

RESEARCH ARTICLE

“They are here to support me”: Community cultural wealth assets and precollege experiences of undergraduate Black men in engineering

DeLean Tolbert Smith 

Industrial and Manufacturing Systems
Engineering Department, University of
Michigan—Dearborn, Dearborn,
Michigan, USA

Correspondence

DeLean Tolbert Smith, Industrial and
Manufacturing Systems Engineering
Department, University of Michigan—
Dearborn, 2270 Heinz Prechter
Engineering Complex, 4901 Evergreen
Road, Dearborn, MI 48128, USA.
Email: dtolbert@umich.edu

Abstract

Background: Families and community networks serve as sources of cultural capital and provide resources that aid the development of Black male engineers. Community cultural wealth (CCW) has been leveraged by engineering education scholars to understand and highlight student and community assets available in communities of color. Little is known about the diverse ways that Black families support engineering education pathways.

Purpose: This study characterized the diverse forms of support that Black families and extended family members provided to undergraduate Black men along their precollege engineering pathways.

Method: Thirteen Black undergraduate men majoring in engineering participated in focus groups at two predominantly White institutions in different regions of the United States.

Findings: The findings suggest that Black parents are engaged in the engineering learning and development of Black males, which opposes the deficit framing of Black parental engagement. The data revealed how the forms of capital overlap. A compelling finding is that capital has a bidirectional nature—meaning that participants described instances of receiving and providing capital.

Conclusions: CCW framework provided a lens to explore how Black men were supported by their family networks and how they used capital to maneuver noninclusive engineering environments. The findings substantiate the role of Black parental engagement on engineering education pathways. This work promotes these parental engagement practices as worthy of inclusion in the canons of effective evidence-based parental engagement strategies that encourage engineering learning and participation.

KEYWORDS

Black family, Black men, community cultural wealth, engineering pathways, parental engagement

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1 | INTRODUCTION

Familial support of a child's academic pursuits yields positive impacts on academic achievement. Deficit perspectives of Black families have led to misconceptions about their influence and ability to support and develop science, technology, engineering, and mathematics (STEM) learners and learning in general (Cunningham, 2021; Harry et al., 2005; Kunjufu, 2002). Parent engagement scholarship privileges White middle-class values (Howard, 2020; McGee & Pearman, 2015). Because the impact of Black families' cultural norms, values, and practices has been understudied, they are often not considered evidence-based, impactful, or supportive practices (Cooper, 2009). This, unfortunately, advances deficit narratives about Black families and their influence on their student's academic achievement (Ladson-Billings, 2004; Liu, 2011).

In 2020, men represented 76.9% of earned engineering degrees, while Black men earned just 3.7% of degrees awarded by United States institutions in the same year (American Society for Engineering Education [ASEE], 2021). Understanding how families and communities support Black males' engineering journeys is critical not only to increasing the number of Black men in engineering career pathways but also to advancing our understanding of how to build and support engineering educational pathways for future Black men who will study engineering. Through this research study, I seek to build upon this body of knowledge and contribute a deeper understanding of how Black males are supported, who supports them, and how the men leverage these supports along their engineering pathways.

Asset-based research approaches value, uplift, and dignify Black cultural ways of knowing, doing, and being (Alim et al., 2020; Ladson-Billings, 1995; Moll et al., 1992). This article advances the body of knowledge by providing evidence of community cultural wealth (CCW) in the precollege and family life experiences of undergraduate Black men enrolled in engineering degree programs. Using CCW (Yosso, 2005) as a theoretical framework, this article addresses the following research questions: *What sources of capital nurtured Black male engineers' engineering interests, exploration, and academic achievement? How did they do so?*

2 | REVIEW OF LITERATURE

The first section of the literature review highlights the importance of expanding the research that explores the richly diverse experiences of Black males who have engineering career interests. In the second section, I challenged the use of deficit-based research to understand Black men's experiences in engineering education and bring to front asset-based scholarship that investigated the various expressions of familial and community support for Black men in undergraduate engineering programs.

2.1 | Building a case for understanding the early experiences of Black males with engineering interests

Much of the research on early STEM experiences for Black males has explored elementary and middle school Black youth and their mathematics and science interests (e.g., Berry et al., 2011; Coleman & Davis, 2020; Henderson et al., 2021; Nasir & Shah, 2011). The existing work in this space helped to build a foundation for understanding the impact of Black men's early experiences and provided evidence for the value of precollege mathematics and science programming, role models, asset-based strategies, and academic support and success strategies. For example, Dickerson et al. (2014) argued that Black males have STEM career aspirations that are comparable to those of their White male peers and that Black males ask for more support and opportunities to explore these career paths. Engineering is recently being integrated into K–12 science education, yet the research findings suggest clear similarities in the ways that Black male students engage and are supported along science, mathematics, and engineering trajectories through precollege activities and family support.

Engineering education scholars have documented the experiences of Black and African American engineering students and explored the influence of precollege extracurricular engagement on their engineering knowledge and identity (J. P. Martin et al., 2015; Simmons & Martin, 2011; Simmons et al., 2014; Young et al., 2014). A majority of the research on the influence of family members on Black males' success in engineering has centered on postsecondary students' reflections on their precollege experiences. Strayhorn's (2015) mixed methods investigation sought to identify influential factors and conditions that enable the success of Black men in STEM fields. Findings from the men, who attended predominantly White institutions (PWIs) and historically Black colleges and universities (HBCU), indicated an association between their interest in STEM through activities, such as playing with computers, using social media, visiting a science

museum, and talking about STEM careers with parents/caregivers. Of this group, 55% of the men had at least one parent/guardian in a STEM career. In their interviews, these men also recalled early childhood interest in STEM and described instances of “concerted cultivation”—whereby parents provided access to formal and informal activities that supported their sons’ early STEM interests.

Berhane et al. (2020) sought to analyze the interplay between racial identity and Black undergraduate men’s engineering trajectories. The analysis of these data led to broader conceptualizations of Blackness across the Black subgroups; there were similar reflections on the influence of parents on their academic development. This study emphasized the supportive roles that parents have regardless of their education levels and professional pathways. Scholars have also investigated the origin stories of Black men who have earned advanced degrees in engineering and those who are in the top 4% of their respective classes (Burt & Johnson, 2018; Fries-Britt, 2017; Long & Henderson, 2017; Maton et al., 1998). Burt and Johnson’s (2018) study of 30 Black men in engineering graduate programs applied CCW as a lens to a better understanding of the origins of their early STEM interests. A majority of the participants credited their success and progress in engineering to family members who exposed them to STEM and cultivated early STEM interests. Parents exhibited STEM advocacy by (1) providing their sons with supplementary math and science tasks and by (2) ensuring that their sons were enrolled in gifted programs.

2.2 | Building a case for asset-based research that investigates the various expressions of family and community support of Black undergraduate men in engineering

Black males are often categorized monolithically in even the most well-intentioned deficit-oriented studies (Burt, 2020), which results in incomplete understandings of these men, their experiences, and their journeys. The solutions that emerge from deficit-oriented studies often overlook and minimize institutional barriers and place responsibility on the individual student, his family, and his community for issues like underrepresentation in STEM (May & Chubin, 2003; Samuelson & Litzler, 2016). In addition to misplaced responsibility, deficit perspectives of Black men and their communities advance ineffective solutions that fail to address the underlying reasons behind Black men’s underrepresentation in colleges of engineering, nor do these solutions provide insight into the needed supports that could lead to increased representation (Harper, 2010). Therefore, scholars must redouble their efforts to challenge and redefine narrowed and stereotypical views of Black men to develop solutions that address the systemic issues (Harper, 2010).

Burt (2020) argued that these monolithic deficit perspectives of Black males are interwoven into the fabric of US history and that there must be a more nuanced understanding of Black males, their experiences, their families, and the communities that they represent. The damage of stereotyping begins early in Black men’s precollege education (Burt, 2020; DeCuir & Dixon, 2004; Feagin & Sikes, 1994; Gillborn et al., 2012). Consider the young Black boys who, regardless of family income, are more likely to be labeled as troublemakers, disciplined more severely than their peers, and placed in lower-level courses when they can, in fact, succeed at higher levels if strategies to counteract negative environmental effects are enacted (Noguera, 2003).

Similarly, parent engagement scholarship has overwhelmingly positioned White middle-class values and practices as normative (McGee & Spencer, 2015), and Black parents are often viewed as disengaged, uninvolved, and deficient (Cooper, 2009). Asset-based research studies can illuminate the various expressions of Black life and the assets they provide to Black boys and men in engineering. For example, Black familial support includes early exposure to STEM experiences, academic support, mentorship, and role modeling, family and community encouragement of academic and STEM interests, and teaching racial socialization and pride (Berry et al., 2011; Hughes et al., 2006; McGee & Spencer, 2015; Noguera, 2009). Although there is limited existing scholarship related to Black families in engineering education, mathematics education scholars have documented different ways that Black parents support mathematics education. Latunde and Clark-Louque (2016) demonstrated that Black parents provide learning support and expose their children to out-of-school learning experiences. Cunningham (2021) interviewed and performed in-home family visits with eight families. Her analysis revealed that Black parents supported their children’s mathematical identities using four approaches: pragmatic, aspirational, affirmational, and race-conscious.

