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## A Study on the Influence and Importance of Black Science Teachers

### About the Author(s)

The author is an assistant professor in the Department of Teaching and Learning at Old Dominion University in Norfolk, Virginia. She teaches K-12 foundation courses and secondary science and math methods to preservice teachers. Before entering higher education, she served as a STEM educator in North Carolina, Maryland, and Indiana public schools. The author's current research centers on investigating the motivations, beliefs, and experiences of Black students in STEM and factors that influence Black STEM teachers' career decisions. She has also collaborated actively with researchers in other fields to study how informal STEM learning experiences affect Black girls.

### Keywords

Black science teachers, teacher education, STEM

### Cover Page Footnote

I would like to thank Dr. Glenda Prime of Morgan State University, for her support and feedback on this topic and project.



## **A Study on the Influence and Importance of Black Science Teachers**

Demetrice Smith-Mutegi, Old Dominion University

### **Abstract**

Black teachers have been known to provide positive experiences and outcomes for students, especially Black students. Nevertheless, Black science teachers are marginally represented in public classrooms across the United States, and Black students are marginally under-represented in science, technology, engineering, and mathematics (STEM). Black science teachers provide an inherent value to the education of Black children, including their ability to make science meaningful and relevant, contribute to the community where they live and work, and relate to students' experiences more intimately. Further, All levels of education should prioritize Black science teacher recruitment, and educational researchers should provide more evidence of recruiting, teaching, and learning best practices as it relates to teachers of African descent.

*Key Words:* Black science teachers, teacher education, STEM

### **Introduction**

Despite the field of science's global significance and history, many nations, including the United States, are battling talent shortages and growing demand (National Science Board, 2021). Nationally, one of the most challenging aspects is increasing the number of workers from underrepresented races and ethnicities, particularly Black Americans. The United States Department of Education (2020) that:

All young people should be confident that they can become innovators, educators, researchers, and leaders who can solve the most pressing challenges facing our nation and our world today and tomorrow. However, not enough of our youth have access to quality STEM learning opportunities, and too few students see these disciplines as springboards for their careers (para 1).

As stated in the statement above, "not enough youth" and "too few students" refer to a vast majority of Black students rather than their White or Asian peers. This discrepancy is one of the factors leading to decreased post-secondary enrollment and STEM degree attainment among

Blacks and African Americans (U.S. Department of Education, n.d.) and was most recently addressed in the Pew Research Center's report on STEM career attainment (Fry et al., 2021).

Numerous studies and theories have been developed regarding the factors influencing Black enrollment in post-secondary institutions and STEM degree attainment (Mau, 2016; McGee, 2021). While Black students enter college intending to major in STEM fields, few graduate with STEM degrees (Babco, 2003; Fry et al., 2021; Riegle-Crumb et al., 2019). In 2018, Blacks represented 7% of STEM graduates, with the lowest representation in math, physical sciences, and engineering, according to the Pew Research Center's report (Fry et al., 2021). With *Stuck in the Shallow End*, Jane Margolis highlighted the impact of school structures and belief systems on the lack of success of African Americans and Latinos in computer science (Margolis, 2017). A metaphorical comparison was made between access to computer science for African Americans and leisure swimming, arguing that African Americans lack access to the educational structures needed for success (Margolis, 2017). Because of this, they do not major in computer science or other STEM fields at the same rate as their White counterparts. While efforts have been made to address the discrepancy, Blacks earn just 2.4% of doctoral degrees in artificial intelligence— a growing computer science field faced with the growing revelation of racial bias (Fry et al., 2021).

Intending to alleviate this disproportion of STEM career and degree attainment, the federal government has attempted to implement several initiatives to support teachers and students in STEM, including making STEM a priority in more federal grant programs and collaborating with 21<sup>st</sup> Century Community Learning Centers to advance informal learning in STEM (U.S. Department of Education, n.d.). These initiatives alone will not give all Black or most Black students access to a quality science education. However, to understand the experiences of Black students more effectively in STEM classrooms, we must first take a closer look at their experiences, most notably with teachers.

