that he applied to pursue his passion for engineering, though they were not engineers themselves. This is consistent with previous research (Sellers et al., 2022; Tolbert Smith, 2022), demonstrating that parents do not have to be engineers to support students' engineering journeys. Barry had ample engineering examples from his uncle and his dad's friend.

Regarding familial capital, Barry's life allows us to lean into Burt's description of a supportive "village" as an extension of the familial network (Burt et al., 2019; Burt & Johnson, 2018). These fictive kin, who are not related by blood, include mentors, spiritual communities, and friends and extend familial capital into other forms of capital, particularly aspirational and social capital for Black children and adolescents (Burt et al., 2019). Barry's village consisted of his father, uncle, dad's friend, cousin, and even his nanny. Our work aligns with Martin and colleagues' (2020) work, demonstrating that familial networks used expressive actions to support students. Barry's narrative was powerfully driven by the supportive conversations that his uncle, dad, and dad's friend shared with him.

In the cursory CCW analysis, Denton et al. (2020) suggests that linguistic capital is often left out of CCW studies about Black male engineering students. However, we point out that Barry's entire interview illuminates his strong linguistic capital. This was illuminated through elements of his story that Yosso (2005) called out as elements such as memorization, attention to detail, dramatic pauses, comedic time, and vocal tone. Along these lines, at the intersection of Barry's linguistic, aspirational, and social capital, we see what others have described as the bi-directional nature of capital (Tolbert Smith, 2022). Barry has deposited the capital invested in him, added to his skillset his own experiences, and has committed to being an example of success for others. Barry's story exemplifies the importance of pulling others up as he continued to rise above the glass ceiling. For him, this is done by being an example of success and sharing his lessons and experiences. We do not take lightly the responsibility we have been given to extend our reach and to be part of his mission, which starts with sharing his story.

Embedded within Barry's aspirations and belief in self, we also saw how he enacted resistant capital. Barry's actions played out in what others have called "prove them wrong" (Moore et al., 2003). Some 15 years later, we see "prove them wrong" play out as a form of resistance. This is a part of the conversation about the participation of Black men that must be foregrounded and understood more deeply. Understanding the origins of these feelings may enable the design of intentional interventions for faculty, administrators, and students to help alleviate this pressure from students. Similarly, we saw Barry use avoidance as a form of resistant capital to avoid a university staff member. Developing interventions to better train faculty and staff members on indicators of the strategies Black males use to resist inequities such as racism and discrimination and how they can be more inclusive may help enhance the experiences of Black men in engineering.

IMPLICATIONS FOR FUTURE RESEARCH AND PRACTICE

In offering implications for future research and practice, we seek to extend from Barry's story research and practices that might be useful in supporting future students. As educational and societal stakeholders grapple with broadening participation in engineering, specifically around the participation of Black men, this study, using an assets-based framework (CCW) to capture the journey of Barry, is uniquely positioned to amplify implications for research and practices. Our discussion of implications for future research and practice is offered based on the goal of adding to the larger body of knowledge and future methodological approaches to examining Black male participation in engineering broadly and within sub-disciplines. Additionally, by retelling Barry's experiences, we speak directly to engineering educators, current and future students, with hopes of shedding insights into educational settings that can support Black men. Barry's experiences provide the context for considering the next steps for research and practice.

IN RESEARCH

Though our work and recent studies illuminate Black men's experiences in undergraduate engineering programs using assets-based approaches (Sellers et al., 2022; Tolbert Smith, 2022), more work is needed to shed light on the experience of this population. For example, additional studies might include more extensive samples of participants from varying engineering disciplines focusing on using methodologies such as phenomenography. Because Black men are not a monolithic group, additional studies should dive into recruiting participants whose salience or centrality of being Black and male might differ. For example, studies examining the cultural capital enacted by Black men of immigrant origins would further enhance the landscape of what we know about Black men in undergraduate engineering programs.

Future longitudinal studies tracking students over multiple years of their undergraduate experiences might also illuminate the temporal nature of CCW among Black men. Additional studies might also more deeply examine CCW and how Black male engineering students in different institutional contexts (e.g., HBCUs, HSIs) and engineering majors employ their cultural wealth to succeed. In so doing, researchers will better understand how well the CCW framework holds up among this population, and for example, dive deeper into what it means to be a Black

male engineering student at an HSI like Barry. Future research studies should also be designed to continue to elucidate how other minoritized students in mechanical engineering, such as Black women, acquire and use their CCW.