2.3 | Purpose

The literature demonstrates that Black families provide critical early support for STEM interests that cultivate later engineering academic success. In some ways, Black parental support of learning differs from traditional definitions of

support, but it is no less impactful. This research study sought to deepen a scholarly understanding of how Black families provide capital and how Black males leverage capital in their engineering education.

3 | THEORETICAL FRAMEWORK

Denton et al. (2020) completed a systematic literature review of 33 documents and identified CCW as an actionable framework that scholars could use to focus on the experiences of STEM students. Yosso (2005), through the development of CCW framework, sought to center the experiences of communities of color as resource-rich. Through this endeavor, she critiqued more classical interpretations of cultural capital that have been built around the experiences of White, male, middle-class norms, values, and practices and identified six forms of capital. See Table 1 for the forms, definitions, and sources of capital.

The six forms of capital that emerged from her studies of cultural norms, values, and practices of communities of color can overlap and build upon one another to form CCW (Yosso, 2005). Although all six forms of CCW described by Yosso (2005) could be applied to an investigation of Black families, this manuscript focuses on the five forms of capital that were strongly associated with the experiences of the participants in this study. Navigational capital is reflected by the inner resources, strategies, skills, and social competencies. Leveraging this form of capital can align with the concept of academic invulnerability and resilience (Ortiz et al., 2019), which enables the students to achieve and maneuver through educational systems (Samuelson & Litzler, 2016) despite the circumstances. Evidence of resistant capital refers can be seen through verbal and nonverbal lessons on opposing oppressive structures. Education has long been an act of resistance for Black people (Anderson, 1988). Some Black students access resistant capital by seeking to dismantle inequitable systems, and others respond by navigating through and succeeding in the system (Samuelson & Litzler, 2016).

Aspirational capital is evidenced by those parents and family members who, even without immediate resources to support this vision, encourage their children to create a vision for future goals that exist beyond their current reality. Black low-income families often encourage their children to set educational goals despite their financial limitations. This has been shown to be a strong factor in some Black men's success in higher education (Strayhorn et al., 2013).

Familial capital refers to “those cultural knowledges nurtured among familia (kin) that carry a sense of community history, memory, and cultural intuition. This form of cultural wealth engages a commitment to community well-being and expands the concept of family to include a broader understanding of kinship” (Yosso, 2005, p. 79). This form of capital and connection to familia can also exist and be experienced through religious practice, sports, student organizations, and community organizations. One of the cultural patterns and practices within the Black community is the notion of fictive kinship. There are extensive kinship ties that create large family networks within Black communities

TABLE 1 Forms of capital identified in the community cultural wealth framework (adapted from Yosso, 2005) and sources of capital (adapted from Denton et al., 2020).

Form of capital	Definition	Sources of capital
Navigational capital	Skills of maneuvering through social institutions not created with communities of color in mind	Peers, student organizations, professional affinity student organizations, faculty, advisors, mentors, cohort programming, precollege teachers and counselors, family, and personal characteristics and support-seeking strategies
Resistant capital	Knowledge and skills fostered through oppositional behavior that challenges inequality	Conversations between parents and children, historically Black institution faculty, mentoring programs, and connecting with peers and affinity groups
Aspirational capital	Ability to maintain hopes and dreams for the future even in the face of real and perceived barriers	Faculty, advisors, mentors, campus affinity organizations/offices, practicing engineers, and family members
Familial capital	Cultural knowledge nurtured among family and fictive kin that carry a sense of community, history, memory, and cultural intuition	Family and extended family, family educational values, faculty, and staff
Social capital	Networks of people and community resources	Positive peer pressure, K–12 teachers, faculty, advisors, mentors, and coaches

(Chatters et al., 1994). The terms “fictive kin,” “fictive kinship,” and “kin” are used interchangeably in this manuscript to refer to extended family networks in Black communities.

Strong familial support and meaningful academic enrichment experiences influence Black men's academic success and identity development (Flowers, 2015; Moore, 2006). Researchers have confirmed the positive effects of parental educational involvement on academic achievement and attainment for African American youth (Dotterer et al., 2014). Regardless of parental education levels, positive parenting strategies that support academic achievement result in higher levels of academic success for the children in the household (McGee & Spencer, 2015). Family members and extended family who spend time reviewing homework and helping students develop mathematics, science, and engineering identities and who teach strategies to navigate and succeed in new environments positively influence the students in academic achievement and social development (Herndon & Hirt, 2004). Black familial practices inculcate youth with engineering identity-building experiences through informal learning (Tolbert Smith et al., 2022).

Social capital refers to peer and other social networks of people and community resources that can provide both instrumental and emotional support to navigate through society's institutions. This can include professional organizations such as the National Society of Black Engineers (NSBE), university minority engineering programs (MEP), or less-structured networks such as neighbors and community organizations (Harley, 2022; Zephirin, 2019). Black men also gain social capital through peer networks and social practices, including joining fraternities, sharing housing, and multigenerational peer mentorship (McGowan & Pérez, 2020). These practices also activate navigational and aspirational forms of capital (Harper, 2013; McGowan & Pérez, 2020). Black male students have reported that supportive teachers, counselors, and mentors provided encouragement and helped them to see STEM careers as viable pathways (Burt & Johnson, 2018; Fries-Britt, 2017; Strayhorn, 2015; Strayhorn et al., 2013).

4 | METHODS

This project emerged from a larger qualitative study that investigated how Black men and middle school-aged Black children experienced engineering and how their families nurtured their precollege engineering attributes (Tolbert, 2017). This manuscript focuses on the data from two focus groups with 13 Black men in engineering undergraduate programs (Allen, 2017). Participants attended two PWI in different regions of the United States. These participants attended top engineering universities in the country. The selected universities, Large Southern Institution (LSI) and Large Midwestern Institution (LMI), offered ABET-accredited engineering degree programs and housed strong engineering program offices that support underrepresented students of color, meaning that they offered similar academic curricula and provided support for minoritized students to succeed in these programs. The LSI is a large PWI located in the southern region of the United States. At this institution, Black men represented less than 5% of undergraduate engineers enrolled at the time the study took place. The LMI is a large PWI located in the midwestern region of the United States. At this institution, Black men represented less than 2% of undergraduate engineers at the time the study took place.

5 | PARTICIPANTS

I recruited Black men who were enrolled in PWIs to participate, using purposive sampling strategies that leveraged relationships with university offices and administrators who had reputations for supporting the success of minoritized undergraduate engineering students. There were 14 survey respondents across both sites, and all but one individual were eligible to participate. Participants were required to have completed a majority (>3/4) of their precollege education (middle school and high school) in the United States. I excluded one respondent because he did not complete the majority of his education in the United States. Of the 13 participants, eight students were enrolled at the LSI and five students were enrolled at the LMI. All the participants were undergraduate engineering students aged 19 or older who self-identified as Black or African American and male, with one person also identifying as Hispanic. Table 2 summarizes the participants' demographic information.

5.1 | Data collection: Focus groups

I gathered rich insights into the participants' various engineering pathways and familial experiences by conducting in-depth student focus groups at the LSI and LMI. The participants' breadth of experiences allowed me to uncover

TABLE 2 Participant demographics for LSI and LMI research sites

Site	Pseudonym	Class	Engineering major	Age	Home region
LSI	Hunter	Senior	Civil	21	Southern
LSI	Howard	First-year	Civil	23	Southern
LSI	McCoy	First-year	Mechanical	19	Southern
LSI	Granville	Senior	Electrical	22	Southern
LSI	Lonnie	Sophomore	Chemical	19	Southern
LSI	Nelson	Junior	Chemical	20	Southern
LSI	Jerry	Sophomore	Mechanical	20	Southern
LSI	Mark	First-year	Software	19	Southern
LMI	George	Junior	Mechanical	21	Northeast
LMI	Walt	Senior	Aeronautical and Astronautical	22	Midwest
LMI	Garrett	Junior	Aeronautical and Astronautical	21	Midwest
LMI	Lewis	Sophomore	Chemical	19	Pacific Western
LMI	Hugh	Junior	Mechanical	21	Southwest

Abbreviations: LMI, Large Midwestern Institution; LSI, Large Southern Institution.

similarities and differences in the ways that they experienced support. Community cultural wealth and the attributes of the Engineer of 2020 (National Academy of Engineering, 2004) informed the design of the semi-structured interview protocol. The protocol also included a modified version of the instrument used in Dotterer's (2007) study investigating the afterschool activities of Black middle-school-aged youth. The discussion that followed the modified instrument provided the data used for this study.

Additionally, the participants were asked to review the engineer of 2020 attributes, reflect on precollege experiences that aligned with those engineering attributes, reflect on their precollege extracurricular activities, and discuss opportunities and challenges they may have experienced because of their ethnicity and gender. The interview and the complete protocols can be found in the supplemental online information, in Appendix A for the former and B and C for the latter. Interviews ranged from one to one and a half hours. The audio recordings were transcribed verbatim. The participants also completed a 12-item recruitment and demographic questionnaire before participating in the focus group.