Advanced science coursework remains necessary to pursue a career in a STEM pathway. Science and mathematics courses at the advanced level are typically required as part of STEM degree requirements (Chen, 2009). Almost all high school students enroll in advanced courses after a recommendation from their teachers or placement from their guidance counselors. This is also where Black students begin to lose confidence and interest in STEM (Potvin & Hasni,

2014). Researchers have also documented Black students' negative and unwelcomed experiences in STEM classroom environments (Basile & Thomas, 2022; Morton & Smith-Mutegi, 2018), as well as more accommodating and humanizing informal spaces (King, 2017; King & Pringle, 2019; Morton & Smith-Mutegi, 2022). Morton and Smith-Mutegi (2018) highlighted the intentional efforts of an informal STEM counterspace to recruit facilitators and staff to reflect the racial and ethnic characteristics of the participants.

Workman (2012) asserts that "teachers are the single most important factor influencing student achievement" (p.1) and are essential to fostering critical perspectives as tools of empowerment for learners (Mutegi et al., 2022). In fact, in classrooms where Black teachers instruct students, Black students have experienced positive outcomes (Egalite et al., 2015; Gershenson et al., 2016). For the sake of my argument, these positive outcomes will be discussed further in this manuscript. However, there are too few Black science teachers in the classroom, and too little research has been published on and about Black science teachers. Therefore, the primary objectives of this position paper are: (1) to provide a rationale to prioritize a focused research agenda on exploring the teaching practices, experiences, and motivations of Black science teachers and (2) to argue for more aggressive recruitment of Black teachers into science teaching. This rationale and argument will be supported by a review of the historical and current status of Blacks and Black teachers in educational spaces, a brief overview of peer-reviewed empirical studies where Black science teachers are centered in work, and an examination of the value provided by Black teachers as represented in peer-reviewed publications. This manuscript identifies Black science teachers as Black, African American, Black Hispanic, or Afro-West Indian in the literature.

### **Black Teachers in the Classroom: Past and Present**

Historically, teaching has been a respectable career field in the Black community. In 1935, DuBois contended that Black teachers are well suited and necessary, among other races of educators, to educate students properly. Before legal desegregation, Black teachers taught more than 80% of Black students (1935), and over 50% of Blacks employed were teachers (Oakley et al., 2009). Researchers have argued that the outcomes of the Brown vs. Board of Education decision left many Black teachers and principals without positions as educators (2009). More than 39,000 principals and teachers were left unemployed as their schools were closed, and their

students were transported to newly integrated White schools (Oakley et al., 2009). As a result of *Brown vs. Board of Education*, the evolution of teaching while Black became more complicated and ultimately unwanted, negatively impacting many Black students (Madkins, 2011; Tillman, 2004).

Based on the Labor Force Statistics from the United States Department of Labor, about 11% of African Americans work in educational services. This statistic needs to be revised, considering that elementary, secondary, and higher education are all included in educational services and other positions within education sectors (U.S. Department of Labor, 2018). The pipeline for preparing Black students to become teachers in higher education programs is similarly inadequate. A mere 12% of all education majors were Black, while 73% were White (U.S. Department of Education, 2016).

The literature on Black teachers' experiences identifies several factors associated with the disparity in the workforce. Teachers have cited lack of autonomy, racism, equal pay, and licensure requirements as reasons for leaving the profession (Griffin & Tackie, 2016; Oakley et al., 2009). Others have avoided the profession due to a lack of confidence and pursuit of other high-paying fields (Griffin & Tackie, 2016; Oakley et al., 2009). Although many Black teachers were pushed out of the field, efforts were made during the 1970s to diversify the teaching workforce with little success (Madkins, 2011). After years of denial from schools and school districts, it is not surprising that teaching is no longer a highly regarded career field in the Black community.

When it comes to science education, Black teachers are more disproportionately represented. In the United States, Black teachers represent less than 8% of K-12 science teaching staff (National Academies of Sciences, Engineering, and Medicine, 2020), while Black students represent 15% of K-12 enrollment (National Center for Education Statistics, 2022). The number of Black high school science teachers teaching the natural sciences is less than 6%, compared to 80% of their white peers (U.S. Department of Education, 2020). Teachers often serve as their students' role models, mentors, and advisors. Due to a lack of Black science teachers, Black students are less likely to see themselves reflected in what may be their first encounter with science - a teacher in the classroom.

