A Critical Autoethnography of a Black Man Teaching Engineering to Black Boys

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It is widely publicized in scholarly and practitioner spaces that Black male students are underrepresented in engineering and related fields. Black boys generally have limited experiences with engineering courses and programs throughout their educational careers in primary and secondary school. More information about how Black boys are taught in engineering spaces is required to address this imbalance. In this critical autoethnography, I share my experiences with teaching Black boys engineering in an after-school program. This study incorporates the use of culturally relevant pedagogy as the theoretical framework and reports findings that capture the essence of my experiences, thoughts, and perspectives on teaching Black boys in engineering spaces. This study calls for more research on Black men teaching and Black boys' learning in engineering settings.

Keywords: Black male educator, Black boys, engineering education, STEM program

Most of the discourse surrounding Black men in engineering focuses on their underrepresentation and lack of persistence in academic programs and the profession at large (Slaughter, 2009). The most popular explanations for these circumstances include Black males' lack of academic preparation, lack of role models, lack of peer support, poor student-faculty relationships, educational and social isolation, and perceptions of engineering as a nerdy, White male-dominated discipline and profession (Freeman & Huggans, 2009). Collectively, these suppositions contribute to the ongoing deficit narrative about Black males in engineering. Unfortunately, there is but a limited body of research focused on successful, high achieving, and persistent Black men in engineering to challenge this deficit perspective (Burrell, Fleming, Fredericks, & Burrell, 2015; Flowers, 2015; Hrabowski & Pearson, 1993; Leggon, 2009; Moore, 2006; Moore, Madison-Colmore, & Smith, 2003). Much of the scholarship focuses on Black men at the higher education level in engineering, meaning that Black male students' experiences

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in engineering courses and programs at the K-12 level are sparse. In both higher education and K-12 contexts, Black males' exposure to and taught engineering is critical to Black males' viable opportunities to and through STEM pathways. There is also a shortage of literature regarding Black men's experiences in teaching engineering at the higher education and K-12 levels, especially when the students are Black males themselves.

This article examines Black men's literature in teaching, in general, with a specific focus on engineering education and Black male students, in particular. It provides an overview of culturally relevant pedagogy (CRP) and critical autoethnography as the theory and methodology for this study. Next, it explains the four themes that represent my experiences teaching Black male students in after school engineering spaces. Lastly, it discusses the implications of this study and reinforces the need for more research on Black men teaching engineering.

Literature Review

Research focused on Black male teachers throughout K-12 classrooms has been developing over the last 20 years (Brown, 2009; Davis, Lewis, & Toldson, 2018; Lewis & Toldson, 2013; Lynn, 2002). Most research on Black male teachers across geographical locations, disciplines, and grade levels examines why they enter the profession, their teacher preparation, and lived professional experiences (Bristol & Goings, 2019; Brockenbrough, 2013; Milton-Williams & Bryan, 2016). Research and discourses on Black male teachers focus on four main areas: a) their educational and professional experiences, b) increasing their representation in the profession, c) retaining and marginalizing them in the profession, and d) their pedagogical practices. This research body mainly stems from a) studies of Black male teachers, b) studies of Black teachers, and c) research on teachers more broadly.

Black male teachers are often positioned as disciplinarians, role models, and saviors of Black boys (Brockenbrough, 2015). Many researchers have cautioned against positioning Black male teachers as simply disciplinarians, saviors, and role models because most of the problems Black boys face in schools are systemic, institutionalized, and structural, the educational landscape cannot simply be changed by placing Black men in classrooms (Lewis & Toldson, 2013; Maylor, 2009; Rezai-Rashti & Martino, 2010). There is very little research on pre- and in-service Black male teachers in the science, technology, engineering, and mathematics (STEM) disciplines (Clark, Chazan, & Johnson, 2009; Davis, 2018; Davis, Frank, & Clark, 2013; Harris & Davis, 2018; Matthews, 2010; Mensah, 2009; Milner, 2008). Some Black men entered the profession to impact the lives and academic experiences of Black students generally, and boys, specifically (Brown, 2009; Bristol, 2015; Maylor, 2009; Rezai-Rashti & Martino, 2010; Tafari, 2013). Black men's race and gender play a significant role in their approaches to teaching, working with students, and navigating the profession. Still, beyond that, there is a void in the research literature about Black men teaching engineering, teaching engineering to Black male students, and teaching in after school spaces.

The scholarship that does exist about Black men and boys in education has identified culturally responsive practices common to many Black male educators (Brown, 2009; Lynn, 2006; Matthews, 2010; Milner, 2008, 2016; Milton-Williams & Byran, 2016). This body of literature demonstrates how Black men use their multiple identities (e.g., Black, men, etc.) to meet their students' needs by assuming the identities of fictive brothers, fathers, and others. The collective results indicate that Black male culturally responsive practices consist of teaching, managing classrooms, connecting with students, sharing their cultural backgrounds and upbringings, using

common communication styles (e.g., Ebonics) and styles of dress (e.g., brand names, popular styles), playing and listening to the same music (e.g., hip hop and jazz), bonding through sports, and using popular cell phone ringtones. Black men used culturally responsive practices to uplift their students, race, and community. Many of the Black men using culturally responsive practices have crossed disciplinary boundaries and grade levels, including mathematics (Matthews, 2010; Milner, 2008, 2016), but there is no research describing how Black men use these practices in engineering education with Black boys in after school settings.

