
“WHAT I SHOULDA, COULDA, WOULD A LEARNED IN SCIENCE CLASS”: BLACK AMERICAN BOYS’ NARRATIVES OF PAST SCIENCE TEACHERS AND VISIONS FOR A CULTURALLY RESPONSIVE SCIENCE TEACHER

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Abstract

This study follows three Black American, high school boys who participated in a “Men in STEM” book club in an urban school in New York City. Through narrative analysis, the boys describe their vision for a culturally responsive science teacher and connections are made between the boys’ experiences with science teachers and interest in STEM careers. 20 10th grade Black American boys joined the “Men in STEM” book club and three participants are highlighted due to their differing interests in pursuing a STEM major in college. By triangulation of semi-structured interviews, two open-ended questionnaires, and researcher field notes, four themes emerged. Black American boys in this study call for S^d teachers - science teachers who:

- *Provide support towards attaining academic achievement;*
- *Exhibit steadfastness by upholding consistent behavior expectations;*
- *See me by infusing culture into science content and reach out to me through one-on-one conversations; and,*
- *Engage in stake in the ground conversations about STEM careers.*

The findings highlight how the “Men in STEM” book club provides a context where the facilitator can show an ethos of care by having “stake in the ground” conversations to acknowledge the academic abilities of each boy while promoting STEM careers. Implications are discussed by encouraging a paradigm shift in science teacher education towards building science teachers’ culturally responsive pedagogical competence as a means of creating gateways for Black American boys into the STEM pipeline.

Introduction

Black and Latino male students are underrepresented among those with college degrees, high school diplomas, and specifically degrees in science, technology, engineering, and mathematics (STEM) (Lord et al., 2009; Moore, 2006; Museus & Liverman, 2010; Riegle-Crumb & King, 2010). Nationally, only 26% of Black males and 18% of Latino males attain an associate degree or higher, compared to 41% of students overall (Lee & Ranson, 2011). Not surprisingly, there are disparities in high school graduation rates as well. According to Holtzman (2012), in 2010, 52% of all Black males graduated from high school and 60% of Latino males graduated from high school, compared to 78% of White non-Latino males. This Achievement Gap is more drastic when discussing the underrepresentation of Black and Latino male students in STEM. Charles M. Vest, President of the National Academy of Engineering, purports that Black American and Latino American children make up approximately one third of college-age students

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but only 13% of them earn engineering degrees (Fortenberry, Didion, Cady, Jing, & Raghavan, 2011).

A large body of literature documents the need to explore ways to confront the pedagogy of poverty that seeks to maintain the “status quo” of Black and Latino boys by limiting academic achievement with methods of control such as capricious school rules (Haberman, 1991; Majors & Bilson, 1992). To address the underachievement of male students of color, the Research Alliance for New York City Schools calls schools to give Black and Latino boys more voice on campus and culturally responsive education that enables school principals and teachers to confront underlying biases against young men of color (Villavicencio, Bhattacharya, & Guidry, 2013). Even more, Villavicencio et al. (2013) calls for an exploration of how teacher expectations affect the choices of male students of color to enroll in advanced courses. Fortenberry et al. (2011) acknowledge the need for qualitative approaches to study the identity development of minority males and research designs that exploit small sample sizes. Beyond the exploration of identity, Fortenberry et al. (2011) call for the exploration of how elementary and middle school experiences affect the decision of minority males to pursue careers in STEM.

Culturally responsive pedagogy is proposed in the literature as a way to move the needle towards equity in education through social justice. According to Chubback (2010), social justice education involves:

- Curricula, pedagogies, teacher expectations, and interactional styles that improve learning opportunities of underserved groups;
- Transforming of educational structures and policies that reinforce structural inequities; and,
- Empowering teachers to critically recognize school structures that perpetuate injustice.

