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Article

Is Texas Holding 'Em?: The Influence of Black STEM Teachers on Black Student Achievement

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Abstract

This study examines the critical issue of underrepresentation of Black science, technology, engineering, and mathematics (STEM) teachers and its potential influence on Black students' academic achievement and experiences in STEM subjects. The research aims to determine how the presence of Black STEM teachers relative to Black student populations might influence academic performance in STEM disciplines. By addressing the lack of diversity and representation in education, particularly within STEM fields, this study contributes to the body of knowledge on the significance of representation in shaping educational experiences and outcomes. The findings underscore the importance of diversity and equitable representation in educational practices and initiatives, potentially informing policy decisions and fostering a more supportive and inclusive environment for all students in STEM. Ultimately, this research aims to contribute to a more diverse and innovative STEM workforce.

Keywords: Urban, STEM, Black teachers, Black students

Introduction

The underrepresentation of Black teachers in science, technology, engineering, and mathematics (STEM) and the corresponding disparities in Black student participation and achievement in these fields have been well-documented (Nevarez et al., 2019; Fox, 2016; Gershenson et al., 2017). Research suggests that racial and cultural alignment between students and teachers enhances academic performance, increases engagement, and strengthens students' sense of belonging (Fox, 2016; Milner & Howard, 2004). However, most existing studies have examined these relationships in board educational settings rather than specifically within STEM disciplines. This study addresses this gap by examining the role of Black STEM teachers in shaping Black student achievement.

Although the student population is growing more diverse, the representation of teachers is not equivalent. According to the National Science Foundation (2023), the lowest racial ethnic group in STEM occupations is Black workers at 18%. The underrepresentation of Black educators in STEM is comprised of multifaceted issues. These barriers include systemic racism, lack of access to quality education and resources, hostile academic environment, stereotype threat, and educator relationships with the absence of mentorship and role models within the STEM field (Neally, 2022). Addressing these challenges requires a comprehensive approach focusing on increasing the number of Black STEM teachers and creating supportive pathways for Black students to pursue careers in STEM.

The impact of having Black STEM teachers goes beyond academic achievement. Racially congruent educators may serve as role models, mentors, and advocates for students of color, helping to affirm their cultural identities and navigate societal and institutional challenges (Gay, 2002; Ladson-Billings, 1995). It encompasses broader social benefits, such as developing a positive racial identity, resilience against stereotypes, and reinforcing a growth mindset (Dee, 2004; Howard, 2003; Milner, 2006). Black teachers in STEM can provide culturally relevant pedagogy that resonates with Black students, making STEM subjects more relatable and engaging (Ladson-Billings, 1995). This connection can inspire students to envision themselves in STEM careers, gradually bridging the diversity gap.

Prior research, such as Gershenson et al. (2017), has found that same-race teacher-student pairings tend to correlate positively with academic performance. However, less is known about whether these patterns hold in STEM subjects or within specific state-level contexts, such as Texas. Given the underrepresentation of Black STEM teachers and the structural challenges they often face, it is possible that the benefits of racial representation are influenced by broader systemic conditions. Such conditions include school funding disparities, resource allocations, and administrative policies. This study investigates these complexities, contributing to a more nuanced understanding of how Black STEM teacher representation interacts with student achievement.

This research seeks to contribute to the body of knowledge on the significance of representation in education, particularly in STEM disciplines. By highlighting the potential benefits of Black STEM teachers for Black students, this study underscores the importance of diversity and representation in shaping educational experiences and outcomes. The findings could inform policy decisions, academic practices, and initiatives to foster a more inclusive and supportive environment for all students in STEM, ultimately contributing to a more diverse and innovative STEM workforce.

Why Texas?

Texas provides an especially relevant case for examining this issue due to its unique educational landscape. As one of the most diverse states in the U.S., Texas has a significant Black student population but a disproportionately low percentage of Black STEM teachers. According to the Texas Education Agency (2022), only 11.79%, approximately 44,547 out of the state's total teachers of 377,836, are Black, and even fewer specialize in STEM. Additionally, Texas policies regarding teacher certification, retention, and placement such as the reliance on alternative certification programs and the expansion of STEM-focused charter schools may influence Black STEM teacher representation in ways that differ from other states. Furthermore, historical and systemic inequities, including the underfunding of predominantly Black schools and the ongoing impact of school accountability measures like the Texas A-F grading system, shape the educational experiences of Black students and their teachers. These factors make Texas an ideal context for analyzing the complex relationship between teacher representation and student achievement in STEM.