5.2 | Data analysis

During the data collection, I documented thoughts, observations, interpretations, and questions to gain familiarity with the data (Tuckett, 2005). Initially, I developed the codebook from the forms of community cultural capital. Throughout the process, I made notes of ways that the framework might help interpret incidences and acknowledged potentially new contributions to the CCW framework (Miles & Huberman, 1994). After I coded the data using the forms of capital, I thematically coded the transcripts to allow new categories and codes to emerge. Data analysis was an iterative process, and I reviewed and revised the themes, categories, and codes throughout the analysis.

In the first iteration of the analysis, I segmented the transcripts according to the interview protocol questions and activities; each segment was transcribed and reviewed for accuracy. Then I coded the segmented transcripts and grouped similar codes or incidences to form categories. In the second iteration of the analysis, I reviewed the recordings of the interviews, wrote a narrative for each entire interview, and made notes on emergent themes. In the peer-debriefing process described in Section *Credibility and trustworthiness*, I worked with two colleagues to interpret the meaning of the narratives, the coding, themes, and subcategories until each was sufficiently explained. After the final iteration, the themes (e.g., five forms of capital) were identified as the framework code and the subcategory categorized how the framework code emerged in the excerpt. The final subcategories of parents and family, community, and culture were formed once there were sufficient data to support them. See Table 3 for an example of three analytic outcomes.

TABLE 3 Example analytic process for data excerpts

Participant	Excerpt	Framework code	Subcategory
Walt	But it's definitely the community. It's definitely the support system you have as a child. You always have this mentality, like yes, people surrounding me are doing good things, so I'm going to do, good things. Like I'm going to prove them right, and strive toward that. That definitely was one of my main motivating factors.	Social capital	Community
Hugh	My dad was always trying to help me go on the path toward engineering. I met a lot of mentors during my high school, a lot of people in my neighborhood. Well, the big thing to do in my hometown was to work for [Engineering Company]. My friend on the soccer team, his dad was with engineering at [Engineering Company], so he coached—helped me out like mentoring. The neighbor was down the street worked for [Engineering Company]. That was also a Black family.	Social capital	Family, community
McCoy	My mom has always been the person that sat me down, was like, “You need to do this.” To me it wasn't about trying to be the best or trying to be the best Black kid, it was trying to be as best you could be because there wasn't much expectations. Like my mom did not even graduate high school. When I graduated high school, it was, “Oh snap.” She was crying and all that. When I got to college, I was the first one in my family to go to college. It's like, “Whoa what is this?” So like to me ... it's an ability to adapt.	Familial capital	Family

5.3 | Credibility and trustworthiness

Using the Walther et al. (2013) model for validity in data collections requires that the research process be dynamically designed to “capture the full extent of the social reality studied” (p. 640). To increase the trustworthiness of the research findings, I invited colleagues to peer-debriefing sessions during separate phases of the study (Miles et al., 2020). During the peer-debriefing phases, I worked with two scholars: one scholar investigated K–12 assessment in formal and informal learning settings, and the second scholar investigated engineering learning in informal learning settings with some emphasis on children and parents' interactions. I provided the scholars with the codebook for their review. I also shared my emergent findings with these two colleagues to uncover any bias and to determine if the findings were reasonable. As I reviewed the emergent themes, my peers performed an external check on the research procedures and preliminary findings to provide feedback and redirect as needed. Results from peer debriefing confirmed that analytical approaches and the codebook were appropriate, findings accurately represented the data, and participants could not be easily identified by their experiences and demographic information.

Concerning reliability, I piloted the focus group protocol with a group of Black undergraduate women and graduate men in engineering to avoid sampling from the small target population at the universities included in this study. The pilot of the group protocol helped me to modify the questions for clarity, and I practiced moderating the questions and managing the dialogue of a focus group. I learned that the participants would expect me to join the conversation as an insider.

5.4 | Positionality

Before I present the findings, I acknowledge my standpoint as a Black American Christian woman who holds multiple engineering degrees. As a doctoral student, I was driven to engage in this research because I benefited from a family and community that encouraged strong values related to educational success and upward mobility. I leveraged my own experiences in the design of the focus group in hopes that it would reflect the community conversational culture found in Black beauty salons, barbershops, and after-church fellowship dinners. My positionality also helped me to build rapport as I shared the identity of being a Black engineer in the United States. To mitigate bias, I discussed my research methods with other scholars to ensure that the selected approaches were appropriate for the study aims.

6 | FINDINGS

The analysis resulted in three primary findings. First, the data highlight the influential roles of Black parents, family members, and members of the participants' communities in their engineering learning and development. Second, I observe various ways that forms of capital can overlap. Finally, the data reveal that Black undergraduate men are deeply aware of family and community expectations related to academic achievement and giving back. Excerpts from the interviews have been included to support the findings. The use of elliptical marks (...) reflect omitted material such as repeated, filler, or stammered words. The em dash (—) signifies an interruption or pivot from the previous thought.

6.1 | Navigational capital

Families serve a prominent role in the success of Black men in engineering. Parents and other family members provided strategies that directed the men on how to successfully maneuver through society, specifically in a school setting. By providing these strategies, the families provided support and care for the men as they navigated their educational journeys. One such strategy is to “be selfish” and prioritize one's education above all potential distractions. Such is the case in this exchange with Jerry, a sophomore mechanical engineering student, and his older cousin:

He [older cousin] told me, “Be selfish. Be there for you, and not anyone else. If friends want to go out and party all the time, you do what you got to do to succeed and don't worry about anyone else. Make sure that you get your education.”—Jerry

Jerry's cousin had already earned his engineering degree and wanted to ensure that Jerry did not allow distractions to deter him from completing his college education. The men nodded in agreement as Jerry recounted this discussion.

The men then reflected on a second navigational strategy: “Be the best. Go above and beyond.” This advice explicitly reminds them to oppose the stereotypical expectations of Black men's low performance and aptitude. This type of navigational capital provided the men with a clear strategy for success, that is, to prioritize their own needs and ensure that they focus on achieving their educational goals. Maton et al. (1998) argue that specific parental behaviors lead to positive outcomes in Black men. Specifically, the men's experiences demonstrate that parents and family members provide navigational capital that influences their focus and motivation by (1) expressing interest in their academic success and (2) advising on how the men should practice establishing priorities and developing academic discipline.

Racial socialization is a common cultural strategy found in scholarship and one that parents shared with their sons in this study (Gaylord-Harden et al., 2012). Through intentional conversations, parents conveyed messages about Black cultural values, beliefs, and ideas that were rooted in cultural identity. Mark, a first-year software engineering student, recounted specific racial socialization messaging from his father:

In fact, he'd [dad] preach it whatever chance he got that, number one, you're Black and that number two, you're male. You got to work twice as hard as anybody else because ... someone else that's ... White and at the same skill level as you do, but odds are, they're going to go with this other person. You got to be above and beyond.—Mark

Parents also provided familial and navigational capital by teaching their sons about the impact of systemic racism in America. The examples in this data set aligned most with messages that prepare students for bias. Culturally, the men agreed that they must outperform their White peers. The men in this study were taught how to respond during instances when they would not be given a fair chance at success because of their race. Their parents' guidance also encouraged the men toward agency as they taught their sons about the “ways of the world” and to work “twice as hard” and to “be the best” so that they would have the same opportunities as those who benefit from being White. This advice, which was also modeled by Mark's dad and Jerry's cousin, also served as a form of resistant capital.

6.2 | Resistant capital

The men learned to leverage resistant capital at various points in their lives. Parents taught the men how to curb the impact of potentially harmful stereotypes by living lives that intentionally counter society's negative deficit views of them. Hugh, a junior mechanical engineering student, reflected on how his parents taught him to demonstrate oppositional behavior that would challenge the negative perceptions others had of Black men:

So I have always had that idea from like my father and what not that I always have to be the best at what I do I was the only Black male in my class, I had to kinda be the representative of the entire race and kinda make sure that it is known that Black people are smart and intelligent and can think for themselves, can be leaders It's kinda driven me and my academics, but it's also kind of a setback as well.—Hugh

Hugh's father both provided him with a navigational and resistant strategy and taught him how to oppose the negative stereotypical conceptions of him that are often enforced on Black male students. Hugh chooses to activate navigational and resistant capital and excels in his academics even as he also acknowledges that this responsibility to counter negative stereotypes puts him under immense pressure. Yosso (2005) asserts that resistance can include various forms of oppositional behaviors and that parents of color can provide verbal and nonverbal lessons that instruct “their children to engage in behaviors and maintain attitudes that challenge the status quo” (Yosso, 2005, p. 81).