When teachers are informed by culturally responsive pedagogy, they are equipped with tools needed to properly care for and support the academic success of students to color, thereby transforming social structures that prevent equity in education. Gay (2010) characterizes authentic caring as an outward magnification of a teacher’s social justice framework when she stated:

These elements of caring require confronting some long-held educational conventions and assumptions. [...] Justice based and authentic caring must be an integral part of all students’ entire educational careers, starting when they begin their formal learning journeys in kindergarten classrooms and continuing thereafter. (p. 52)

Theoretical Foundation

Closing the STEM Achievement Gap for Black and Latino males will require teachers to understand of the cultural diversity of students, acknowledge inherent biases that limit the success of minority males, and acquire methods for infusing ethnic diversity in the design and delivery of content. Bartolome (1994) suggests that the “right” teaching strategies incorporate a “humanizing pedagogy that respects and uses the reality, history, and perspectives of students as an integral part of educational practice” (p. 173). Gay (2010) asserts that “the race, culture, ethnicity, individuality, and intellectuality of students are not discrete attributes that can be neatly assigned to separate categories, some to be ignored while others are attended to” (p. 14-15). These considerations are essential to teachers as they craft culturally responsive teaching methods to engage their students.

Culturally Responsive Pedagogy

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In this study, *culturally responsive pedagogy* (CRP) is defined as “using the cultural characteristics, experiences, and perspectives of ethnically diverse students as conduits for teaching them more effectively” (Gay, 2002, p. 106). CRP encompasses five main components:

1. Developing a knowledge base about cultural diversity;
2. Including ethnic and cultural diversity content in the curriculum;
3. Demonstrating caring and building learning communities;
4. Communicating with ethnically diverse students; and,
5. Responding to ethnic diversity of instruction.

There are many foundational theories that preceded the development of CRP, namely culturally relevant pedagogy. Ladson-Billings (2006) discusses the importance of being a culturally relevant pedagogue over instituting culturally relevant pedagogy, which emphasizes the need for teachers to understand the cultural diversity of students as a linchpin to successfully implementing CRP.

Recent studies document attempts to actualize CRP in the classroom. For example, Young (2010) presents a critical case study that chronicles teachers’ attempts to implement culturally relevant teaching (CRT) in the classroom. Though teachers generated personalized definitions for CRT, this study was limited by the teachers’ cultural biases and lack of support from facilitators. Goldston and Nichols (2009) present a photonarrative of the challenges to teaching science from the perspective of Black middle school science teachers. Though the participants agreed on a definition for CRP, the principles were not translated into tangible science practices. Griner and Stewart (2013) developed and analyzed web-based tools that provided schools with ideas for implementing CRP classroom instruction. Though this study documents changes in the participants’ classroom practices, there was no significant change in the teachers’ cultural beliefs based on the Common Beliefs Survey Tool and Teacher Acceptance Model Measurement Scale (Venkatesh & Davis, 2000). Altogether, the literature calls for rich descriptions on how to enhance a teacher’s “culturally responsive pedagogical competence” and methods for the implementation CRP in classroom practice (Gay, 2010, p. 251).

Ethos of Care

The research literature points to caring as a key attribute of effective teachers of Black boys (Jackson, Sealey, & Watson, 2014; Noguera, 2001, 2003; Sizemore, 1988; Weinstein, Madison & Kuklinski, 1995). Should teachers develop tools for implementing CRP based practices without developing awareness and value for the cultural capital of students, all interventions will appear aesthetic rather than authentic (Valenzuela, 1999). Numerous studies highlight the close connection between social support and encouragement from teachers and the academic success of Black and Latino students (Foster, 1997; Ladson-Billings, 1994; Lee, 2000). These studies corroborate the work of Sizemore (1988), who documents the ethos of caring and accountability as imperative for academic success. In fact, academic performance suffers when Black boys believe their teachers do not care (Noguera, 2001, 2003; Sizemore, 1988; Weinstein, Madison & Kuklinski, 1995). Black and Latino boys need more than just different pedagogical strategies for learning science; they need teachers who display culturally responsive caring. Thompson (2004) characterized culturally responsive caring as when teachers “see the world that the children see, and [...] help students develop responses both to cultural difference and to racism [...] and care enough to abandon our [the teachers’] willed ignorance and political blindness” (p. 37). Gay (2010) describes the attributes of caring as multidimensional, multifaceted, and comprising of a myriad of culturally conscious mindsets. In this study, *culturally responsive caring* is defined as “the warm-demanding [...] demeanor of teachers who garner high performance expectations for students as a result of cultivating a sense of kindredness and providing spaces and relationships where ethnically diverse students feel recognized and