By investigating the presence of Black STEM teachers in Texas and its relationship to Black student achievement, this study highlights the importance of addressing broader systemic issues that may influence these outcomes. The findings aim to inform policy, teacher recruitment strategies, and school support mechanisms to enhance the experiences of both Black STEM teachers and students.

Literature Review

Historical Overview of Black Teachers and Their Impact

Black teachers have historically played a crucial role in fostering academic success and social-emotional development for Black students. In the 19th and 20th centuries, particularly during the Jim Crow era in the United

States, Black educators provided knowledge, empowerment, and advocacy within their communities (Gordon, 2000; Madkins, 2011; Siddle Walker, 2001). Teaching within segregated schools, these educators cultivated learning environments that emphasized high expectations, academic excellence, and reinforced shared family values and perspectives. By creating educational environments characterized by leadership, high expectations, substantial instruction, and effective discipline, Black educators earned respect and were esteemed as professionals within their communities (Dingus, 2006; Milner & Howard, 2004; Siddle Walker, 2001).

Despite facing challenges such as underfunding, resource shortages, overcrowded classrooms, racism, and discrimination, Black teachers remained steadfast in their commitment to education, incorporating both institutional and interpersonal care (Heller, 2019). However, following the Civil Rights Movement and the landmark Supreme Court case Brown v. Board of Education of Topeka in 1954, which mandated school integration, the presence and roles of Black teachers began to decline (Fairclough, 2004). This decline was fueled by displacement, school closures, and layoffs (Fairclough, 2001). Between 1954 and 1965, approximately 38,000 Black teachers lost their positions within their communities (Holmes, 1990; King, 1993).

Despite the challenges and decline in Black teachers in today's classrooms, their impact remains significant, particularly for Black students, as they bring their family history, values, and experiences into the educational setting (Pang & Gibson, 2001). Black educators establish connections with Black students through shared experiences, familiarity, and a nurturing demeanor (Griffin & Tackie, 2017). By fostering solid relationships and maintaining high expectations, Black teachers enhance instruction and challenge deficit thinking, often associated with underachievement and low expectations (Milner, 2012).

Research indicates numerous benefits for all students in having at least one Black teacher throughout their K-12 schooling, as many Black educators focus on creating academically and socially successful environments (Redwine Johnson et al., 2024). Literature has long highlighted the value added to students' social and emotional development and learning outcomes by teachers of color (Anderson, 1998; Foster, 1997; Irvine & Irvine, 1983; Ladson-Billings, 2009). Gershenson et al. (2017) underscores the positive correlation between Black students and Black teachers, noting improvements in standardized testing scores and perceptions. This racial congruence in the classroom has a sustained impact, increasing the likelihood of male and female Black students attending a four-year college (Gershenson et al., 2017). Black teachers support Black students by refraining from rationalizing failure, accepting students where they are, fostering achievement, and maintaining positive expectations (Fox, 2016; Milner & Howard, 2004).

Black teachers bring more than just their subject expertise to the classroom; they incorporate approaches that promote positive cultural views, care, empathy, success, and avenues for racial and social reform (White et al., 2020). Despite not always reflecting the racial makeup of their student populations, Black teachers in Texas, like their counterparts across the United States, adeptly employ these practices to impact student outcomes positively.

Black Teachers in Texas

Teachers play a pivotal role in schools, influencing student learning, relationships, comprehension, confidence, standardized testing outcomes, and overall academic achievement (Hanushek & Rivkin, 2010; Scherer et al., 2020). However, the impact of a teacher is further amplified when Black students are exposed to Black educators. Despite extensive research highlighting the benefits of diversity in hiring, Texas still faces a shortage of Black teachers. According to the Texas Education Agency (2022), there were 377,836 regular classroom teachers during the 2022-2023 school year. Only 11.79% (44,531) were Black teachers, compared to 111,339 Hispanic teachers and 208,119 White teachers (TEA, 2022). While the populations of Hispanic and White teachers are growing in Texas classrooms, the number of Black teachers remains disproportionately low. However, some Black educators, like their counterparts, are qualified to specialize and teach various subjects and grade levels based on their bachelor's degree, training, and certification areas.