Beyond the research on Black male teachers, Black men have demonstrated an increased interest in sharing their experiences through autoethnography or critical autoethnography. The majority of the Black men using these methodological approaches are former K-12 teachers and educational researchers whose work focuses on some element of teaching Black male students (Goings, 2015; Hayes, 2014; Johnson, 2013; Simmons, 2014; Warren, 2014; Washington, 2014). The experiences of Black men captured through autoethnographic methods have provided insight into their K-12 and collegiate experiences, professional teaching experiences and practices, and methods of advocacy for Black students. Still, much of what has been written about Black men through autoethnographic methods exclude Black men's narratives teaching engineering with culturally responsive approaches, especially for Black boys.

Khalifa (2015) provided one of the only critical autoethnographies about a Black man in a STEM discipline using critical race theory as a theoretical lens. In the autoethnography, he shared his experiences as a Black man teaching science at his urban high school alma mater and as an advocate for Black male students. Khalifa described his "quad-consciousness" as a Black, male Muslim with an Islamic name and how this impacted him in society, schools, higher education, and professionally. Khalifa went on to discuss how he has embraced, accepted and celebrated these multiple identities that shaped him as a professional. Throughout his narrative, Khalifa explored how the White imaginative and power structure constructed multiple aspects of his life and those of his Black male students.

Qualitative research has been the primary approach used to study Black male teachers. This study continues with a qualitative approach that fills a void in the research literature by sharing a Black male educator's critical autoethnography about teaching Black boys in after-school engineering spaces. This research utilizes a culturally relevant theoretical approach to explore the teaching of engineering and interactions with Black male students.

Culturally Relevant Pedagogy in Engineering Education

Academic researchers have offered many articulations of culturally relevant frameworks contextualized for educators (Gay, 2018; Ladson-Billings, 2009; Villegas & Lucas, 2002). Ladson-Billings' seminal work on CRP focuses on successful teachers of African American students. Her framework posits three propositions students must a) experience academic success, b) attain and develop cultural competence, and c) develop a sense of sociopolitical consciousness. In recent discussions of CRP, Ladson-Billings (2014) argues that socio-political consciousness is the most ignored component of her framework. Gay (2018) advances five elements of CRP; specifically, educators should develop a culturally diverse knowledge base, design culturally relevant curricula, demonstrate cultural care and build a learning community, establish cross-cultural communications, and establish congruity in classroom instruction.

Villegas and Lucas (2002) identified six characteristics of culturally responsive educators, the presence of which indicates that they possess a sufficient sociocultural consciousness to

recognize that there are multiple ways of viewing reality and that one's location influences these ways in the social order. They contend that culturally responsive education requires teachers to affirm the views of diverse student backgrounds; see resources for learning in all students rather than viewing differences as a problem to overcome; see themselves as both responsible for and capable of bringing about educational change that will make schools responsive to all students; understand how learners construct knowledge and are capable of promoting learners' knowledge construction; know about the lives of their students, and use their understanding of students' lives to design instruction that builds on what they already know while stretching them beyond the familiar.

In the present study, CRP was used to develop Black male students' cultural competence, racial and gender identities—namely, as Black males—and sociopolitical consciousness in engineering spaces. The sociopolitical consciousness was also essential to the Black male educator's process of reorganizing engineering education to meet the needs of Black boys more keenly by knowing about their lives and knowledge construction processes, and by designing instruction to meet their needs. CRP helps the Black male instructor recognize that his perspective on engineering education for Black boys is one of many perspectives about their education in White male-dominated fields. The CRP elements of the framework were used to develop curriculum and learning communities, and establish congruence for Black boys in the informal engineering learning space. In this space, the Black male engineering educator sought to reaffirm Black boys and accept their differences and perspectives as the norm.

Critical Autoethnography

Critical autoethnography combines ethnography, autobiography, and critical pedagogy to develop a methodology allowing a researcher to examine him/herself systematically and transparently, engage in research, infuse the social context, and address the marginalization of people and communities (Boylorn & Orbe, 2014; Tilley-Lubbs, 2016). Critical autoethnography facilitates understanding the lived experiences of people in context, examines social realities and oppressive conditions, and uses theory and action to challenge dominant power structures (Boylorn & Orbe, 2014). Self-analysis is an essential component of critical autoethnography. Accordingly, the researcher is situated within the study as a reflexive and introspective participant, critically examining the effectiveness of their pedagogy. The preconceived thoughts and beliefs of critical autoethnographers are expected to be shared, and therefore, the study itself is not expected to be completely objective.

Critical autoethnographers seek to understand cultural complexities that shape the researcher and their pedagogy. In sharing personal experiences, Boylorn and Orbe (2014) believe that critical autoethnography combines cultural and social phenomena from a "raced, classed, gendered, sexed, positionality, identifying the distinctions between [their] lenses for viewing the world and those of others" (p. 13). From this perspective, critical autoethnography seeks to understand the intersectionality of lived experiences in context. Critical autoethnographers seek to understand the meanings of different phenomena from both individual and group perspectives (Tilley-Lubbs, 2016). In this study, I examine my lived experiences alongside my race, class, and gender intersectionalities as a student and teacher of engineering. Critical autoethnography was used to answer the following research question: What is the pedagogy, practices, and experiences of a Black man teaching Black boys using engineering design and engineering thinking to address structural inequalities?

The Role of the Researcher

As the sole research subject in this study, I operated as the researcher and the researched, which calls for greater depth in disclosing my positionality within this work. When I was younger, I participated in the Detroit Area Pre-College Engineering Program (DAPCEP). I participated before entering high school and did not do any engineering-specific programs afterwards. I was encouraged to explore engineering by a former teacher after sharing my interest in mathematics and problem-solving. After turning to Google searches to learn about engineering majors. I determined that Mechanical Engineering (ME) would be the best fit for me. I was rejected admission to my first-choice university but was admitted to Tuskegee University (TU), my second choice. I went on to earn a master's degree in ME from Michigan State University (MSU), even though I was nearly dismissed for unsatisfactory performance. My enrollment at Purdue University's School of Education doctoral program was a calculated quest to merge my engineering training with my devotion to Black youth' welfare. This project is the culmination of that effort.