## Black Science Teachers as Subjects in Research

With thousands of peer-reviewed publications published annually, educational research is essential for informing educational policy and practice decisions. In a National Center for Research in Policy and Practice report, most school district leaders indicated that research was frequently used to support an activity (Penuel et al., 2016). Therefore, education research must present an unbiased and balanced view of education's current needs, practices, and ideas.

Unfortunately, few research publications focus on Black science teachers' experiences, motivations, or instructional tools. In the last twenty years (as of this submission), a mere nine studies were found to fit the criteria of peer-reviewed papers on Black science teachers, with just two in the last five years. Researchers have explored motivation to teach, retention, racial experiences, instructional strategies, and impact on student achievement and STEM significant persistence. Additionally, the number of participants in the study was primarily few, with one large-scale study of college-bound students. Table 1 presents different characteristics and contexts of each study.

Table 1

### *Characteristics of Peer-Reviewed Publications on Black Science Teachers*

<b>Publication</b>	<b>Focus of Study</b>	<b>Context</b>	<b># of Black Science Teacher Participants</b>
Coats & Xu (2013)	Parental outreach, strategies, thoughts on policy	Lower-income schools, Southeastern United States	8 Elementary Teachers
Fraser-Abder (2010)	Retention	Urban Unknown, United States	5 Secondary Teachers
Mensah (2009)	Representation	Rural, Southeastern United States	3 Secondary Teachers
Mensah (2019)	Critical Race Theory	Urban, Northeastern United States	1 Elementary Teacher

Milner (2016)	Instructional Practices	Urban, Southeastern United States	1 Male Teacher
Parsons et al. (2005)	Student Achievement, Culture Studies	Urban, Southeastern United States	1 White Teacher Middle School Teacher; 1 Black Middle School Teacher
Smith-Mutegi (2021)	Experiences; Motivations	Various, United States	24 Elementary and Secondary Teachers
Stearns et al. (2016)	Girls, Student Success	North Carolina	16,300 College-bound students
Xu et al. (2012)	Instructional Strategies	Southeastern United States	8 Elementary Science Teachers

Not only are students not likely to see themselves in science classrooms, but educators and administrators also have limited knowledge of researched best practices related to Black science teachers. Of the studies included in this brief review, most researchers selected exemplary Black science teachers to participate in the studies. Therefore, many of the papers focus predominantly on the perspectives of veteran science teachers, except for Mensah (2019) and Smith-Mutegi (2021). For example, two of the nine studies were published by the same authors (Coats & Xu, 2013; Xu et al., 2012) and employed the same research data from eight exemplary Black science teachers. Teachers in these studies were award-winning, nominated by administrators, colleagues, and former students, and National Board certified. Similarly, Fraser-Abder (2010) recruited teachers from a graduate database who were teachers with ten or more years of teaching experience with the following characteristics (p. 240):

- students scoring higher on standardized tests,
- whom parents and students regard as ‘great,’
- who are rated highly by principals,



- who are considered successful by central office supervisors,
- who cooperating universities regard as superior, and
- who self-evaluated as outstanding.

Researchers identified veteran teachers in smaller studies involving one or two teachers and teachers with substantial teaching experience (Mensah, 2009; Milner, 2016; Parsons et al., 2005).

Black science veteran teachers can provide valuable insights into instructional practices, student success, challenges of teaching, strategies for overcoming challenges, and parent and community engagement (Coats & Xu, 2013; Fraser-Abder, 2010; Milner, 2016; Parsons et al., 2005; Xu et al., 2012). In contrast, in schools where underrepresented students are the majority, they are more likely to experience science with a novice or less experienced and sometimes non-certified teacher (National Center for Science and Engineering Statistics, 2021). While it is noteworthy to provide perspectives of teachers who have persisted in the field, it is also essential to shed light on the experiences of novice and pre-service Black science educators (Smith-Mutegi, 2020; 2021).

### **Exploring the Value of Black Science Teachers**

Despite the relatively small set of literature available on Black science teachers, evidence suggests that reform in teacher recruiting and teacher research is necessary to maintain the value added to the classroom by Black science teachers. A growing body of recently published research cites the impact and outcomes of Black teachers, in general, on Black students. Although not specific to science education, I am suggesting that these outcomes can also be projected to Black science teachers of Black students.