Black STEM Teachers in Texas

Specialization in the subjects of science, technology, engineering, and mathematics (STEM) allows teachers to become experts in these critical fields. STEM education initiatives have been developed to address the challenges of the 21st century, focusing on promoting knowledge, skills, and innovation for workforce preparedness (Rifandi & Rahmi, 2019). These initiatives aim to foster problem-solving skills applicable to everyday life by eliminating

disciplinary boundaries (Rifandi & Rahmi, 2019). STEM courses and programs offer numerous advantages, including advancements in various industries, global competitiveness, and the creation of new technologies and solutions that enhance daily life (Tytler, 2020). Additionally, STEM education promotes equity and inclusion by providing career opportunities for women and minorities (Weissmann et al., 2019). By nurturing STEM education early, the U.S. aims to cultivate a future workforce equipped with critical thinking skills and innovative solutions.

Researchers have extensively studied the long-term impact of STEM education on students' perseverance in STEM courses and related careers (Maltese et al., 2014; National Research Council, 2009; Stocklmayer et al., 2010; Tal & Dierking, 2014). These experiences, whether structured learning opportunities or informal exposure at home, introduce students to the fundamental fields of science, technology, engineering, and mathematics (Dou et al., 2019). The demand for STEM-related jobs in the U.S. economy is driven by the continuous advancement

of technology (Green & Sanderson, 2018). Xie, Fang, and Shauman (2015) emphasize the pivotal role of STEM development in the U.S.'s economic growth and security, highlighting the importance of representation in these fields to remain innovative.

Despite the emphasis on STEM education, the 2022-2023 academic year in Texas saw a lack of representation of Black students in newly certified math and science teachers. The Texas Education Agency (2022) reported only 166 newly certified Black math teachers and 145 science teachers out of 1,472 newly certified math and science teachers. This disparity is concerning, as the lack of Black teachers in STEM education classrooms affects the enrollment and achievement of Black students. Despite gains in enrollment, Black students and other students of color remain underrepresented in STEM education and lag behind their White and Asian peers in achievement (Chen & Soldner, 2014; National Science Board, 2014). Underrepresented students, including Black students, face significant challenges in STEM areas, leading to fewer students pursuing STEM courses (Xie et al., 2015).

While STEM education aims to address real-world issues through multidisciplinary and

interdisciplinary approaches, not all students have equal access to these opportunities. Despite ongoing discussions about recruiting and retaining Black students in STEM education, barriers hinder workforce diversity and innovation (Collins, 2018). The underrepresentation of Black teachers and students in STEM education courses limits the diversity of ideas and solutions essential for addressing current societal needs.

Black Students in STEM

Black student achievement in STEM fields, particularly mathematics and science, has historically faced significant challenges within urban educational settings. Research by Zilanawala et al. (2018) highlights these challenges through a longitudinal study focused on Black male students in a large urban city. The study tracked the standardized mathematics scores of these students over time, revealing a concerning trend of decreasing achievement trajectories. This decline not only underscores persistent academic disparities experienced by Black students but also emphasizes the complex interplay of socioeconomic factors, obstacles of mental health, educational policies, and institutional practices that contribute to these outcomes (Ragland Woods et al., 2021; Stone et al., 2018).

Moreover, the underrepresentation of Black teachers and students in STEM education is a critical issue, as representation plays a pivotal role for Black students. Research indicates that Black students encounter numerous challenges in science, technology, engineering, and mathematics education. These challenges include systemic racism, biases, lower expectations from educators, excessive disciplinary measures, a sense of disconnect, a lack of culturally responsive teaching, and feelings of not belonging (Ortiz et al., 2019). Additionally, there persists a false stereotype that Black students are less competent in STEM subjects, which further perpetuates their underrepresentation in STEM fields (Castro, 2014). Unfortunately, these obstacles disengage students from STEM fields and hinder their overall academic achievement. To address these multifaceted challenges and improve Black student achievement in STEM, it is essential to understand the underlying factors and implement interventions that promote equity and inclusivity.

Frameworks

Community Cultural Wealth in Black STEM Classrooms

Yosso's (2005) Community Cultural Wealth (CCW) framework challenges deficit perspectives of students of color by highlighting the various forms of capital they bring to educational spaces. Navigational capital refers to Black students' ability to maneuver through educational spaces that may not have been designed for their success. Black STEM teachers can enhance this form of capital by guiding students through gatekeeping mechanisms in STEM education, such as tracking into advanced courses and navigating implicit biases in STEM learning environments (Ortiz et al., 2019). Social capital, on the other hand, involves the networks of support that students develop, often facilitated by Black STEM teachers who serve as mentors, advocates, and sponsors for students (Ladson-Billings, 1995). By leveraging their professional networks, Black STEM teachers provide students with access to enrichment programs, research opportunities, and career pipelines that are often inaccessible due to systemic barriers. By integrating CCW into discussions of Black STEM achievement, this study highlights how Black teachers do more than instruct, as they cultivate environments that expand access to STEM-related opportunities and empower students to navigate structural inequities.