In addition, like other recent studies, we also acknowledge the need for research that includes the perspectives of faculty, staff, administrators, and students' families (Denton et al., 2020; Sellers et al., 2022) in the same study to provide multi-perspectives on how community cultural wealth is transmitted, deployed, and identified. The interplay of the different types of capital was illuminated in this work. Additional research might be specifically designed to explore the overlap of the different types of capital as the study's aim and at the onset of the study.

IMPLICATIONS FOR PRACTICE

Understanding the forms of capital Black male engineering students lean upon for success might inform how educators support them. For example, as an engineering faculty, understanding the importance of social networks—I (the third author) might provide more opportunities for students to meet their peers and encourage this within my class and not count on it to happen randomly (Henderson, Hines et al., 2023). Acknowledging that not all families have the resources and social networks that Barry's family does, I might introduce my students to practicing engineers as a part of the course curriculum to help build their social network. For example, I might explicitly include activities in-class assignments that help engage students' navigational capital, such as a simple activity requiring that they find my office—inviting librarians to come to class to talk about the resources that they have and including subsequent assignments that require students to apply what they learn. As educators, we might develop structures that support students in reflecting on their assets to help strengthen their aspirational, navigational, linguistic, and resistant capital. For Barry, one example was finding a professor he could confide in.

In this study, we saw that peers supported Barry emotionally by imparting navigational capital. Because of the apparent importance of peer support, institutions should develop or enhance peer mentoring as a strategy to help promote academic success. Institutions should ensure institutional support (e.g., budget line items, study, and networking spaces) for interventions and student organizations that help students engage their navigational and social capital (Henderson, Hines et al., 2023; Martin et al., 2020). This strategy has the potential to be impactful since peer support and social capital are generally found to be crucial to student success but are often left for students to seek themselves. In addition, Barry highlighted that having found support from his peers was a meaningful connection to helping him achieve academic success. He also shared his challenges with advisors. Institutions should do more to ensure academic advisors and faculty are trained to support not only Black males but all students. This could be done by providing support for additional advising and mentorship training for faculty and staff. Also, in understanding that there are multiple pathways to obtaining engineering degrees and that students do not always complete their degrees where they started, institutions should make better efforts at creating systems that consider how credits are transferred from one institution to another.

Last, though college students like Barry are adults, institutions might reconsider how we engage family members as stakeholders, especially since researchers have reported the importance of familial capital.

CONCLUSION

This study centers the voice of a Black male mechanical engineering student, Barry, and provides insight into how he acquired and used his capital. In our use of a narrative approach, we do justice to these scholars (Sochacka et al., 2018, p. 371) by illuminating their experiences and disaggregating their voices from other gender, racial, and ethnically minoritized groups (Priddie, 2020). In re-telling Barry's story, we also act as a vessel to advance and extend his advocacy for the advancement of Black men in engineering. Sellers and colleagues (2022) describe the use of research methods with the explicit intent of enacting social change as methodological activism. Through this work, we advocate for increasing the use of the various pathways to engineering for

students of color and hope for continued social and systemic changes in engineering spaces for the next Barry—perhaps a future student who shares not only ethnic identity and gender identity but also multi-national or non-traditional.

Shedding light on the capital that Black men bring into their educational settings will be vital in enhancing the recruitment and retention of Black men in engineering. This work provides insights into supporting Black male engineering students at multiple phases of their lives and perhaps how to design intervention strategies that build upon their assets as emerging engineers. Findings will likely impact this underrepresented group at Amistad University, and implications might be adapted and extended to others as we move the conversation about Black men in engineering from side conversations to the main agenda.

COMPETING INTERESTS

The authors have no competing interests to declare.

AUTHOR CONTRIBUTIONS

All authors approve the author list and this manuscript for submission to *Studies in Engineering Education.* We also agree to be accountable for the study.

a. Marcus D. Brown participated in all aspects of the research process and manuscript preparation process.

b. David Horton, Jr. participated in data analysis, data analysis discussions, and the manuscript preparation process.

c. Jerrod A. Henderson conducted interviews and participated in all aspects of the research process and manuscript preparation process.

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