In addition to the previously discussed navigational and resistant capital that family members imparted when they reinforced academic expectations, discipline, and achievement, the men also discussed the diverse ways that their parents modeled resilience. Hunter, a senior civil engineering major, demonstrates how his mom provided both navigational and resistant capital:

My mom lost her job. Going through that, actually put a lot of characteristics and stripes on me. Always being resilient—I was actually going into the 11th grade and accepted into the IB program, International Baccalaureate Program, and that program is, basically, college on steroids. It's a step above AP. Yeah, going into that, and actually, that's when I really learned time management and things such as that. I learned resilience and perseverance through that whole thing. That has benefited me in college thus far ... knowing not to give up.—Hunter

In this instance, Hunter reflects on the challenges his family faced during high school. He believes that those challenges taught him how to excel academically while learning how to manage work responsibilities and his International Baccalaureate (IB) courses and preparing for college. He developed resilience, and it benefited him in college. Lonnie, a sophomore chemical engineering student, agreed and added, “resilience, that persistence, that kind of drive was instilled from an early age.”

Activating and developing resistant capital acknowledges that they must resist a system of oppression to meet their goals. For Black people in the United States, education has been a form of resistance (Anderson, 1988; Peoples & Foster, 2020). Thus, the participant's choice to succeed and intentionally outperform their peers and defy stereotypes serves as a form of resistance. Walt, a senior aeronautical and astronautical engineering major, reflects on why it is important to succeed so that he can make a case that Black men can also succeed academically, regardless of where they are from:

So for calc 1, I got bodied the first time. I did not do so well. I retook it and I said, “This cannot stop me.” So after that I did really well. I think I got a B+, almost got an A. I just did not want to be a poster child like Black people cannot be smart people. Black people cannot be engineers, scientists, whatever, whatever. I wanted to be, I wanted to make an example ... specifically coming from Chicago, south side of Chicago, where not a lot of Black men make it out of the neighborhoods and stuff like that. I really wanted to make an example so that we can show that we are able to do something and that we are able to be smart as well as other people.—Walt.

Walt's experience aligns with previous scholarship in that he revealed how some Black males demonstrate resolve, internal belief, and a commitment to be an example despite adversity (Moore et al., 2003).

Overall, the men's response to choose to embrace the culture of academic success and work toward it is considered an assertive academic posture and represents a commitment to academic persistence (Moore et al., 2003), and is an extension of familial academic achievement expectations.

6.3 | Aspirational capital

The men represented families with various educational histories and diverse socioeconomic status backgrounds. Some of their parents, who were unfamiliar with the college-going process, were still supportive of their career aspirations and success. The approaches that these parents used to support their children were different from those of college-educated parents or parents who were familiar with college preparation. They were often working multiple jobs with long workdays, which restricted the amount of time they spent at home. Consider Garrett, a junior astronautical and aeronautical engineering major; neither of his parents went to college. Although they had not experienced college education themselves, his parents instilled a sense of purpose in him as they acknowledged his talents and identified engineering as a potential career path. Garrett recalls that his grandmother studied education in college and was able to provide some support as he made his college decisions. His parents and grandmother provided aspirational capital. Garrett reflects on the impact that his family and his community had on his journey:

My parents, they didn't go to college. My grandma did for teaching, but that was decades ago. The help with college was limited just because of experience, but they definitely had the effort there, as well as my city Excelling well at a bad district doesn't give you really good judgment of where you are. That transition and planning for a college was a little ... just hit and miss. I was very blessed to end up in this situation, as well as with engineering. They told me, "You know, you should be an engineer. You're good at science and math and you have analytical skills." Those were the three things that they saw. They were like, "Go into engineering."—Garrett

Walt reflected on the different ways that his divorced parents supported his educational goal as they balanced heavy workloads and limited knowledge of how to access a college education:

I didn't know how to apply for my scholarship My parents weren't really helping me on that because, first, my dad didn't go to college so he really didn't know. He would guide me to like, "Oh, you should do this scholarship or this scholarship."... He didn't really know what other information I needed My mom ... she couldn't really help me out sometimes because she was either working until 8:00 o'clock in the evening, or she was just too tired to actually help me do so. She did give me some good information about scholarships and such, but yeah, that was about it.—Walt

Similarly, McCoy grew up with his mother, who had not graduated from high school. He reflected that his family did not have specific academic goals and just wanted him to be the best. This is a lesson that many of the men expressed learning from their parents. McCoy considered his family an economically poor family, so his motivation to support his family and escape poverty propelled him:

When you look at your parents, cousins, just family members, in general, you say either, "This is what I want" or "This is what I don't want." How you decide on that depends on what your work ethic is, what you want to do with your life. Whether you want to be in the hood or whether you want to get out of the hood, that determines how you hold yourself, I guess.—McCoy

Some of the men had parents who completed college and worked multiple jobs to pay off their student college tuition. Lonnie reflected on how he both learned from and benefited from their experiences and how this motivated him to continue to persist throughout his challenges:

Both my parents had to work two or three jobs to pay [their way] through college. They both graduated from college, but ... I'm lucky enough, fortunate enough that I don't have to do that. Seeing their hard work, their struggle, and how, despite all that was against them, they both being the ... only child of the

family to go to college and graduate, is the motivation, ... That gets me through, you know, my struggle that I'm going through right now.—Lonnie

Despite limitations and challenges, parents provided love, care, and emotional support that motivated the men to persist. The men acknowledged that these sources of aspirational capital were valuable to them. Similarly, Flowers (2015) found that parents provided academic support, and the men in this study reported that their parents provided support that was both academically supportive and pragmatic.

6.4 | Familial capital

Familial capital was most evident in the relationships between the men and their parents. The men reflected on the critical role their parents played in their success. Some parents were intentionally supportive, and other actions served as motivation for the men as they took agency in their success. For example, some parents recognized the potential in their children and enrolled them in programs that aligned with their recognized engineering potential, while other parents observed when their sons were going astray and found ways to motivate them to complete high school and focus. The men attributed their matriculation in engineering to these parents' actions—overall, the parents put their children in situations that allowed them to develop skills aligned with their potential and interests. Hunter reflected on how his mother served as an inspiration and encouraged academic success. This created early expectations within Hunter's extended family for his future college success:

Yeah, I think, I know I can't speak for everyone, but I think mothers, in general, are a big influence in a Black male's life.--My mom dropped out of high school but later got her GED. But to see what she had done without a college degree and still get to the same places as people with college degrees, is very inspiring. I think that, knowing that alone, regardless of the expectations from my family. Everybody already knew I was going to college since middle school. They already expected that because my mom molded me that way. She enforced education.—Hunter

Despite their diverse backgrounds, all the participants commented that there was at least one parent who provided some familial capital and that this positively influenced their engineering career decisions and interests. Hugh reflected on how his father shared cultural-historical knowledge about how Black innovators, and in some ways, some of the STEM-degree-holding parents, provided living examples of this rich history of Black people's contributions to innovation. This is similar to McGee and Pearman's (2015) work, which discusses how parents with STEM degrees actively connected their children with mentors within their networks and how parents served as STEM role models—increasing their sons' social capital.

Granville, an electrical engineering senior, reflected on how his father would often read the quote from Bible scriptures about developing children, and because of his tightly held Christian beliefs, he provided his son with resources to help develop Granville's engineering and mathematics interests. For example, his father helped him with math, created math games, and learned new math material to help Granville in his classes. He attributes his “engineering mind” to his mother's engineering degrees and his ability to apply mathematics to his father's accounting background:

My mom actually graduated from [HBCU] with a mechanical engineering degree. Then went to [Technology University] for her Master's. So I've always had an engineering mind in the house ... He's [dad] very spiritual, so, the scripture, he liked to teach by was, train up the child by the way they should go. And, when they're old, they won't depart from it. His biggest thing with that was, he wanted me to do what I was supposed to be good at. Not what he necessarily wanted me to be good at. He noticed real early that I really liked Legos, I was really good at math. He would like, test me in different situations and kind of gave me a real-world perspective on stuff. We would go through the grocery store, and he would let me try to calculate the price for everything in my head before we got to the counter. I got really good at it. He would be doing it on his calculator and I would always get the number right.—Granville

Throughout this study, the data provide evidence that parents who identify engineering potential and provide engineering opportunities for their children to engage in can positively influence their child's engineering trajectory and

later academic success. Like Granville's father, parents identified their child's skills and then found activities and resources that would help strengthen those skills. In the following excerpt, Lonnie describes how his family introduced him to performing calculations quickly while shopping at the grocery store. Lonnie's parents explicitly provided opportunities to use mathematical skills in everyday life. He acknowledged that this positively influenced his career success:

We'd be looking at all different products. We'd be like, "Which one has the best deal, per ounce, or per gram," or whatever. So trying to reduce costs, kind of playing with the math skills, but also getting an early introduction to finances.—Lonnie

Hugh believes that his military parents molded him to be an engineer. While his parents experienced success in their respective military careers, Hugh recalls that they ensured that they provided Hugh and his siblings with opportunities that they did not experience as children. These various parental supportive practices align with Strayhorn's (2010) research that found that regardless of parents' education levels, consistent school involvement produced higher school achievement among Black high school students. Additionally, the impact of parental support aligns with existing research that found that consistent parental involvement in academic interests yields positive results in students' academic performance and affects their academic trajectories (Burt & Johnson, 2018; Maton et al., 1998; McGee & Spencer, 2015).