Research Site and Participants

The students in the course are considered secondary participants in this study since I am the primary research subject. The participants were middle-school-aged Black boys (between 10-13 years old). The recruitment process consisted of seeking eligible youth who participated in an after-school program. I managed youth who lived in the vicinity of the research site. Some of the students continued to invite their peers as the class progressed, and if they could get the research documents signed, I allowed them to participate. The Hub was selected as the research site because it was conveniently located for the young participants and their families. This center also served numerous Black males that either resided in proximity or had transport to the location before I facilitated the course.

Curriculum on Repurposing Engineering and Teaching Equity (CREATE)

CREATE has three modules interwoven throughout the curriculum to pursue an interdisciplinary educational experience that addresses problems of academic disengagement and civic misfortune experienced by Black males. Before beginning this project, I developed lesson plans for the first five sessions, and the fourth class meeting completed the remaining five. Engineering education, civics education, and culturally relevant teaching are merged to (a) cultivate Black male intellectuals and (b) foster sociopolitical development. Understandably, these aspirational outcomes were not fully realized by the course; nevertheless, CREATE is designed as a seminal effort to incite the students towards such goals.

In my view, engineering education urges educators to critically evaluate how to equip Black boys (and other youth) with the problem-solving abilities they often attribute to engineers. Katehi, Pearson, and Feder (2009) offer three guiding principles for K-12 engineering education: a) emphasize engineering design, b) incorporate important and developmentally appropriate mathematics, science, and technology knowledge and skills, and c) promote engineering habits of mind (Katehi et al., 2009, 151-152). CREATE attempts to accentuate principles 1 and 3 because students will likely be underexposed to them, whereas K-12 education already focuses heavily on mathematical and scientific concepts and practice. CREATE provides students with the

opportunity to select an area of personal interest (e.g., sports, food, entertainment) and identify a problem that can be addressed by developing a technological solution. The students then employ the engineering design process (EDP) to conceptualize and create their solution. After performing the EDP, students evaluate their use of the engineering habits of mind (eHOM). The motivation for endorsing eHOM is to train students to develop the values, attitudes, and thinking skills they generally acquire through engineering problem-solving exercises, in a manner that they can cross-apply to problems related to societal patterns of structural inequality.

In my experience, youth are aware of the sociopolitical factors that shape their everyday lives, but usually need help deciphering the implications of the realities they recognize. Black youth perceive subtle and overt prejudices, and poor youth know what is beyond their means; even so, they lack the power, infrastructure, and opportunities to alter their fates. Therefore, CREATE concentrates on developing competent and responsible citizens. Specifically, this curriculum employs three mechanisms to breed youth civic action: (a) discussion of meaningful, contemporary, and controversial issues; (b) participation in guided experiential civic learning; and (c) development of practical solutions to identified problems. These civic activities aim to increase students' sense of personal and political efficacy and trust.

The CREATE course was originally designed for a maximum of 10 students to allow for deeper engagement with the pupils while maintaining the potential for diverse student work and characteristics. Still, at least 15 students attended the class on one or more occasions.

Data Collection

For this study, the data collection consisted of interviewing, videotaping, journaling, lesson plans, and student artifacts. I was interviewed by a researcher with expertise in qualitative research before, in the middle of, and after delivering the CREATE curriculum using the interview guide or semi-structured approach (Patton, 2002). All three interviews were repeatedly revisited following the conclusion of the course. Throughout the study, I videotaped my lessons with a camera in the rear of the classroom and a microphone on me, but the recordings were not transcribed. I journaled my thoughts, experiences, perspectives, beliefs, and reflections, resulting in 30 entries. I also created and modified five lesson plans. Students completed numerous assignments and created numerous artifacts during the course that conveyed their messages and added meaning to the responses students provide during course activities.

Data Analysis

Critical autoethnographers make it explicit that they interpret the data based on their perspectives by openly exposing their presence in the study without the pretense of objectivity or disguising one's perspective. Critical autoethnographers examine an event, a practice, or a circumstance in the researcher's life (Tilley-Lubbs, 2016). The critical autoethnographers' narrative involves "research, writing, story, and method that connect the autobiographical and personal to the cultural, social, and political… [demonstrating] action, emotion, embodiment, self-consciousness, introspection" (Ellis, 2004, p. xix). The critical autoethnographer interprets lived experiences through social, cultural, historical, political, and economic perspectives, events, and circumstances.

Themes

Four major themes that capture the essence of my experiences with thoughts about, and perspectives on teaching Black boys in engineering spaces. The themes are community servant for Black male students, Black male engineering identity development, revolutionary engineering education for Black male students, and critical self-reflection on teaching Black male students in engineering spaces.

Community Servant for Black Male Students

Community servants have a cultural understanding of the community members they want to engage, whether they have previously resided in the same community during their youth or a community with similar cultural practices, or whether they have studied the community through conversations with community members or examining the literature on communities with similar dynamics (demographics, resources, location, etc.). Community colonizers go into an environment thinking about what they know and will be beneficial to any context. Community servants desire to learn about the community's richness before their engagement, then co-labor with other community members to enrich areas that neighbors desire to improve. Community colonizers enter communities believing there is nothing to learn, or that anything necessary to learn can be understood in a short period of time, but it's certainly not a lifelong process; moreover, they desire to have power and authority in the community without accountability to other residents and work to bring about the changes they see as necessary to the community.