Black Gaze Theory and STEM Representation

Black Gaze Theory (Campt, 2023) serves as a critical lens for reinterpreting Black students' experiences in STEM classrooms. Traditionally, STEM education has been shaped by a white gaze, which frames Black students as outsiders and contributes to exclusionary practices such as implicit bias in grading, tracking, and discipline (Carter, 2006). By applying a Black Gaze, Black STEM teachers disrupt these deficit narratives and center Black students as capable, innovative thinkers in STEM. Black STEM teachers, who often share similar cultural backgrounds with their students, provide affirming perspectives that challenge dominant assumptions about Black students' abilities in STEM (Howell et al., 2019). This shift is significant because it reframes STEM identity by positioning Black students as active participants in scientific discovery and technological advancement rather than as individuals struggling to fit within historically exclusionary spaces (Campt, 2023).

Beyond shifting perceptions, Black Gaze Theory also recognizes the systemic barriers that Black students face in STEM education. Black teachers are uniquely positioned to address structural inequities such as tracking, resource disparities, and implicit bias. Their presence challenges mainstream STEM education discourses that often overlook the ways racial identity intersects with student achievement and classroom experiences. Through a Black Gaze, these teachers validate students' experiences and work to create more inclusive learning environments. Rather than viewing Black students' behaviors and learning styles through a deficit lens, Black STEM teachers acknowledge cultural expressions of intelligence and engagement that may not align with traditional STEM norms. By integrating Black Gaze Theory into this study, the research moves beyond simplistic explanations of racial representation and instead interrogates the larger structural conditions that shape Black students' success in STEM.

This framework emphasizes the positive relationship between Black STEM teachers and Black STEM students, where shared lived experiences significantly influence outcomes. Black STEM teachers can recognize the intersection of race with other identities, such as gender, class, and sexuality, among their students. These intersections shape the experiences and perspectives of Black students, fostering a deeper understanding and awareness of cultural issues, needs, and challenges rather than through dominant educational perspectives.

Current Study

The researchers aimed to determine the relationship between the presence of Black STEM teachers in Texas schools and Black student achievement in mathematics and science. Moreover, this study examines Black student achievement in fifth-grade and eighth-grade mathematics and science, Algebra I, and Biology during the 2018-2019 school year. This particular school year was analyzed as it was the last school year that students in Texas took standardized exams before the COVID-19 pandemic. The investigation will address the following research questions:

1. How does the percentage of Black STEM teachers compare to White STEM teachers in urban Texas schools?
2. Is there a correlation between the percentage of Black mathematics and science teachers and Black students' mathematics and science achievement in urban Texas schools?

Methods

Sample

This study utilizes teacher and student data from the Texas Education Agency (TEA) for the 2018-2019 academic year. The dataset includes demographic and professional characteristics of K-12 mathematics and science teachers, as well as Black students' performance on standardized state assessments in mathematics and science.

The teacher sample includes 57,216 mathematics teachers and 54,078 science teachers across 3,169 urban schools in Texas (see Table 1). Teacher demographics, including race, years of experience, and degree attainment, were analyzed to determine the percentage of Black STEM teachers in urban schools. To provide a clearer understanding of STEM teacher representation, this study categorizes teachers by subject area and school level (elementary, middle, and high school).

The student sample consists of 147,537 Black students enrolled in urban schools who took the State of Texas Assessment of Academic Readiness (STAAR) and End-of-Course (EOC) exams in mathematics and science during the 2018-2019 school year. This study focuses on student performance in fifth-grade mathematics and science, eighth-grade mathematics and science, Algebra I, and Biology, as theses exams are key indicators of STEM proficiency and future STEM participation.

Urban Schools

Given the focus on urban education, a clear definition of urban schools is necessary. In this study, urban schools are defined based on the Texas Education classifications. The districts are categorized into Major Urban, Major Suburban, Other Central City, and Other Central City Suburban (Texas Education Agency, 2019). Schools in Major Urban and Other Central City districts are included in this study to represent urban educational settings. These classifications account for district population size, student enrollment, and the percentage of economically disadvantaged students, making them a relevant framework for analyzing the relationship between Black STEM teacher representation and student achievement in Texas.