Some families have very high educational expectations. Lewis believes that his Nigerian culture has even higher expectations for his academic performance than that of his Black American peers. This is an example of the additional pressure that some men experience along their educational journeys, in addition to societal pressure. Lewis reiterates his feelings that society does not care about his success:

I guess I could say there's just so much pressure on me, on all of us to do well as a Black man in engineering and, more specifically for me, I'm Nigerian and so our culture has even higher standards even aside from society's. Everything I'm doing seems to be analyzed under a microscope by them, by family, by friends and everything, but society could care less where I go.—Lewis

Lewis believes that as a Nigerian, he experiences pressure to be successful within his family and from society. However, the key difference is that his family cares about his success.

These excerpts demonstrate how parents care for their sons with engineering interests. They not only expose their children to engineering as a career but also develop STEM language and knowledge, thus providing them with capital and directly developing their STEM identities and confidence. These findings support McCallum's (2016) research that indicates that Black American families institute and invest in cultures of academic excellence and achievement.

6.5 | Social capital

Parents who were engineers or belonged to communities with access to engineers served as engineering mentors who were able to provide opportunities that contributed to positive engineering self-efficacy (McGee & Spencer, 2015). For example, Hugh's military family lived in a diverse community, which had a few Black families with engineers who worked for the local defense company. While there were no engineers in his home, Hugh shared that his dad worked on airplanes, taught his children about Black inventors during Black History Month, and "was always trying to help [him] go on the engineering path":

Yeah, because I'd heard about NSBE, but I didn't really do any research. I finally decided I liked drawing and went to it. My dad was always talking about Black engineers. For Black history, he's always teaching things like Black inventors and what not. That kinda really inspired me to be an engineer. Yeah, when I went to my first NSBE event, that solidified what I wanted to do, that opened my eyes to a bunch of connections and whatnot.—Hugh

In addition to their knowledge and experiences, parents have vast connections to networks, such as the NSBE, which include potential mentors and role models for their children. In the following excerpt, Hugh describes how his parents leveraged their social network to introduce him to engineering:

Yeah, sure. Well, like I said before, my parents, especially my dad was always trying to help me go on the path towards engineering. I met a lot of mentors during my high school, a lot of people in my neighborhood. Well, the big thing to do in my hometown was to work for [Engineering Company]. My friend on the soccer team, his dad was at [Engineering Company], so he coached ... helped me out like [with] mentoring. The neighbor down the street worked for [Engineering Company]. That was also a Black family.—Hugh

A parent's social network can benefit their children, and in some cases, these individuals either are already extended family or are granted extended family-member status. These networks can also create partnerships that extend beyond the parents' income level and expertise. Hugh's parents introduced him to NSBE, a wide-reaching organization for Black engineers that has members ranging from precollege to career professionals and provides support for students along their engineering pathways (Zephirin, 2019). Individuals in a child's community social network can later become a part of the child's informal support system as they matriculate through their education and later career (Cochran et al., 1993; Zephirin, 2019). Thus, Hugh's parents introduced him to a useful community network that he could rely upon throughout his education.

Garrett received additional support beyond his family members from fictive kin, such as the MEP office at his institution. He attended a 5-week MEP academic boot camp in the summer before his first semester of college. He reflected that “the boot camp really helped solidify a lot of stuff and that saved me, more or less.” The timing and support of that program were providential. Garrett believes that he was blessed to have had that opportunity, given that his family was not able to provide the same level of support during his college selection and preparation process because his parents did not have college degrees. He believes that once he earns his degree, he will be able to provide help to future engineers in his family:

Well, the whole community but specifically my mom and my dad.—Even now, they don't know exactly what I do, but they realize that I'm going through a difficult major. They are here to support me as much as they can, but I think for the future generations in my family I'll be a lot more help for any other family members who want to go into engineering. I can guide them a little bit better.—Garrett

These excerpts highlight how parents introduce professional identities to their children and help them to develop social capital. Being exposed to Black engineers in the workplace, interacting with Black engineers in the neighborhood, and learning about the historical contributions of Black engineers provided access to social capital and helped the participants to value engineering as a career pathway and a gateway to a better future. In addition to parents and community, institutional structures can provide sources of supportive African American and Black-centered communities. For example, the MEP office offered a boot camp to support Garrett, and NSBE provided a precollege engineering community for Hugh. Gaylord-Harden et al. (2012) argue that these types of programs are forms of culturally relevant strategies that Black communities use to empower, foreground, value, include, and support Black youth by affirming positive cultural identity through community support, positive communication, role models, group-centered activities, and peers, in addition to the preparation needed to succeed in engineering programs (Ladson-Billings, 1995).

7 | DISCUSSION

This qualitative study investigated Black familial involvement and contributions to Black males' engineering schooling and learning using Yosso's (2005) CCW framework. I focused the study on data generated from two focus groups of Black men who were pursuing undergraduate engineering degrees and were asked to reflect on their precollege family experiences. Thus, my findings emphasize the influence of the family on the participants' engineering education journeys, with particular emphasis on their parents' supportive practices and forms of CCW that were nurtured by family members.

7.1 | Black parental engagement and support in engineering learning and development

The parents, as perceived and experienced by the men in this study, supported engineering learning and education. Parents provided support by connecting their sons with engineering professionals, providing resources to explore

engineering, reinforcing Black identity and values, encouraging and enforcing academic success and progress, teaching about race, racism, and navigational strategies, and creating opportunities to apply STEM concepts to everyday life. These findings support Cunningham's (2021) research that identified ways that parents emphasized financial literacy and the usefulness of mathematics by creating games and mathematics challenges during grocery shopping trips. Cunningham's (2021) pragmatic approach aligned with familial capital because the men's families introduced them to a culture of using mathematical skills and language to reinforce basic life skills.

Family members often used aspirational approaches to supporting engineering education by encouraging men to pursue STEM careers despite opposition and limitations. For example, Garrett's parents and grandmother were not able to help him with the college preparation process; however, they provided aspirational capital when they affirmed his engineering skills and told him that he should be an engineer. Similarly, McCoy was one of the first in his family to graduate from high school. His family's aspirations for him to graduate from high school despite limitations served as motivation for him. Some families encouraged engineering learning and interest by providing social capital through their networks of engineers and engineering experiences. Affirmational approaches included words of encouragement and advice that provided navigational capital.

The overlap of resistant and navigational forms of capital is apparent when parents communicate values and lessons related to racial socialization and success strategies. Hughes et al. (2006) suggest that there are four themes for parental racial socialization messages—racial pride, preparation for bias, egalitarianism, and promotion of mistrust. In the current study, parents applied strategies related to racial pride and preparation for bias when they taught about the contributions of Black people to engineering and reinforced messages about their need to outperform White peers because of racism. There was evidence in the data that some parents demonstrated egalitarian values, but these values were not at odds with racial pride. There was not enough evidence to explore if parents promote mistrust. However, the available evidence demonstrates that parents provided and encouraged men to leverage resistant capital and oppose negative stereotypes of their academic abilities.

The men recalled first-hand precollege school-based experiences of racism. Noguera (2003) reflects on the hardship that Black males experience in society and their precollege educational performance and believes “it would be more surprising if Black males were doing well academically, in spite of the broad array of difficulties that confront them (p. 433).” This “surprising” outcome is exactly what I observed in this data and what other scholars have found as they investigated the achievement behavior of Black male STEM scholars (Bonner, 2008; Burt et al., 2019; Hrabowski, 1998; Long & Henderson, 2017). Whether barriers be restrictive cultural and familial factors or racist societal stereotypes and systems, Black men in STEM model resolve and choose to succeed in the face of opposition, especially when they are reassured that they belong in learning environments (Holly, 2020). This aligns with the Moore et al. (2003) prove-them-wrong syndrome, which asserts that in the face of adversity Black men chose to take control and assert a strong academic posture, commitment, and confidence to succeed.

Parents also play a major role in development. Students who, even amidst obstacles, were raised in families with “high academic engagement, strictness, nurturance, and community connectedness” are also known to develop and exhibit resolve (Hrabowski, 1998, p. 662). The strategies that the parents and family members gave to the men indicate that they acknowledged how race and racism would help to define their sons' engineering learning experiences. Some parents taught their children about influential Black engineers, and when possible, connected their sons with Black engineer role models and organizations. Additionally, they taught their sons what it means to be Black and male and how to navigate society and educational systems historical rooted in racism. In these ways, parents were committed to their sons' engineering identity formation, racial socialization, racial dignity, and pride (D. B. Martin, 2006; White-Johnson et al., 2010). These findings also suggest that some of the participant's families took responsibility for providing resistant and navigational capital while other men developed this resolve on their own.