In a study of teacher expectations, Gershenson & Papageorge (2015) found that White and non-Black teachers were 12 percent less likely to expect Black students to enter and graduate from college. Other researchers have found that Black female students significantly benefit when taught by a demographically similar teacher. According to Egalite et al. (2015), Black teachers provide a sense of caring, a call to challenge, and more effective communication. These findings are consistent with others who found that Black students felt they were treated differently by White teachers due to their cultural background, beliefs, and values (Douglas et al., 2007).

Furthermore, increasing the number of Black teachers in science can benefit all students. Cherng & Halpin (2016) found that even minority teachers were perceived more favorably than

White teachers by White students. Regarding mathematics, it has been suggested that increasing the representation of Black mathematics teachers could influence the subsequent enrollment in rigorous mathematics courses among Black students (Klopfenstein, 2006) and that schools, districts, and pre-service programs should prioritize diversifying the teaching workforce to combat the lack of minority presence (Cherng & Haplin, 2016; Evans & Leonard, 2013; Gershenson & Papageorge, 2017). Accordingly, having more Black teachers in science could improve Black students' science outcomes. Despite their limitations in scope and quantity, peer-reviewed empirical studies document vibrant, engaging, and culturally relevant teaching practices, community engagement, and shared experiences of Black science teachers (Coats & Xu, 2013; Milner, 2016; Parsons et al., 2005; Xu et al., 2012).

### **Black Teachers: Teachers of Cultural Relevance**

A growing body of literature connects teacher expectations and the quality of instruction children receive (Egalite et al., 2015; Evans & Leonard, 2013; Gershenson & Papageorge, 2016). Teacher expectations can be based on ethnicity, race, and socioeconomic status. Several studies have found that White teachers do not share the exact expectations for Black students compared to White/Euro-American students (Egalite et al., 2015). Rather than lower expectations for learning, some teachers have found success in making learning culturally relevant and transformative (Fraser-Abder, 2010; Parsons et al., 2005). In *Culturally Responsive Teaching: Theory, Research, and Practice*, Gay (2010) identifies several dimensions of culturally responsive teaching. In one dimension, culturally responsive teachers are described as “socially and academically empowering by setting high expectations for students with a commitment to every student’s success.”

Moreover, culturally responsive teachers bridge gaps between school and home through diverse instructional strategies and multicultural curricula and use students’ strengths to drive instruction, assessment, and curriculum design. Evidence supports that Black science teachers can be exemplary culturally responsive teachers. The culturally relevant teaching framework requires teachers to diversify instructional strategies. One example of diversifying strategies is supported in Milner’s case study of a Black male teacher’s culturally responsive practices (2016). In this study, the teacher participant used a method to engage students in a game-like format for review. During *Science Feud*, students listened and danced to music as they walked

up to the front of the class to answer science review questions. The researcher described this practice as validating in the sense of affirming the cultural values of his students. Other studies have supported this instructional approach to learning, including Mensah's study of three Black teachers in the rural southeastern United States. In Mensah's study, teachers used inquiry-based methods to help students make personal connections to science and explain how the world worked and how people lived (2009). Fraser-Abner (2010) suggests that teachers' instructional abilities enabled them to adapt teaching strategies to student learning contexts.

### **Black Science Teachers and Black Students: Shared Experiences**

DuBois (1935) believed that cultural understanding among teachers was necessary for students. While many teachers can be trained to implement culturally relevant practices in the classroom, most Black teachers offer some advantage to Black students as products of the Black community. In a study of eighth-grade students in an urban district in the Southeastern United States experiencing Black Cultural Ethos (BCE)-incorporated lessons, researchers found that Black students responded favorably to culturally congruent science instruction (Parsons et al., 2005). Lessons incorporating BCE emphasized communalism, verve, and movement (2005). BCE is a "repertoire of practices acquired through prolonged participation in a cultural community" (p. 194, 2005). As a result, Black science teachers are highly equipped to deliver the practices of BCE instruction.