Table 1

Mathematics and Science Teacher Demographics in Urban Schools Across Texas in 2018-2019

	Mathematics		***Science***	
Characteristic	*N*	*M(SD)*	*N*	*M(SD)*
Overall	57,216		54,078	
Race	57,216		54,078	

Asian	1,514	0.03(0.16)	1,282	0.24(0.15)
Black	6,818	0.12(0.32)	6,219	0.12(0.32)
Hispanic/Latinx	23,320	0.41(0.49)	22,203	0.41(0.49)
Native American/ Alaskan Native	171	0.002(0.05)	167	0.003(0.06)
Native Hawaiian/Other Pacific Islander	90	0.002(0.04)	85	0.002(0.04)
Two or More Races	646	0.01(0.11)	614	0.01(0.11)
White	24,442	0.43(0.49)	23,293	0.43(0.50)
Tenure	57,001	7.38(7.56)	53,863	7.39(7.56)
Years of Experience	57,001	10.02(8.58)	53,863	10.00(8.54)
Degree	57,001		53,863	
No Bachelors	486	0.01(0.09)	484	0.01(0.09)
Bachelors	43,516	0.76(0.42)	40,925	0.76(0.43)
Masters	12,702	0.22(0.42)	12,070	0.22(0.42)
Doctorate	297	0.01(0.07)	384	0.01(0.08)

Measures

The mathematics and science STAAR and Algebra I and Biology EOC exams were used to measure Black students' mathematics and science achievement in urban Texas schools. These standardized tests encompass the state curriculum standards outlined in the Texas Essential Knowledge and Skills (TEKS). The STAAR and EOC exams are typically administered at the end of the academic school year, late April and early May. The STAAR exams are administered to students in grades 3-8, and the EOC exams are administered in grades 9-12. This study focuses on fifth-grade and eighth-grade STAAR exam scores and the Algebra I and Biology EOC ninth-grade exam scores. In Texas, students in fifth, eighth, and ninth grades take both mathematics and science exams at the same time. These grade levels are especially important because performance on these standardized tests plays a key role in determining whether students can advance to the next grade level.

Variables

Dependent Variables

The dependent variables in our analysis are Black students' mathematics and science achievement scores. Mathematics achievement was standardized based on students' raw scores on the 2018-2019 STAAR fifth and eighth-grade tests and the Algebra I EOC exam. Science achievement was standardized based on students' raw scores on the fifth and eighth-grade STAAR tests and the Biology EOC exam. All analysis and data preparation was carried out in Stata 18.0.

Independent Variables

The independent variables are the percentage of Black mathematics and science teachers at a school. Using the TEA data, we identified science and mathematics courses (see Appendix). Unique mathematics and science teacher identifiers were created to account for teaching multiple preps (i.e., mathematics, science). Furthermore, additional tags were created using the unique mathematics and science teacher identifiers to indicate teachers' race and subjects taught.

Control Variables

In this analysis, we account for Black mathematics and science teachers' years of experience (i.e., years teaching) and tenure (i.e., years teaching at the same school).

Addressing Additional Variables & Omitted Factors

Given the study's finding of a weak negative correlation between Black STEM teachers and Black student achievement, additional factors may explain this result. The omission of certain school and teacher characteristics could be influencing the observed relationship. One such factor is teacher certification pathways, as alternative certification programs have expanded in Texas and may produce different instructional outcomes than traditional teacher preparation programs (Carver-Thomas & Darling-Hammond, 2019). Research suggests that teachers who enter the profession through alternative routes often have less pedagogical training and higher attrition rates, which can negatively impact student achievement, particularly in STEM disciplines where specialized pedagogical content knowledge and discipline content knowledge are critical (Boyd et al., 2006; Marder et al., 2020).

Additionally, school leadership structures may impact how Black STEM teachers are supported and retained, particularly in urban schools facing high teacher turnover rates (Ingersoll et al., 2018). Studies indicate that administrative support and school climate play a significant role in teacher retention. Black educators, in particular, may experience workplace marginalization that contributes to higher exit rates (Grissom, et al. 2016). The effectiveness of Black STEM teachers may therefore depend not only on their presence in schools but also on whether school leadership provides adequate mentoring, resources, and professional development (Martin et al., 2022).

Another critical factor is teacher placement in underfunded schools, which could mediate the relationship between Black STEM teacher representation and student outcomes. Research suggests that Black teachers, especially in STEM, are often disproportionately assigned to schools with fewer resources, outdated technology, and limited access to advanced coursework (Carver-Thomas & Darling-Hammond, 2019). Urban schools with a higher percentage of Black STEM teachers may be less likely to offer AP STEM courses, research opportunities, or STEM extracurricular activities, which could explain why representation alone does not necessarily lead to higher student performance (Ronfeldt et al., 2013).