7.2 | Contributions to community cultural wealth framework: Black families

Black people and institutions (i.e., churches, schools, and social societies) have been “stabilizing forces” for Black communities and families (Morris, 2004, p. 102). With this in mind, the first contribution of this research is the finding that capital has a bidirectional nature. In addition to benefiting from CCW, the men discussed their responsibility to become a source of capital for others in their families and communities. Second, this work contributes insights into the relationships between various forms of capital as they emerge in Black family and community life. Third, this research leveraged the CCW framework to affirm the role of the entire community in the life of Black men in engineering.

7.2.1 | Bidirectional nature of capital

The most compelling observation is that capital has a bidirectional nature; that is, Black men in this study not only receive and leverage capital but also position themselves to provide capital for others in their families and communities. I observed that when the men's agency was coupled with familial supportive practices (regardless of the type of support), the men were motivated to achieve academically, and in turn, to make themselves assets to their families and communities as they matriculated through engineering education. The men exercised agency when they chose to follow precollege role models or to become the role model needed for others to follow. Foxx (2014) similarly identified that some Black and Latiné engineering students experience the pressure to succeed and be role models (p. 139). So the men both receive resources associated with capital and act as sources of capital. This finding is particularly important because it highlights some of the additional responsibilities and challenges of succeeding as a Black man in engineering. Morris reinforces this nature of cultural capital in Black communities being shared for survival and success (Morris, 2004, p. 81). Further research is needed to understand if this bidirectional nature of capital applies only to Black males in engineering and how it might emerge in other minoritized groups. This has implications for how universities should better support these students during their college education.

7.2.2 | Overlap and intersections between forms of capital

My second contribution to the CCW scholarship is the application of the framework to investigate Black families' in-home/informal learning settings. We sought to identify examples of this overlap in the context of Black family life, specifically those experiences described in the study. In Yosso's (2005) framework, the various forms of capital are dynamic, overlap, and build on one another. Other scholars have addressed the overlaps. For example, Denton et al. (2020) found that aspirational, navigational, and social capital were most frequently described as overlapping with one another. In this study, familial, navigational, and social had the most overlaps with the other forms of capital. Both navigational capital and familial capital informed Mark's and Jerry's commitment to prioritize academics, especially in engineering. The strategy of outperforming White peers is a type of cultural knowledge that the men used to navigate oppressive and racist systems.

Resistant and familial capital overlapped in several instances, specifically in how NSBE and MEP programs helped develop familial capital. For some participants, the peer community and support offered by NSBE and MEP were more social and provided evidence for an overlap between social and navigational capital support. Additionally, the overlap was apparent in how parents modeled resilience through financially challenging times, which taught Hunter and Lonnie persistence, resilience, and time management. Hugh recalls that his parents introduced him to their professional engineering networks, which provided precollege engineering experiences and continued into his college network. This was an example of the overlap between familial capital and social capital. The relationship between aspirational capital and familial capital emerged in some of the participants' aspirations to earn engineering degrees so that they could provide additional capital to family members. The agency that the men in this study demonstrated to persist in engineering despite adversity could serve as an extension of the academic achievement expectations that their families support. This is one example of the intersection between resistant, navigational, and aspirational capital.

7.2.3 | System of community cultural wealth: Multiple capital sources and resources

The findings confirmed that Black family members, cultural influences and expectations, and social networks served as sources of capital and created a system of CCW. When any source was unable to provide capital, another served as a supplemental provider of capital. At different times and in different ways, the participants and their family members had to access resources in this system of CCW by exercising agency. Bonner (2008) affirms a well-understood concept of the African American community—that the family is the unifying force. The “it takes a village to raise a child” mindset integrates the broader community into the family (e.g., fictive kinship). This means that everyone in the community can play a role in the development of each child. Latunde and Clark-Louque (2016) defend that “Black families contribute to their children's learning in many ways, not only in the school, but also in the broader learning system that includes home and community (p. 78).”

8 | IMPLICATIONS FOR PRACTICE AND POLICY

The development of a more comprehensive understanding of these impactful familial practices has great potential to extend familial supportive practices to institutional settings. The following sections provide insight for family, professional STEM community and organizations, MEP offices and institutions, policymakers, and scholars.

8.1 | Implications for family and fictive kin

Families should continue to encourage academic success and support their children's engineering interests by providing whatever resources are available. Parents should leverage their social and professional networks and connect their children with STEM professionals. These connections can forge long-lasting supportive relationships that can positively impact their children's aspirations and academic success. The men benefited from parents and family members holding the men accountable for exercising academic discipline in high school, joining engineering clubs, and introducing them to potential Black mentors in the field. Parents should continue to express interest in their sons' academic performance and probe when/if they notice negative changes in their study habits and grades. It is important to develop a family culture that invests in Black males' engineering and academic interests and encourages them along their engineering pathways.

MEP offices provide on-campus and from-home access to familial capital for minoritized students who are attending college. For some students, the MEP office provides social and navigational capital that is critical to their educational success. However, for other students, the MEP office and staff become fictive kin. The level of support, encouragement, accountability, and access to a network is on par with the level of impact as a supportive family. The students in this study expressed valuing the support of their immediate family but lamented that their immediate family did not understand how challenging earning an engineering degree could be. MEP offices are designed to support engineering students through graduation and provide the much-needed on-campus familial capital. Universities should ensure that MEP offices are financially supported and adequately staffed.

8.2 | Implications for NSBE

At least one participant participated in NSBE before college and benefitted from being connected to a community that provided him with memorable engineering experiences, professional mentors, and a community to connect to in college. NSBE is uniquely positioned to nurture social capital, navigational capital, and familial capital because the organization offers K-12, collegiate, and career programs. An exploration of how NSBE nurtures various forms of capital could bolster programming that continues to support its members in strategic ways, especially in this postpandemic era.

8.3 | Implications for policymakers

Engineering educators, researchers, policymakers, and parents are eagerly looking for solutions that address the challenge of inequitable education along engineering pathways in the United States. Valuing the impactful role of Black parents and the community on Black students' achievement, policymakers along with Black men, families, and communities should co-develop policy that addresses obstacles and barriers that increase the challenges faced by Black males who want to pursue engineering career pathways. In considering the complex sociotechnical tasks of the future and the aforementioned educational challenges, Black male students must be well equipped for future academic and career success. We must oppose pervasive deficit-oriented narratives to understand these students' actual experiences and to co-develop strategies with students, parents, and communities that support their success.

8.4 | Implications for scholars

Researchers must understand these students' experiences and further explore what works. We must rethink our approach to research related to communities of color. In addition to their engineering expertise and interest, Black men

bring unique perspectives and capital to the classroom and engineering teams. Researchers should seek to understand and describe the impact Black men have on the engineering discipline and find ways to communicate this impact to educational communities, families, industry, and policymakers. This could include more research studies designed with communities of Black families and students, gaining their input on what types of experiences, practices, and ways of being are most influential to engineering learning.

9 | LIMITATIONS

The focus group has advantages, including researcher–participant interaction, opportunities for direct observations related to body language, and the rich data generated from this open response format. A limitation of the focus group method is that some focus group members can be hesitant to talk. I served as moderator, and while I ensured that more vocal participants did not dominate the interview, there were men in the focus group whose contributions occurred far less frequently than others did. As I combed through the data, I felt that their voices and experiences were missing and yearned to read and analyze more of their experiences. I simply have no way of knowing what could be missing from this study.

Concerning the participant selection, I chose to select one institution type—large, predominately White institutions. At the time of the study, I had not developed the types of relationships needed to facilitate research at an HBCU. Including the experiences of Black men enrolled in engineering programs at HBCUs may have allowed me (1) to refine or extend an understanding of family/fictive kin, (2) to explore the differences and similarities in precollege experiences of Black men enrolled in these two different types of universities, and (3) to advance research on students in HBCUs and provide useful implications for practice beyond PWIs.

10 | CONCLUSIONS

CCW has been leveraged by engineering education scholars to understand and highlight student and community assets. This framework provided a lens to explore how Black men were supported by their family networks and how they used capital to maneuver noninclusive engineering environments. This study challenges the deficit framing of Black families and their engagement in education by providing evidence of the ways that Black families support STEM education, learning, and development. While these findings highlight these familial assets, I caution against using these findings to make broad generalizations about all of Black American family life. As scholars consider extending CCW to explore other characteristics of Black life and the educational achievement of Black students, they should critically reflect on why Black students and their families enact specific strategies. This study contributes to existing research by deepening our understanding of the bidirectional nature of capital, exploring the overlaps of forms of capital, and highlighting the ways that members of the Black community support engineering education. I present these familial practices as worthy of inclusion in the canons of effective evidence-based parental engagement strategies that encourage engineering learning and participation.