Black science teachers have experienced and survived some of the scientific challenges that current students face. Milner (2006) suggests that "Black teachers can have a meaningful impact on Black students' academic and social success because they often deeply understand Black students' situations and their needs" (p. 93). This is further explained by his observation that: "Black teachers, by virtue of their out-of-school interactions and their deep cultural understanding of what it meant and means to be Black in America, often brought a level of knowledge and connectedness into the classroom that showed up in their teaching" (p. 99, 2006). Mensah noted the challenges an elementary teacher, Michele faced to find her identity in teacher education and the role of science education in her experiences with race and racism (2019). Unfortunately for Michele, some of her early experiences with race were unwanted and negative, reflecting the experiences of many Black students today (2019). Thus, the work of Milner and others (Cherng & Haplin, 2016; Evans & Leonard, 2013; Gershenson & Papageorge, 2018)

supports the premise that Black teachers benefit Black students by leveraging shared experiences.

### **Black Science Teachers and Community Capital**

We may need to look beyond the classroom to comprehend the role of a Black science teacher fully. The traditional proverb: "It takes a village" can best be explained as a community-engaged agenda "that pushes against codified, prepackaged teaching and demands transformative teacher practice that is essential for ensuring optimal learning outcomes for all students" (p.70, Haddix, 2015). As examined through a limited number of studies, Black science teachers have been described as representatives of their communities, as doers of a community-engaged agenda (Coats & Xu, 2013; Mensah, 2009).

Mensah (2009) describes the experiences of three Black secondary science teachers in the southeastern United States. Interviews with these teachers revealed a theme of supporting students' learning through community resources (2009). Black science teachers rely on their connection to the community to become more effective science teachers. Examples of this connection include teachers organizing science or engineering clubs to get more parents and community members involved and inviting scientists and other community members to talk with their class and judge science fairs (Coats & Xu, 2013). The motivations of Black students to become science teachers can also be traced to prior formal and informal experiences during secondary educational experiences (Smith-Mutegi, 2021). Thus, a community approach is needed to make Black science teachers more effective.

There are other ways that Black teachers have pushed a community-engaged agenda. When challenges to teaching exist, Black science teachers have often found support in the community. One example includes how Black science teachers took the initiative to find tutors from the outside community to assist with helping students in improving their literacy skills (Coats & Xu, 2013). They have also found ways to teach science in conjunction with community responsibility. Teachers shared that their students maintained the school grounds and other community activities (Mensah, 2009). These Black science teachers were involved in their communities and wanted the same for their students.

Teachers were integrated as community members rather than involving students in community activities. Black teachers are described as being involved in the community as

residents, church members, and in other social roles (Fraser-Abner, 2010). For example, one veteran teacher was known by many in her community as she was active and involved in many aspects of the community. She also served as a former teacher to students' relatives (Mensah, 2009). Moreover, the literature points to science teachers in multiple roles: mentors, friends, and parents (Fraser-Abner, 2010; Mensah, 2009).

Lastly, Black teachers encourage participation among parents and family members to teach science. They believe that science provides opportunities for families to have discussions together (Coats & Xu, 2013). They also involved parents by informing them via newsletters and forms explaining fundamental concepts that students were learning (Coats & Xu, 2013; Mensah, 2009). Black teachers feel obligated to "... develop strategies that will help them achieve despite the limitations of parental involvement" (p. 245, Fraser-Abder, 2010). Black teachers can view their students beyond the confines of a classroom or assessment score as students who can be held to high expectations and become successful.

### **Concluding Thoughts**

As a nation, we must recognize our role as an institution, a system, and a collective in meeting STEM challenges. Especially students of color; more students should be encouraged or challenged to excel in science (Beckford et al., 2020). In DuBois's (1935) view, too few students have received a proper education. Further, the number of Blacks in the classroom as educators is inadequate, especially in the sciences. Therefore, it is imperative to do something—make a case for Black science teacher research. This manuscript is a call to action to make a difference in Black children's lives and STEM experiences through increased attentiveness and exposure to culturally similar teachers.

While limited in scope, prior research has noted the inherent value of a Black science teacher. Black teachers have a unique ability to make science meaningful and relevant, contribute to the community where they live and work, and relate more closely to the experiences of Black students (Bristol & Martin-Fernandez, 2019; Griffin & Tackie, 2017; Milner, 2006). To better understand the needs and roles of Black science teachers, academic researchers need to capture the experiences of Black science teachers and their students. Using existing research to develop and enhance recruitment and preparation practices will benefit schools, districts, and higher education institutions.

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