Lastly, student access to advanced STEM coursework and participation in honors or AP STEM courses may not be evenly distributed across urban schools, potentially affecting achievement trends. Prior studies suggest that tracking mechanisms and implicit bias in teacher recommendations disproportionately exclude Black students from advanced STEM opportunities. This limits their exposure to rigorous STEM instruction (Scott et al., 2022; Xie, Fang, & Shauman, 2015). Future research should consider incorporating additional teacher-level and school-level variables to deepen understanding of how systemic conditions influence the effectiveness of Black STEM teachers.

Analysis

Pearson's correlation coefficient (R) was employed to assess the strength and direction of the relationship between the percentage of Black teachers and the academic achievement of Black students in mathematics and science. The correlation coefficient determines the strength of the relationship between two variables. For instance, the variables are strongly related if the correlation coefficient is between 0.50 and 1 or -0.50 and -1. The variables have a weak relationship if the correlation coefficient is between 0.50 and 0 or -0.50 and 0. A correlation coefficient

of 0 indicates that the variables are not correlated. Furthermore, a positive correlation coefficient indicates a positive relationship and a negative correlation coefficient indicates a negative relationship. This method was chosen due to its effectiveness in identifying linear relationships between continuous variables.

Results

RQ1: How does the percentage of Black STEM teachers compare to White STEM teachers in urban Texas schools?

Table 2 includes the descriptive statistics for the percentage of teachers averaged across urban schools in Texas used in this study. The analysis revealed that most mathematics teachers in urban schools are White, comprising 42.14% of teachers across elementary and middle school mathematics. In contrast, Black mathematics teachers constitute a much smaller percentage of urban mathematics teachers at just 14.6%. This trend persists across grade levels. In Grade School (K-5), Black teachers represent the smallest percentage of Black teachers in mathematics at 12.27%, while White teachers make up 40.51%. In Middle School (6-8), Black teachers account for 23.08% of mathematics teachers, with White teachers at 46.15%. Lastly, in High School (9-12), Black mathematics teachers make up 17.35%, compared to 44.24% for White teachers.

In science, we observed similar trends among the science teachers in urban schools. Overall, Black science teachers accounted for 14.40%, and White science teachers accounted for 42.93% in urban schools. This pattern is consistent across grade levels. In Elementary School (K-5), Black teachers comprised 12.23%, and White teachers represented 40.46%. In Middle School (6-8), Black teachers constituted 25.25% of teachers, whereas White teachers comprised almost half of the science teachers in urban schools at 48.95%. Lastly, in High School (9-12), Black teachers comprised 16.78%, and White teachers comprised 46.11% of science teachers in urban schools.

Table 2

Distribution of Teachers by Race Across Urban Schools in Texas

	Percent of Black Teachers				**Percent of White Teachers**		
	Percent				Percent		
	N	*M*	*SD*		*N*	*M*	*SD*
Mathematics							
Overall	3,169	14.60	22.53		3,169	42.14	31.04
Level							
Elementary School (K-5)	1,847	12.27	20.04		1,847	40.51	30.10
Middle School (6-8)	118	23.08	30.22		118	46.15	34.54
High School (9-12)	1,204	17.35	24.69		1,204	44.24	31.69
Science							
Overall	3,169	14.40	22.80		3,169	42.93	31.30
Grade Level							
Kindergarten - 5th grade	1,847	12.23	19.87		1,847	40.46	30.15
6th-8th grade	118	25.25	32.65		118	48.95	35.68
9th-12th grade	1,204	16.78	25.20		1,204	46.11	32.21

***Note.** N = Number of urban schools

RQ2: Is there a correlation between the percentage of Black mathematics and science teachers and Black students' mathematics and science performance in urban Texas schools?

To examine the correlation between Black STEM teachers and Black student performance, we first analyzed Black students' mathematics and science achievement on the STAAR and EOC exams (see Table 3). In the 2018-2019 school year, Black fifth-grade students had mean raw scores of 21.59 (59%) in mathematics and 22.14 (62%) on the science STAAR test. In eighth grade, Black students had a mean raw score of 19.37 (46%) on the mathematics STAAR test and 23.73 (57%) on the science STAAR test. On the Algebra 1 EOC, Black students had a mean raw score of 29 (54%); on the Biology EOC, they had a mean raw score of 27.67 (55%). These results indicate a consistent performance range for Black students in mathematics and science in the 2018-2019 school year.