I worked to cultivate community servant's attitude and posture during my collegiate studies by volunteering and working jobs in areas where there was a high level of need (or interest) for after school academic coaching of K-12 students. These experiences provided me with an abundance of great memories and relationships. Still, I noticed that most of the youth were Black youngsters from low-income households and that their educators (during and after school) often were neither of low-income status nor Black. That did not necessarily surprise me, but what did shock me was how little these adults knew about the students they worked with. Moreover, the routine maltreatment of the youth was mind-blowing, primarily because the adults claimed to be the most concerned about the well-being of the kids. The scholarship that I reviewed concerning the educational experiences of Black youth, particularly those in low-income communities, confirmed that the cultural disconnection and abuse I witnessed were commonplace across America. I also discovered that my presence and engagement with the youth outside of the academic learning setting was hugely effective in fostering positive interactions and productive activities within the learning space.

Some students would invite me to their athletic competitions or performances, which provided opportunities to meet their family members, and as my own family was newly established (through marriage) and grew bigger (with the birth of my first child), they were able to meet mine. I saw the youngsters at church, in the grocery store, out walking, and so on. Sometimes we simply greeted each other, and at times we had extended conversations, occasionally participating in activities together (like sitting together at an athletic event, playing basketball, etc.). I have played basketball for most of my life, both for leisure and organized competition, and many Black boys are interested in the sport, so the court serves as an easy connection point. To an outsider, it may appear impossible to have a conversation while playing basketball, but the moments before or after a game, mostly when guys are just "shooting around" provide ample opportunity to engage in

dialogues, deep and superficial alike. Youngsters are not used to their teachers participating in recreational activities with them, so this is an easy way to gain rapport with youth, regardless of their skill level. If you are actually highly-skilled (or at least mediocre) in whatever activity/sport you join in on, then your credibility with the students' skyrockets instantaneously! It is kind of crazy, but true, I have won the admiration of many students with a crossover move, jump shot, and occasional dunk. I am not advocating using one's athletic ability (or extra-curricular skillset) to manipulate or exploit youth's interest. Still, it can be a powerful tool to build deep connections with young people if used properly. Sometimes just being present in the space where young people dwell, even if you just watch and do not participate, can be a strong signal to a student of your care and concern. I have been doing this for years, and it seemed naturally effective to me.

Before each session of the Black Boys Club, I would show up to the basketball court outside the research site to interact with the boys in the class and any other young men that happened to be there. I viewed these basketball court interactions as opportunities to join the community classroom. The basketball court became an extension of the academic classroom I established for my research project. It essentially saved the project from failing because of the high number of absences for my course. There were many instances when I would have a great conversation with one or a few of the boys before a meeting. They would not come to the class, but even in cases when we see each other afterward, they would be cordial. Despite my befuddlement with this phenomenon, it provided a broader framework for understanding what it means to teach Black boys. These observations resulted from living in the same communities where I worked and volunteered or by initiating and maintaining a regular presence in the kids' communities by frequently visiting for various reasons.

I also noticed that when I interacted with children outside of the role of educator, I began to view them with a more nuanced and compassionate perspective. I witnessed the connection between the chaotic ways some youth act in classes and the chaos they experience at home. I became capable of identifying the nonconformist behaviors exhibited in class and linked that to the ways that youth expressed themselves and demonstrated creativity in nonacademic activities. It became easier to reject and expunge from my psyche false messages about the aggression and insolence of Black youth. I watched them be childishly naïve, sincere, and declare their ability to be firefighters, professional basketball players, or dancers without hesitation. When I actively engage the community classroom, I feel less pressure to overcompensate for any learning deficits while in the formal classroom, which leads to overload and stress for the student and myself. I reinforced content from the formal classroom when I engage youth in the community classroom, advancing their comprehension through multiple interactions and responsive teaching.

When I was younger, we called those savvy people in their ability to navigate life and demonstrate resourcefulness "street smart." We called those who excelled in school "book smart." The irony is that those who were street smart did not do well in school, and vice versa. Pause, and think about that. I intentionally participate in the community classroom to successfully help Black youth deal with the academic classroom. The community classroom further serves as a space where I can be a teacher and student interchangeably. The community syllabus includes lessons on parenting, contemporary culture, and insight into living in survival mode 24/7. By positioning myself as a learner in the community classroom, I grew the humility necessary to identify my shortcomings as an educator. Students and community members feel empowered to teach the teacher, we humanize each other, and repudiate the stigmas associated with traditional teacher/student roles so that co-laboring and transformation can occur.

Before I knew it was a concept, I was embodying community-engaged scholarship, and

my community involvement directly contributed to the coordination and successful execution of my research. Community-engaged scholarship is fundamentally doing work that bridges the gap between researchers in academia and community-based practitioners. It is collaborative and mutually beneficial to the researchers and community partners involved. The community partners for this project were the parents and the director of the center where the course took place (i.e., research site). The site director was primarily concerned with activities that would expose the boys to new things and encourage them to perform well academically. The parents were excited about an engineering course; they wanted their boys to gain some familiarity with the profession, as well as whatever else I could offer their sons as a positive Black male role model. I wanted to promote a critical and optimistic disposition toward civic engagement and education, which is couched in the CREATE curriculum. I wanted to study my ability to use engineering to accomplish these goals.

Black Male Engineering Identity Development

Black male engineering identity development focuses on my approach to developing young men's racial and gender identities—to cultivate positive masculinity—in engineering spaces. I entered my undergraduate studies with little familiarity with the field while still going through maturing and claiming my self-identity. The longer that I stayed within the engineering education pipeline, the more I realized that my whole self—and other Black males like myself—was not welcome unless my entry enhanced some superficial diversity initiative. My assessment is not true of every individual within the engineering community, but I believe it represents the culture of the field, meaning that people who express delight in my presence and contribution to the field can also do and say things that make my presence difficult and prevent other Black males from occupying engineering spaces. I do not believe that all engineering and its culture are bad, but I believe that unless a revolution occurs, it will continue to be bad for Black men (and women) overall.