respected” (Gay, 2010, p. 51- 75). A teacher who makes decisions based on an ethos of care is more likely to get to know students as individuals and tailor instruction to the needs and culture of students, thereby enabling culturally responsive pedagogy.

Book Clubs

The literature describes the use of book clubs as a context to develop the identity of the participants and knowledge of multiculturalism. Smith (2000) utilized an after-school book club to help middle school female students expand their identity from “good girls,” to “independent, daring, and courageous teenagers” (p. 36). With a focus on multicultural education, Mensah (2009) designed a book club for elementary pre-service teachers to allow them to confront and uncover their biases and assumptions about teaching science to diverse learners. This study prepared teachers for urban classrooms by fostering critical discourse that led to “a-ha” moments regarding connections between science and diversity. In an attempt to increase Nature of Science (NOS) understanding, Griffard, Mosleh, and Kubba (2013) facilitated a book club for first year pre-medical students using two nonfiction works. Participants in this book club increased their NOS understanding based on Views of Nature of Science Questionnaire-Form C administered before and after the intervention.

Book Club in the Current Study

The “Men in STEM” book club serves as the context of this study. Participants self-selected to join this club to learn more about possible careers in STEM, to explore the book *Gifted Hands* by Ben Carson (1992), and to join a learning community of young men. This book club is ongoing and continues to be a place where boys meet regularly to discuss openly their identities and experiences as young, Black men. Though this study does not focus on the direct impact of the book club on the perceptions of the young men, this club serves as a space where the boys can discuss their past experiences in science classes. The purpose of this study is to document the experiences of Black American boys with past science teachers in an effort to understand the attributes of a culturally responsive science teacher from the perspective of the boys. Even more, the curriculum, instruction, and communication within the “Men in STEM” book club were modeled after Gay’s (2010) CRP framework. While interacting with the boys, I served a dual role as researcher and teacher, which provided me the opportunity to better understand the cultural diversity and subject-specific lived experiences of my male students. As an African American science teacher with a bachelor’s of science in biomedical engineering, I am committed deeply to closing the gap in student achievement. This involves uncovering the methods and mindsets of successful science teachers of Black boys as a means of expanding STEM access to all children. The research questions for this study are:

1. *What are the students’ perceptions of the characteristics of a culturally responsive science teacher?*
2. *What is the relationship between the Black American boys’ lived interactions with science teachers and their interest in pursuing STEM careers?*

Methods

Setting and Participants

This narrative was conducted at a public, charter high school located in New York City.

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The high school accepts students from three different middle schools within the school network, or district. The school student population is 94% Black American, 4% Latino American, and 2% Asian American, with 70% qualifying for free or reduced lunch. Students at this New York City public school follow a zero-tolerance weapon policy and a structured merit system. Following the Guns-Free Schools Act of 1994, many schools implemented zero-tolerance policies as an alternative to installing metal detectors in school lobbies to maintain security (Skiba et al., 2006). However, research suggests that these policies may be biased against male students of color who may receive harsher punishments for the same infractions as other students (Caton, 2012; Fenning & Rose, 2007; Thomas & Stevenson, 2009). In the school setting, Black male students earn more than half of the expulsions and suspensions. All of the boys in the study attended a charter, middle school that adopted a similar learning style and culture as the high school.

Of the 120 tenth grade students enrolled in chemistry, 20 male students self-selected to participate in the single-gendered book club entitled “Men in STEM.” To recruit participants, an announcement was made in 10th grade chemistry classes inviting the participants to the book club. As a researcher and teacher, I also engaged participants in a one-on-one conversation to enroll them in joining the club. The book club met once a week for 35 minutes during a study hall block at the school for eight weeks. The boys are not required to attend the book club, but they eagerly looked forward to this gathering every week.