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ORCID

DeLean Tolbert Smith  <https://orcid.org/0000-0003-3729-1772>

REFERENCES

- Alim, H. S., Paris, D., & Wong, C. P. (2020). Cultural sustaining pedagogy: A critical framework for centering communities. In N. S. Nasir, C. D. Lee, R. P. Pea, & M. McKinney de Royston (Eds.), *Handbook of cultural foundations of learning* (pp. 261–276). Routledge.
- Allen, M. (Ed.). (2017). *The Sage encyclopedia of communication research methods*. SAGE. <https://doi.org/10.4135/9781483381411>

- American Society for Engineering Education. (2021). *Profiles of engineering and engineering technology*. Washington, DC. <https://ira.asee.org/wp-content/uploads/2021/11/Total-by-the-Number-2020.pdf>
- Anderson, J. (1988). *The education of Blacks in the South, 1860–1935*. University of North Carolina Press. http://www.jstor.org/stable/10.5149/9780807898888_anderson
- Berhane, B., Secules, S., & Onuma, F. (2020). Learning while Black: Identity formation and experience for five Black men who transferred into engineering undergraduate programs. *Journal of Women and Minorities in Science and Engineering*, 26(2), 93–124. <https://doi.org/10.1615/JWomenMinorScienEng.2020024994>
- Berry, R. Q., III, Thunder, K., & McClain, O. L. (2011). Counter narratives: Examining the mathematics and racial identities of Black boys who are successful with school mathematics. *Journal of African-American Males in Education*, 2(1), 10–23.
- Bonner, F. A., II. (2008). Capitalizing on leadership capacity: Gifted African American males in high school. *Roeper Review*, 30(2), 93–104. <https://doi.org/10.1080/02783190801954965>
- Burt, B. A. (2020). Demystifying the monolithic Black male mystique: Advancing a research agenda on Black men in engineering graduate programs. In P. Felder, M. Barker, & M. Gasman (Eds.), *SANKOFA: Exploring the racial and cultural implications for doctoral education from the African American perspective* (pp. 91–110). SUNY Press.
- Burt, B. A., & Johnson, J. T. (2018). Origins of early STEM interest for Black male graduate students in engineering: A community cultural wealth perspective. *School Science and Mathematics*, 118(6), 257–270. <https://doi.org/10.1111/ssm.12294>
- Burt, B. A., Williams, K. L., & Palmer, G. J. (2019). It takes a village: The role of emic and etic adaptive strengths in the persistence of Black men in engineering graduate programs. *American Educational Research Journal*, 56(1), 39–74.
- Chatters, L. M., Taylor, R. J., & Jayakody, R. (1994). Fictive kinship relations in Black extended families. *Journal of Comparative Family Studies*, 25(3), 297–312. <https://www.jstor.org/stable/41602341>
- Cochran, M., Larner, M., Riley, D., Gunnarsson, L., & Henderson, C. R., Jr. (1993). *Extending families: The social networks of parents and their children*. Cambridge University Press.
- Coleman, S. T., & Davis, J. (2020). Using asset-based pedagogy to facilitate STEM learning, engagement, and motivation for Black middle school boys. *Journal of African American Males in Education*, 11(2), 76–94.
- Cooper, C. W. (2009). Parent involvement, African American mothers, and the politics of educational care. *Equity & Excellence in Education*, 42(4), 379–394. <https://doi.org/10.1080/10665680903228389>
- Cunningham, J. (2021). “We made math!”: Black parents as a guide for supporting Black children's mathematical identities. *Journal of Urban Mathematics Education*, 14(1), 24–44. <https://doi.org/10.21423/jume-v14i1a414>
- DeCuir, J. T., & Dixon, A. D. (2004). “So when it comes out, they aren't that surprised that it is there”: Using critical race theory as a tool of analysis of race and racism in education. *Educational Researcher*, 33(5), 26–31. <https://doi.org/10.3102/0013189X033005026>
- Denton, M., Borrego, M., & Boklage, A. (2020). Community cultural wealth in science, technology, engineering, and mathematics education: A systematic review. *Journal of Engineering Education*, 109(3), 556–580. <https://doi.org/10.1002/jee.20322>
- Dickerson, D. L., Eckhoff, A., Stewart, C. O., Chappell, S., & Hathcock, S. (2014). The examination of a pullout STEM program for urban upper elementary students. *Research in Science Education*, 44(3), 483–506. <https://doi.org/10.1007/s11165-013-9387-5>
- Dotterer, A. M. (2007). Implications of out-of-school activities for school engagement in African American adolescents. *Journal of Youth and Adolescence*, 36(4), 391–402. <https://doi.org/10.1007/s10964-006-9161-3>
- Dotterer, A. M., Lowe, K., & McHale, S. M. (2014). Academic growth trajectories and family relationships among African American youth. *Journal of Research on Adolescence*, 24(4), 734–747. <https://doi.org/10.1111/jora.12080>
- Feagin, J. R., & Sikes, M. P. (1994). *Living with racism: The Black middle-class experience*. Beacon Press.
- Flowers, A. M., III. (2015). The family factor: The establishment of positive academic identity for Black males engineering majors. *Western Journal of Black Studies*, 38(1), 64–74.
- Foxx, K. A. (2014). *A cultural wealth perspective on success and persistence in engineering for Black and Latino students: Exploring interactions with faculty and other institutional agents* [Doctoral dissertation, University of North Carolina—Charlotte]. <https://repository.charlotte.edu/islandora/object/etd:1700>
- Fries-Britt, S. (2017). It takes more than academic preparation: A nuanced look at Black male success in STEM. *Journal of African American Males in Education*, 8(1), 6–22.
- Gaylord-Harden, N. K., Burrow, A. L., & Cunningham, J. A. (2012). A cultural-asset framework for investigating successful adaptation to stress in African American youth. *Child Development Perspectives*, 6(3), 264–271. <https://doi.org/10.1111/j.1750-8606.2012.00236.x>
- Gillborn, D., Rollock, N., Vincent, C., & Ball, S. J. (2012). ‘You got a pass, so what more do you want?’: Race, class and gender intersections in the educational experiences of the Black middle class. *Race Ethnicity and Education*, 15(1), 121–139. <https://doi.org/10.1080/13613324.2012.638869>
- Harley, R. (2022). *Black beyond measure: An antideficit exploration of cultural capital within a National Society of Black Engineers (NSBE) chapter at a predominately White institution (PWI)* [Doctoral dissertation, University of San Diego]. <https://digital.sandiego.edu/dissertations/931>
- Harper, S. R. (2010). An anti-deficit achievement framework for research on students of color in STEM. *New Directions for Institutional Research*, 2010(148), 264–271. <https://doi.org/10.1002/ir.362>
- Harper, S. R. (2013). Am I my brother's teacher?: Black undergraduates, racial socialization, and peer pedagogies in predominantly White postsecondary contexts. *Review of Research in Higher Education*, 37(1), 183–211. <https://doi.org/10.3102/0091732X12471300>