Part of helping Black boys identify with engineering is to show them Black male engineers who are themselves diverse and working in diverse fields. Part of the process also involves breaking down stereotypes about what engineers look like; showing Black engineers helps to do that, as does showing engineers of any race that look like ordinary people. In my experience, many think that all engineers are nerdy White men who love math and science, and some think that they mainly work on cars or even trains. To combat this perception, I did an activity where the students looked at Black men's pictures and guessed which of the men were engineers; at the same time, I tried to get them to think about what caused them to choose certain men. I strategically chose men with a wide range of characteristics to further emphasize Black engineers' diverse backgrounds. Not all engineers have a college degree; some are incredibly famous; some work directly in the engineering field, while others work in a variety of career sectors, and so on. I highlighted the college degrees that these many men had earned to show them that success in school is most helpful in becoming an engineer. Still, learning and intellectual curiosity are most important, as I attempted to reinforce by showing one person who did not have a college degree. I wanted students to understand that college is the most popular way, but that it is not required—it is not the only way— because many educators engage Black youth in general and males in particular, as if it is.

This focus on diverse paths to success may seem contradictory to the mission implicit in informing them about the low representation of Black males in engineering. Still, I do not want to make it seem as if it is their responsibility to increase that number. Rather, I wanted them to think

about why that number is so low. Do Black males like engineering? Are they incapable of making it through? Or is something else causing their underrepresentation? I think it is a complex issue, but most of the fault lies outside the control of Black males themselves. Nevertheless, seeing Black male engineers can help cultivate racial pride and confidence, helping Black youth to maintain their aspirations.

To assist their identification with engineering, we did an activity called "Make an Engineer," where students designed their engineering figurines based on their interests and skills (i.e., intrinsic motivation). The purpose of this exercise was to help these students envision themselves as engineers. Before students can authentically decide whether or not they want to pursue any given career, they must first believe that the career pathway is achievable. People may not directly say that Black males cannot be engineers—or they may, but without seeing such representations or engaging the content in a positive light, the boys may simply believe that to be the case. Another component of the "Make an Engineer" activity is that it is meant to help Black boys see engineers as social experts and leaders. Many Black boys are natural leaders but need help productively re-channeling their skillsets. Black boys naturally exemplify useful life skills naturally, but in school, many of the ways they express themselves are deemed socially unacceptable. The promoted attributes for success in school are often anti-Black and may favor behaving in ways that are not traditionally seen as masculine. Especially in any context where Black boys are overwhelmingly present—like urban schools—docility and conformity are rewarded while outspokenness and self-expression are criminalized. Black boys are generally seen as social leaders in the classroom, but the "push-out" phenomenon leads them to exercise their influence in negative and self-defeating ways. Therefore, I talk about the attributes of the ideal engineer in a way that allows Black boys to see skills that they already possess (or may want to attain) as useful in this career/discipline.

Revolutionary Engineering Education for Black Male Students

Revolutionary engineering education for Black male students seeks to develop their engineering identity and their habits of mind and civic engagement. I also wanted to enhance and transform their lives to address problems impacting their communities and people. Throughout my experiences participating in engineering spaces, I was never taught how to use this knowledge to impact my life, family, community, or people. Over the years, throughout my educational journey, I learned how to apply engineering concepts, ideas, and habits to issues impacting me, my family, community, and people. Traditional engineering lessons place a heavy focus on math and science. Thus, I chose to mostly ignore those areas to contextualize the skills that Black boys need to succeed in engineering. I conveyed to them that engineering can be a useful tool for addressing problems impacting them and their community.

Most of my life, I was simply told and encouraged to get a "good education" to be successful, with no training on how to navigate social and political aspects of life. I learned social skills as I went, learning from various experiences, and adapting my behavior based on what I witnessed. The message to get a good education was bolstered further when I attended Tuskegee and learned how to be professional in a way that reflects my racial culture. Now, I teach with that in mind, always wondering how I can prepare Black boys (and girls) to identify the problems they endure and equip them to devote effort toward eliminating these issues. Activism and protest are needed, they are not the only ways to be effective, and some people would prefer a different way of pursuing justice.

From this perspective, an educator cannot just teach subject matter without cultural considerations. To me, this meant reflecting on my own experience in learning about engineering, as well as the impact of my presence in the community. This involved reviewing how the engineering community describes itself and its contribution to society, analyzing the past and present quality of Black male experiences in engineering, investigating whether engineering can enrich the lives of Black males (and if so, how), and contemplating what Black males can contribute to the engineering community, amongst other musings. For the equitable inclusion of Black males in engineering, we as engineering educators cannot just teach engineering. We must perform sociopolitical teaching, which allowed my class to understand three main themes—racial identity, politics, and education from a Black (male) perspective—and connecting them to engineering (and vice versa).

Sociopolitical teaching is about being more concerned with context than content while understanding that the two are inextricably linked. This class was more than an effort to improve engineering interests, preparation, connections, experiences, and opportunities among Black males and transform engineering education based on scholarship and research. This research is the culmination of a four-year journey, studying how I can be a warrior on behalf of Black men and boys (and myself). Too many Black boys have been choked out of the schooling system, never able to explore whether their skills and talents could be useful to the engineering community, perhaps advancing the field. The experiences of Black males in engineering are microcosmic of Black male experiences across the United States of America. My approach to the design of this work was to prepare the Black boys I taught for both.