Table 3

Black Student Mathematics and Science Achievement in Texas

	Mathematics			***Science***		
	N	*M(SD)*	*Min/Max*	*N*	*M(SD)*	*Min/Max*
Fifth Grade	23,387	21.59(8.00)	0/36	23,425	22.14(7.23)	0/36
Eighth Grade	23,017	19.37(11.37)	0/42	21,940	23.73(8.81)	0/42
Algebra 1	23,814	29.00(13.12)	0/54	-	-	-
Biology	-	-	-	21,954	27.67(10.95)	0/50

To understand the relationship between the percentage of Black teachers in Texas urban schools and Black student achievement, we found Pearson's correlation coefficients (*R)*. The analysis of the correlations between the percentage of Black mathematics and science teachers and Black student performance in mathematics and science in urban Texas schools revealed an overall weak and negative correlation (see Table 4).

The relationship between the percentage of Black teachers and Black student achievement on the 5th-grade mathematics STAAR was weak and negatively correlated ($R = -0.05$, $p < 0.001$). As the percentage of Black teachers increases in urban schools, there is a minimal decrease in Black student achievement in mathematics. Similarly, in 8th grade, there was a weak and negative relationship between the percentage of Black teachers and Black student achievement in mathematics ($R = -0.02$, $p < 0.05$). In 5th-grade science, there was a statistically significant relationship between the percentage of Black teachers and Black student achievement on the science STAAR ($R = -0.05$, $p < 0.001$). This statistically significant relationship was also true for 8th-grade science achievement ($R = -0.13$, $p<0.001$). Algebra I ($R = -0.06$, $p < 0.001$) and Biology ($R = -.187$, $p < 0.001$) both had weak negative correlations. While the results reveal that there is a negative correlation between the percentage of Black teachers and Black student achievement on the STAAR and EOC exams, something is happening in science that needs further examination.

Table 4

Correlations Between Percent of Black Teachers in Urban Schools and Achievement

	R
5th Grade Math	-0.05***
5th Grade Science	-0.05***
8th Grade Math	-0.02*
8th Grade Science	-0.13***
Algebra I	-0.06***
Biology	-0.187**

*Note. * $p < 0.05$, *** $p < 0.001$*

Discussion and Implications

This study aimed to explore the relationship between the presence of Black STEM teachers in urban schools in Texas and the academic achievement of Black students in mathematics and science. Specifically, it focused on Black student performance in fifth and eighth-grade mathematics and science, as well as in Algebra I and Biology, during the 2018-2019 school year. Unlike previous research, which did not examine specific subjects, our study emphasized influential grade levels and subjects in Texas for mathematics and science. We analyzed the scores of Black students, acknowledging that Black teachers may not have necessarily taught all of these students. We observed a weak negative correlation between the presence of these teachers and student achievement in mathematics and science.

Additionally, an increase in Black teachers did not correlate with higher scores for Black students. However, it is essential to recognize that the number of Black STEM teachers in urban schools is minimal compared to White teachers and the Black student population. Beyond the low percentage of Black teachers, research indicates that urban schools face additional challenges, such as low teacher retention and inadequate funding, which uniquely affect student academic achievement (Ronfeldt et al., 2013; Zhou, 2003; Martin et al., 2022). We predict that these other factors and challenges contributed to the lack of correlation found in our study.

First, the small number of Black STEM teachers may not provide a sufficient sample size to detect significant impacts on student achievement. Moreover, the presence of Black teachers alone may not be enough to address the systemic issues prevalent in urban schools, such as inadequate resources, larger class sizes, limited access to advanced coursework, and testing and graduation rates (Dolph, 2017). Additionally, the impact of Black teachers might be more nuanced, involving factors such as mentorship, culturally relevant teaching practices, and the overall school climate, which were not directly measured in this study. The influence of Black teachers may also depend on their ability to build meaningful relationships with students and serve as role models who can inspire and motivate Black students to pursue STEM fields (Griffin & Tackie, 2017; Milner, 2006).