- Harry, B., Klingner, J. K., & Hart, J. (2005). African American families under fire: Ethnographic views of family strengths. *Remedial and Special Education*, 26(2), 101–112.
- Henderson, J., Snodgrass Rangel, V., Holly, J., Greer, R., & Manuel, M. (2021). Enhancing engineering identity among boys of color. *Journal of Pre-College Engineering Education Research*, 11(2), 2. <https://doi.org/10.7771/2157-9288.1311>
- Herndon, M. K., & Hirt, J. B. (2004). Black students and their families: What leads to success in college. *Journal of Black Studies*, 34(4), 489–513. <https://doi.org/10.1177/0021934703258762>
- Holly, J. S. Jr. (2020). A critical autoethnography on teaching engineering to Black boys as a Black man. *Journal of African American Males in Education*, 11(2), 25–42.
- Howard, N. R. (2020). Terms of engagement: Redefining parental involvement and STEM identity for Black girls. In N. M. Joseph (Ed.), *Understanding the intersections of race, gender, and gifted education: An anthology by and about talented Black girls and women in STEM* (pp. 53–70). Information Age Publishing.
- Hrabowski, F. A. (1998). *Beating the odds: Raising academically successful African American males*. Oxford University Press.
- Hughes, D., Rodriguez, J., Smith, E. P., Johnson, D. J., Stevenson, H. C., & Spicer, P. (2006). Parents' ethnic-racial socialization practices: A review of research and directions for future study. *Developmental Psychology*, 42(5), 747–770. <https://doi.org/10.1111/1467-8624.00593>
- Kunjufu, J. (2002). *Black students. Middle class teachers*. African American Images.
- Ladson-Billings, G. (1995). Toward a theory of culturally relevant pedagogy. *American Educational Research Journal*, 32(3), 465–491. <https://doi.org/10.3102/0002831203200346>
- Ladson-Billings, G. (2004). New directions in multicultural education: Complexities, boundaries, and Critical Race Theory. In J. A. Banks & C. A. M. Banks (Eds.), *Handbook of research on multicultural education* (2nd ed., pp. 50–65). Jossey-Bass.
- Latunde, Y., & Clark-Louque, A. (2016). Untapped resources: Black parent engagement that contributes to learning. *The Journal of Negro Education*, 85(1), 72–81. <https://doi.org/10.7709/jne-groeducation.85.1.0072>
- Liu, A. (2011). Unraveling the myth of meritocracy within the context of U.S. higher education. *Higher Education*, 62(4), 383–397. <https://doi.org/10.1007/s10734-010-9394-7>
- Long, L. L., & Henderson, T. (2017). *Lessons learned from successful Black male “buoyant believers” in engineering and engineering-related fields*. Paper presented at the ASEE Annual Conference and Exposition, Columbus, OH. <https://peer.asee.org/28620>
- Martin, D. B. (2006). Mathematics learning and participation as racialized forms of experience: African American parents speak on the struggle for mathematics literacy. *Mathematical Thinking and Learning*, 8(3), 197–229. https://doi.org/10.1207/s15327833mtl0803_2
- Martin, J. P., Garrett, S. D., Adams, S. G., & Hamilton, J. (2015). *A qualitative look at African American students' perceptions of developing engineer of 2020 traits through non-curricular activities*. Paper presented at the ASEE Annual Conference and Exposition. Seattle, WA. <https://peer.asee.org/23434>
- Maton, K. I., Hrabowski, F. A., & Greif, G. L. (1998). Preparing the way: A qualitative study of high-achieving African American males and the role of the family. *American Journal of Community Psychology*, 26(4), 639–668. <https://doi.org/10.1023/A:1022197006900>
- May, G. S., & Chubin, D. E. (2003). A retrospective on undergraduate engineering success for underrepresented minority students. *Journal of Engineering Education*, 92(1), 27–39. <https://doi.org/10.1002/j.2168-9830.2003.tb00735.x>
- McCallum, C. M. (2016). “Mom made me do it”: The role of family in African Americans' decisions to enroll in doctoral education. *Journal of Diversity in Higher Education*, 9(1), 50–63. <https://doi.org/10.1037/a0039158>
- McGee, E. O., & Pearman, F. A. (2015). Understanding Black male mathematics high achievers from the inside out: Internal risk and protective factors in high school. *The Urban Review*, 47(3), 513–540. <https://doi.org/10.1007/s11256-014-0317-2>
- McGee, E. O., & Spencer, M. B. (2015). Black parents as advocates, motivators, and teachers of mathematics. *The Journal of Negro Education*, 84(3), 473–490. <https://doi.org/10.7709/jnegroeducation.84.3.0473>
- McGowan, B. L., & Pérez, D., II. (2020). “A community built just for me”: Black undergraduate men bridging gaps to community cultural wealth. *Journal of the First-Year Experience & Students in Transition*, 31(1), 43–57. <https://www.ingentaconnect.com/contentone/fyesit/>
- Miles, M. B., & Huberman, A. M. (1994). *Qualitative data analysis: An expanded sourcebook* (2nd ed.). SAGE.
- Miles, M. B., Huberman, A. M., & Saldana, J. (2020). *Qualitative data analysis: A methods sourcebook* (4th ed.). SAGE.
- Moll, L. C., Amanti, C., Neff, D., & Gonzalez, N. (1992). Funds of knowledge for teaching: Using a qualitative approach to connect homes and classrooms. *Theory Into Practice*, 31(2), 132–141. <https://doi.org/10.1080/00405849209543534>
- Moore, J. L., III. (2006). A qualitative investigation of African American males' career trajectory in engineering: Implications for teachers, school counselors, and parents. *Teacher College Record*, 108(2), 246–266. <https://doi.org/10.1111/j.1467-9620.2006.00653.x>
- Moore, J. L., III, Madison-Colmore, O., & Smith, D. M. (2003). The prove-them-wrong syndrome: Voices from unheard African-American males in engineering disciplines. *The Journal of Men's Studies*, 12(1), 61–73. <https://doi.org/10.3149/jms.1201.61>
- Morris, J. (2004). Can anything good come from Nazareth? Race, class and African-American schooling and community in the urban South and Midwest. *American Educational Research Journal*, 41(1), 69–112. <https://doi.org/10.3102/00028312041001069>
- Nasir, N. S., & Shah, N. (2011). On defense: African American males making sense of racialized narratives in mathematics education. *Journal of African American Males in Education*, 2(1), 24–45.
- National Academy of Engineering. (2004). *The engineer of 2020: Visions of engineering in the new century*. National Academies Press.
- Noguera, P. A. (2003). The trouble with Black boys: The role and influence of environmental and cultural factors on the academic performance of African American males. *Urban Education*, 38(4), 431–459. <https://doi.org/10.1177/004208590q3038004005>

- Noguera, P. A. (2009). *The trouble with Black boys ... And other reflections on race, equity, and the future of public education*. John Wiley & Sons.
- Ortiz, N. A., Morton, T. R., Miles, M. L., & Roby, R. S. (2019). What about us? Exploring the challenges and sources of support influencing Black students' STEM identity development in postsecondary education. *The Journal of Negro Education*, 88(3), 311. <https://doi.org/10.7709/jnegroeducation.88.3.0311>
- Peoples, L. Q., & Foster, L. (2020). *Focus, resistance & joy: Lessons learned from Black communities, and education for liberation*. <https://steinhardt.nyu.edu/metrocenter/focus-resistance-joy>
- Samuelson, C. C., & Litzler, E. (2016). Community cultural wealth: An assets-based approach to persistence of engineering students of color. *Journal of Engineering Education*, 105(1), 93–117. <https://doi.org/10.1002/jee.20110>
- Simmons, D. R., & Martin, J. P. (2011, October 12–15). *Implications of Black Greek letter membership on the development of the engineer of 2020*. Paper presented at the IEEE Frontiers in Education Conference, Rapid City, SD. <https://doi.org/10.1109/FIE.2011.6142984>
- Simmons, D. R., Young, G. G., Adams, S. P., & Martin, J. (2014, June 15–18). *Non-curricular activities help African American students and alumni develop engineer of 2020 traits: A quantitative look*. Paper presented at the ASEE Annual Conference and Exposition, Indianapolis, IN. <https://peer.asee.org/22870>
- Strayhorn, T. L. (2010). The role of schools, families, and psychological variables on math achievement of Black high school students. *The High School Journal*, 93(4), 177–194. <https://www.jstor.org/stable/40865058>
- Strayhorn, T. L. (2015). Factors influencing Black males' preparation for college and success in STEM majors: A mixed methods study. *Western Journal of Black Studies*, 39(1), 45–63.
- Strayhorn, T. L., Long, L., III, Kitchen, J. A., Williams, M. S., & Stenz, M. E. (2013). Institutional barriers to Black and Latino male collegians' success in engineering and related STEM fields. Paper presented at the ASEE Annual Conference and Exposition, Salt Lake City, UT. <https://strategy.asee.org/30673>
- Tolbert, D. (2017). *Living, learning, and leveraging: An investigation of Black males accessing community cultural wealth and developing engineering attributes* [Doctoral dissertation, Purdue University]. Purdue e-Pubs <https://docs.lib.purdue.edu/dissertations/AAI10254340/>
- Tolbert Smith, D., Jones, T., & Cardella, M. E. (2022). A narrative investigation of Black familial capital that supports engineering engagement of middle-school-aged youth. *Journal of Pre-College Engineering Education Research*, 12(1), 2. <https://doi.org/10.7771/2157-9288.1308>
- Tuckett, A. G. (2005). Applying thematic analysis theory to practice: A researcher's experience. *Contemporary Nurse*, 19(1–2), 75–87. <https://doi.org/10.5172/conu.19.1-2.75>
- Walther, J., Sochacka, N. W., & Kellam, N. N. (2013). Quality in interpretive engineering education research: Reflections on an example study. *Journal of Engineering Education*, 102(4), 626–659. <https://doi.org/10.1002/jee.20029>
- White-Johnson, R. L., Ford, K. R., & Sellers, R. M. (2010). Parental racial socialization profiles: Association with demographic factors, racial discrimination, childhood socialization, and racial identity. *Cultural Diversity and Ethnic Minority Psychology*, 16(2), 237–257. <https://doi.org/10.1037/a0016111>
- Yosso, T. (2005). “Whose culture has capital?” A critical race theory discussion of community cultural wealth. *Race, Ethnicity and Education*, 8(1), 69–91. <https://doi.org/10.1080/1361332052000341006>
- Young, G., Knight, D. B., & Simmons, D. R. (2014, October 22–25). *Co-curricular experiences link to nontechnical skill development for African-American engineers: Communication, teamwork, professionalism, lifelong learning, and reflective behavior skills*. Paper presented at the IEEE Frontiers in Education Conference, Madrid, Spain. <https://doi.org/10.1109/fie.2014.7044076>
- Zephirin, T. (2019). *Integration outcomes and cultural capital in a NSBE chapter*. Paper presented at the Collaborative Network for Engineering and Computing Diversity Conference, Crystal City, Virginia. <https://peer.asee.org/31734>

AUTHOR BIOGRAPHY

DeLean Tolbert Smith is an Assistant Professor in the Industrial and Manufacturing Systems Engineering Department in the College of Engineering and Computer Science at the University of Michigan—Dearborn, 2270 Heinz Prechter Engineering Complex, 4901 Evergreen Road, Dearborn, MI 48128, USA; dtolbert@umich.edu.

SUPPORTING INFORMATION

Additional supporting information can be found online in the Supporting Information section at the end of this article.

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