Accordingly, the engineering habits of mind (eHOM), with their composition of values, attitudes, and thinking skills useful for problem-solving, provide transcendent attributes that Black boys can use within and beyond the field of engineering. Things like creativity, communication, and collaboration are beneficial in any context. Engineering not only allows students to exhibit these skills but also encourages them to expand their circle of knowledge and practice how to do them well. Black boys may work well as teammates on the athletic terrain, but they may not use the same skills in the classroom for various reasons. I use eHOM to help the boys develop a reciprocal awareness of how to effectively use their intelligence as they perform various activities within and outside the classroom setting. This pedagogical framework is inspired by my belief that as a prerequisite to those skills that will help them succeed academically, Black boys (and all kids) need skills that will help them succeed as responsible and informed citizens; regardless of whether they matriculate through the school or not, they have the potential to impact society positively.

We had numerous discussions because I wanted to know what the boys genuinely thought and felt. So, I delayed or discarded the course's planned aspects to allow for more conversation between myself and the boys. Although we did not get through the entire curriculum, using the provided activity and discussion prompts, I believe, helped to make politics more specific and relevant for them. For instance, their sentiments overwhelmingly expressed distrust in elected officials, but when I asked them who was responsible for the state of national/local politics and what can be done about it, there was no answer. Our discussions moved beyond "general politicians and elected officials" to naming the people making decisions that affect their lives daily. We went from ambiguous "community issues" to naming the specific problems they see as making their lives difficult and contributing to unsafe/unhealthy living environments.

The class discussion on politics led to an exercise. I gave them a brief definition of public policy and time to select a community problem that affected Black boys, including racist police officers, gun violence, fighting, littering, drugs, gangs, lack of diverse governmental

representatives, and school miseducation. It was clear that they wanted the issues resolved but had no idea how to make that happen, which could easily translate to resignation and hopelessness. I wanted them to take ownership of their issues and display some passion in putting forth the effort to brainstorm solutions to their topics, so I had the students work in groups to specify a segment of their topic to focus on (awareness building, information gathering, etc.) and use the engineering habits of mind to articulate the components involved in developing a problem-solving policy. I hoped they understood that it is easier to identify the problems we experience than it is to develop solutions or even determine who is responsible for solving community issues; therefore, we have to spend time informing ourselves and others as an essential step to political competency. Moreover, political will and coalition building are necessary to bring about change.

Critical Self Reflection on Teaching Black Male Students in Engineering Spaces

I engaged in critical self-reflection with the support of a fellow scholar who interviewed me throughout the project and accompanying research. During this process, I engaged in critical self-reflection by examining my motives and approaches to working with Black male students, including how they viewed me. In one of the interviews, I was asked how I feel about teaching the class and did not know how to answer the question. At the time, it felt as if someone had discovered something I was hiding, and I was embarrassed and dumbfounded about how they located that hidden thing. The hidden thing was fear, fear of thinking I was doing something good for them, and being told it was not as good as I thought it was. Educators of Black boys must be willing to investigate how they are experiencing our presence and our teaching, separately. They can find comfort in my Black male identity and feel my instructional practices are just as grievous as other teachers.

Whatever the case, Black boys must genuinely verbalize how they feel in our learning environments. If done with sincerity and humility, Black boys may feel reassured that their presence and voice matters, which can motivate them to engage more. Further, it helps the teacher become aware of what they are doing that is un/helpful. Beyond the students' responses to my presence and teaching, the interviewer demonstrated an interest in my response to the boys' answers, not only asking them about how they feel but then acknowledging how I feel about how they feel. This conversation was heavy but necessary. I accepted the challenge, and I modified my planned activities for the following class session after my interview to discuss how the boys thought/felt about me, as a Black man specifically, teaching the class.

Educators of the Black boy must identify and scrutinize their biases, especially if they tend to think negatively in situations involving Black boys that they do not know. Teaching Black boys is specifically a challenge for me because I have to unlearn the methods I have been taught to suppress their energetic behavior (and their intellectual freedom). I have to reject the notion that they are predisposed to misbehavior and carry a hostile/aggressive demeanor. I must counteract a deficit mentality, even as a Black man, with Black male friends and family who exhibit none of these negative stereotypes. The messaging, the dominant narrative, the propaganda is just that strong.

Discussion

This study of a Black male engineering educator provides insight into developing relationships, developing multiple identities, challenging traditional views of engineering, and

engaging in critical self-reflection. My primary takeaways from this research are that studying my identity formation helped me understand how I teach Black boys and use culturally relevant practices. Self-study can be an underestimated tool for teaching more effectively. We may feel that we already know ourselves well, and even if that is true, we may not be aware of how our ideas, cultures, and worldviews influence our interactions with others. While culturally relevant frameworks guide my study and practices (Gay, 2018; Ladson-Billings, 2009), I recognize that their institutionalized structures and practices impact both the students and me.

Black male engineering educators need to develop relationships with their Black male students before focusing on engineering content. Most of the research on Black male educators suggest that many spend time developing relationships with their students; specifically, Black boys are important (Brockenbrough, 2013, 2015; Lynn, 2006; Matthews, 2010; Milner, 2008, 2016). As a culturally responsive Black male engineering educator, I worked to develop relationships with my students (and their families) by playing basketball, attending events that were important to them, listening to them, engaging in conversations about topics that were important to them in one-on-one and group settings, sharing my experiences, and offering them advice. The field could benefit from more research of Black men teaching Black boys in engineering education to develop a better understanding of how they develop relationships with and teach them. It certainly is a sacrifice to spend more time than already given trying to serve and connect with Black male students, but the "payoff" is invaluable and mutually beneficial.

Black male engineering educators teaching Black boys in engineering education must also address the stereotypical images and identities of White men as engineers. Many Black male students view engineering as a White male-dominated field of study and profession. Black male educators must help Black boys develop healthy and positive racial, ethnic, gender, and engineering identities. These identities are crucial culturally relevant practices to helping Black boys see themselves as engineers and engage meaningfully in engineering thinking and content.