These factors and challenges may explain our study's lack of observed correlation. By addressing these underlying issues, we can develop more effective strategies to support Black students in reaching their full potential in mathematics and science. Therefore, this study considered the broader campus climate and its potential influence on Black student's achievement in STEM courses. The campus climate includes a school's overall atmosphere and quality of life, factoring in inclusivity, cultural responsiveness, and supportive relationships between students and staff (Hurtado et al., 2012). Positive campus environments significantly improve various aspects of student life, including attendance, engagement, health, communication, and academic achievement (Daily et al., 2019; Thapa et al., 2013; Wang & Degol, 2016). This is further crucial as a lack of a healthy school climate highlights teacher perceptions such as deficit and asset displaying teacher-level microaggressions that lead to the marginalization of Black students (Allen et al., 2013). Like all school members, Black STEM teachers and Black STEM students depend on the school's climate to create an environment conducive to success to aid learning and improvement (Thapa et al., 2013). This climate fosters inclusivity, cultural responsiveness, and support, builds strong relationships between students and staff, and enhances connections with parents and the community (Benbenishty et al., 2016; Haynes et al., 1997; MacNeil et al., 2009; Uline & Tschannen-Moran, 2008).

Future research should consider these complexities and investigate the interplay between teacher demographics, teaching practices, and the overall school environment to fully understand the factors contributing to Black student achievement in STEM fields. Teacher diversity alone is not enough. To further the achievement of Black students in STEM, urban schools in Texas need access to more resources, interventions, teacher training, and the implementation of culturally responsive teaching practices. Additionally, the challenges urban schools face, such as poverty, violence, and mobility, must be addressed to improve academic achievement. Policymakers and educators must focus on systemic changes that provide equitable resources and support for urban schools. Further research should also explore other grade levels where students are assessed in STEM subjects, such as third, fourth, and seventh grades. These foundational years build-up to the crucial testing periods and offer students a preview of the concepts they will encounter in the subsequent year.

The findings of this study highlight several areas for future research that would deepen our understanding of the relationship between Black STEM teachers and student achievement:

- Qualitative Studies on Black STEM Teacher Experiences – While this study provides quantitative data on Black STEM teacher representation and student outcomes, future research should incorporate qualitative studies that explore how Black STEM teachers navigate school environments, curriculum constraints, and

racialized expectations**.** Interviews and ethnographic studies could provide insights into why retention rates remain low despite the known benefits of racial representation in education.

- Longitudinal Studies on Black STEM Teacher Impact – Future research should investigate whether the positive effects of Black STEM teachers emerge over time. Do schools with sustained Black STEM teacher representation show long-term gains in Black student STEM participation and achievement? Longitudinal studies tracking cohorts of Black students over multiple years could clarify whether the benefits of representation accumulate over time.
- Intersectionality in STEM Education – More research is needed to examine how gender, socioeconomic status, and geographic location influence Black students' STEM achievement. Are Black male and female students impacted differently by the presence of Black STEM teachers? Do rural and suburban schools see different outcomes than urban schools? Intersectional analyses would provide a more nuanced understanding of how Black STEM teachers influence student learning across different contexts.

Limitations

While this study provides valuable insights into Black students' STEM achievement, there are several limitations that should be considered when interpreting the results. First, the study focused solely on fifth, eighth, and ninth-grade Black students' scores, which may not fully represent trends across other grade levels. Second, the study was limited to students in Texas, which may affect the generalizability of the findings to other regions or states with differing educational policies and demographics. Furthermore, we did not account for other potential factors influencing achievement, such as socioeconomic status, access to resources, or parental involvement. Despite these limitations, the findings contribute to the growing body of knowledge on the influence of Black STEM teachers on Black student achievement in Texas, offering a valuable foundation for future research.

Conclusion

In conclusion, the findings of this research suggest that merely increasing the number of Black STEM teachers in urban schools is not sufficient to enhance Black students' STEM scores and promote diversity within STEM fields. Furthermore, the study indicates a weak negative correlation between the percentage of Black STEM teachers and Black student achievement in mathematics and science. However, this finding underscores the need to address the underrepresentation of Black teachers in STEM discipline at the school level. Despite the lack of direct correlation in our study, the presence of Black teachers remains crucial for fostering supportive and inclusive educational environments for all students. Black teachers can serve as role models, mentors, and advocates for students of color, affirming their cultural identities and inspiring them to succeed. The significance of diversity and representation in shaping education experiences and outcomes cannot be understated or overlooked. It is particularly important in STEM disciplines, where Black teachers can play pivotal roles in encouraging students to pursue STEM careers. Addressing the challenges of diversity and representation in education requires targeted policies and initiatives to create a more inclusive and supportive environment for all students. This study emphasizes the ongoing need to increase diversity in the teaching workforce, specifically in STEM disciplines. By doing so, we can contribute to a more equitable educational system and foster a more diverse and innovative workforce across all fields, including STEM.

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