In Khalifa's (2015) critical autoethnography, he discussed how the White imaginative impacted Black boys and men throughout his lived experiences and how it shaped his and other Black males' identity development. Similarly, the White power structure, workforce, study body, curriculum, and objectives in engineering shaped my identity as a Black male student and educator and continue to shape the identities of my Black male students in engineering spaces.

In this study, I developed the culturally relevant curriculum, teaching practices, assignments, and experiences that I thought were necessary to challenge this White male domination in engineering education and to help my Black male students develop positive, healthy racial, gender, and engineering identities. While the extant research literature has described other Black men in K-12 settings who have used culturally relevant practices, investigations of Black men in engineering education are scant (Brockenbrough, 2008; Lynn, 2006; Matthews, 2010; Milner, 2008, 2016). More research about how other Black male engineers challenge the field's White power structure and develop Black male students' identities in engineering education is necessary to make further advances toward equitable representation.

Challenging traditional views and approaches to learning engineering content and concepts, earning degrees, and securing positions in the field are critical socio-political positions that Black male engineering educators and Black male students entering this space must embody and address. As a culturally responsive engineering educator, I created curriculum, assignments, experiences, and teaching practices that I thought would enhance my students' sociopolitical consciousness. As Ladson-Billings (2014) noted, sociopolitical consciousness is often ignored by educators, but in engineering education, I believe it is a crucial component of the learning

experience. I join many other Black male educators (Khalifa, 2015; Lynn, 2006) in engaging students to raise their sociopolitical consciousness.

The field of engineering has traditionally been a White male-dominated field that serves the needs of the White community. Black men teaching Black boys in engineering education must consider their socio-political position and how they seek to challenge the engineering tradition. Engineering educators must be aware of and be willing to expose their students (and not just their Black students) to the abundant contributions of Black people to engineering. The field would benefit from more research on how Black male engineering educators develop their own and Black male students' sociopolitical consciousness.

Conclusion

This study was conducted to help others in the engineering community think about practical ways of teaching engineering in a culturally relevant and liberatory way, especially for Black male students. Still, engineering educators must be concerned about more than culturally relevant and emancipatory teaching. The way I taught engineering was about something much bigger than but directly tied to engineering. I believe engineering culture and practice will genuinely be transformed. Engineering must be about more than the increase in quantity and quality of engineers, tokenizing ethnic/racial minorities to appear inclusive, or seeking diverse perspectives to advance global technological competitiveness. I hope my journey helps to make engineering more relatable to Black boys and not vice versa.

References

Boylorn, R. M., & Orbe, M. P. (2014). Critical autoethnography: Implications & future Directions. In R.M. Boylorn and M.P. Orbe (Eds.), *Critical autoethnography: Intersecting cultural identities in everyday life* (pp. 234-238). Routledge.

Brockenbrough, E. (2013). Educating the race in postmodern times: The intraracial border crossings of Black male teachers. In. C.W. Lewis and I.A. Toldson (Eds.), *Black male teachers: Diversifying the United States' teacher workforce* (pp. 25-42). Emerald Group Publishing Limited.

Brockenbrough, E. (2015). "The discipline stop": Black male teachers and the politics of urban school discipline. *Education and Urban Society*, *47*(5), 499-522.

Brown, A. L. (2009). "Brothers gonna work it out": Understanding the pedagogic performance of African American male teachers working with African American male students. *The Urban Review*, *41*(5), 416-435.

Bristol, T. J. (2015). Teaching boys: Towards a theory of gender-relevant pedagogy. *Gender and Education*, 27(1), 53-68.

Bristol, T. J., & Goings, R. B. (2019). Exploring the boundary-heightening experiences of Black male teachers: Lessons for teacher education programs. *Journal of Teacher Education*, *70*(1), 51-64.

Milton-Williams, T., & Bryan, N. (2016). Respecting a cultural continuum of Black male pedagogy: Exploring the life history of a Black male middle school teacher. *Urban Education*, 1-29.

Burrell, J. O., Fleming, L., Fredericks, A. C., & Burrell, J. O. (2015). Domestic and international student matters: The college experiences of Black males majoring in engineering at an HBCU. *The Journal of Negro Education*, *84*(1), 40-55.

Clark, L.M., Johnson, W. & Chazan, D. (2009). Researching African American mathematics teachers of African American students: Conceptual and methodological considerations. In D.B. Martin (Ed.), *Mathematics teaching, learning, and liberation in the lives of Black children* (pp.39-62). Routledge.

Davis, J. (2018). An examination of three Black African male mathematics teachers' teacher preparation and teaching experiences in Africa and the USA. *Journal for Multicultural Education*. *12*(2), 161-171.

Davis, J., Frank, T. J., & Clark, L. M. (2013). The case of a Black male mathematics teacher teaching in a unique urban context: Implications for recruiting Black male mathematics teachers. In. C.W. Lewis and I.A. Toldson (Eds.)*, Black male teachers:*

Diversifying the United States' teacher workforce (pp. 77-92). Emerald Group Publishing Limited.

Davis, J., Lewis, C., & Toldson, I. (2018). Introduction to special issue: International perspectives of Black male teachers, teacher leaders and school leaders. *Journal for Multicultural Education*. *12*(2), 161-171.

Ellis, C.E. (2004). *The ethnographic I: A methodological novel about autoethnography.* AltaMira Press.

Freeman, T.L. & Huggans, M.A. (2009). Persistence of African-American male community college students in engineering. In H.T. Frierson, J.H. Wyche, and W. Pearson (Eds.), *Black American males in higher education: Research, programs, and academe* (pp. 229-251)*.* Emerald Group Publishing Limited.

Flowers, III, A. M. (2015). The family factor: The establishment of positive academic identity for Black males engineering majors. *Western Journal of Black Studies*, *39*(1), 40-55.

Gay, G. (2018). *Culturally responsive teaching: Theory, research, and practice.* Teachers College Press
.

Goings, R. B. (2015). The lion tells his side of the (counter) story: A Black male educator's autoethnographic account. *Journal of African American Males in Education*, *6*(1), 91-105.

Harris, D. L., & Davis, J. L. (2018). The experiences of three Black African male mathematics teachers in a same race and gender peer mentoring program. *Journal for Multicultural Education*, *12*(2), 172-182.

Hayes, C. (2014). What I know about teaching, I learned from my father: A critical race autoethnographic/counternarrative exploration of multi-generational transformative teaching. *Journal of African American Males in Education*, *5*(2), 247-265.

Hrabowski, F.A. & Pearson, W., Jr. (1993). Recruiting and retaining talented African American males in college science and engineering. *Journal of College Science Teaching*, *22*(4), 234-238.

Johnson, R. M. (2013). Black and male on campus: An autoethnographic account. *Journal of African American Males in Education*, *4*(2), 25-44.

Katehi, L., Pearson, G., & Feder, M. (2009). *Engineering in K-12 education: Understanding the status and improving the prospectus.* Washington, DC: National Academies Press.

Khalifa, M. A. (2015). A critical autoethnography of a Black man from Detroit. In F. Briscoe and M. Khalifa (Eds.), *Becoming critical: The emergence of social justice Scholars* (pp. 187-206). SUNY Press.

Ladson-Billings, G. (2009). *The dreamkeepers: Successful teachers of African American children.* John Wiley & Sons.

Ladson-Billings, G. (2014). Culturally relevant pedagogy 2.0: Aka the remix. *Harvard Educational Review*, *84*(1), 74-84.

Leggon, C. B. (2009). African American males in academic science and engineering. In H.T. Frierson, J.H. Wyche, and W. Pearson (Eds.), *Black American males in higher education: Research, programs, and academe* (pp. 209-222)*. Emerald Group Publishing Limited.

Lewis, C. W., & Toldson, I. A. (Eds.). (2013). *Black male teachers: Diversifying the United States' teacher workforce.* Emerald Group Publishing Limited.

Lynn, M. (2002). Critical race theory and the perspectives of Black men teachers in the Los Angeles public schools. *Equity & Excellence in Education*, *35*(2), 119-130
.

Lynn, M. (2006). Education for the community: Exploring the culturally relevant practices of Black male teachers. *Teachers College Record*, *108*(12), 2497.

Matthews, L. (2010). This little light of mine! Entering voices of cultural relevancy into the mathematics teaching conversation. In D.B. Martin (Ed.), *Mathematics teaching, learning, and liberation in the lives of Black children.* London: Routledge.

Maylor, U. (2009). 'They do not relate to Black people like us': Black teachers as role models for Black pupils. *Journal of Education Policy*, *24*(1), 1-21.

Mensah, F. M. (2009). A portrait of Black teachers in science classrooms. *Negro Educational Review*, *60*(1-4), 39-52.

Milner, H. R., IV. (2008). Disrupting deficit notions of difference: Counter-narratives of teachers and community in urban education. *Teaching and Teacher Education*, *24*(6), 1573-1598.

Milner, H. R., IV. (2016). A Black male teacher's culturally responsive practices. *The Journal of Negro Education, 85*(4), 417-432.

Milton-Williams, T., & Bryan, N. (2016). Respecting a cultural continuum of Black male pedagogy: Exploring the life history of a Black male middle school teacher. *Urban Education*, 1-29.

Moore, J. L. (2006). A qualitative investigation of African American males' career trajectory in engineering: Implications for teachers, school counselors, and parents. *Teachers College Record*, *108*(2), 246-266.

Moore, J. L., 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

Patton, M. Q. (2002). *Qualitative research and evaluation methods* (3rd ed.). Sage Publications.

Rezai-Rashti, G. M., & Martino, W. J. (2010). Black male teachers as role models: Resisting the homogenizing impulse of gender and racial affiliation. *American Educational Research Journal*, *47*(1), 37-64.

Simmons, R. W. (2014). Navigating intraracial and interracial relationships at a Jesuit high school: Using resilience theory and critical race theory to craft a framework for success. *Journal of African American Males in Education, 5*(2), 167-181.

Slaughter, J. B. (2009). African American males in engineering: Past, present, and a future of opportunity. In H.T. Frierson, J.H. Wyche, and W. Pearson (Eds.), *Black American males in higher education: Research, programs, and academe* (pp. 193-208). Emerald Group Publishing Limited.

Tafari, D. (2013). "I can get at these kids": A narrative study exploring the reasons Black men teach. In. C.W. Lewis and I.A. Toldson (Eds.), *Black male teachers: Diversifying the United States' teacher workforce* (pp. 93-106). Emerald Group Publishing Limited.

Tilley-Lubbs, G. A. (2016). Critical autoethnography and the vulnerable self as researcher. In G.A. Tilley-Lubbs and S. Benard Calva (Eds.), *Re-telling our stories: Critical autoethnographic narratives* (pp. 1-15). Sense Publishers.

Villegas, A. M., & Lucas, T. (2002). Preparing culturally responsive teachers: Rethinking the curriculum. *Journal of Teacher Education*, *53*(1), 20-32.

Warren, C. A. (2014). Perspective divergence and the mis-education of Black boys... Like me. *Journal of African American Males in Education*, *5*(2), 134-149.

Washington, A. R. (2014). Southern post-integration sensibilities in a post-racial educational context. *Journal of African American Males in Education*, *5*(2), 23