The book club developed in three phases. The purpose of phase 1 allowed the boys to answer the question: *Why is my story important?* During phase 1, the boys read an article from Forbes Magazine entitled, “If I Were a Poor Black Kid.” The purpose of this piece was to reveal to the boys a biased narrative that outsiders sometimes paint of their lived experiences. At this time, I introduced the boys to this narrative study and stated that their experiences may be documented and used as a model for teachers to learn how to teach more effectively in urban communities. All the boys left this conversation excited to write down and discuss their lived experiences with each other, their school community, and those who would read their published narratives. The boys completed a participation waiver as well as the first open-ended questionnaire (see appendix A). The purpose of the first questionnaire was to learn about the demographics of the boys, the degree of their interest in STEM, and some information about their past science teachers in middle school and high school. Once this foundation was established, the book club entered phase 2 where the boys explored the question: *What is my story?* During phase 2, the boys began reading the introduction and first two chapters of *Gifted Hands*, followed by a second questionnaire. The questions in the second open-ended questionnaire were designed after Gay’s (2010) five main components of culturally responsive pedagogy (see Appendix A). The questions were designed to garner open-ended responses about when and how the boys experienced culturally responsive science teaching in their middle school and high school classes. In phase 3, the boys explored the question: *How is your story evolving?* as they read *Gifted Hands*.

The data from the first open-ended questionnaire revealed that the boys in the book club associated with three main attitudes towards STEM careers: (1) some were never interested in STEM, (2) some were interested in STEM college majors, and (3) some had a former interest in STEM. Of all book club participants, three boys were selected during phase 2 to participate in semi-structured interviews. The boys were selected based on two criteria: (1) their lack of success in their current science class and (2) their attitudes towards STEM careers that represented the perspectives in the larger book club group. First, the boys were selected because they all struggled in science courses, as evidenced by their failing science grades on the most recent quarter progress report, 68%, 69%, and 69% respectively. Second, the boys were selected for their answer to the question: *What is your interest in STEM?*

Jerome, the first participant, is a 15-year old student who definitely planned to pursue STEM to become a forensic anthropologist. He loves to sing, dance, and watch mystery murder television sitcoms. K-Shawn, the second participant, stated that he formerly wished to study

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computer engineering but currently wants to pursue a psychology major. He is 17-year old and was retained multiple times in middle school. Lance, the third participant, is a 16-year old. He also wishes to pursue psychology and stated that he was never interested in STEM. Lance is proud of his Haitian heritage and loves analyzing the decisions and persona of historical figures such as Adolf Hitler and Lyndon B. Johnson. It is important to acknowledge that Lance only mentioned learning about white historical figures and has been given very few opportunities to read about the perspectives and contribution of Black American historical figures in his middle and high school course work.

The book club was designed to create a culturally responsive context. The boys and I sat in a circle to facilitate valuing all contributions. Snacks were provided to create a communal and warm gathering place. The “one-one thousand- two-one-thousand” rule enabled boys to self-select who read the text out loud by allowing a few moments of silence between comments as to not cut off speakers. At the end our meetings, the boys shared with a member sitting next to them or the whole group how their life experiences were similar or different than Ben Carson’s story. The boys also reflected on their “a-ha” moments and ideas through weekly, open-ended Google surveys.

Data Sources

The purpose of this study is to capture the worlds that the participants constructed in the form of a story (Bruner, 1986). The primary data source is the main semi-structured interview with Jerome, K-Shawn, and Lance (see Appendix B). These interviews ranged from 35-45 minutes and were organized with open-ended questions geared towards learning the experiences each boy had with each component of Gay’s (2010) CRP framework. The semi-structured interviews were designed like conversations, so the boys would feel comfortable sharing their thoughts and the interview questions were designed from a culturally responsive lens (Merriam, 2009). Additional questions were asked at the beginning of the interview as a means of understanding how the boy’s experiences in science classes shaped their interest in a STEM career. The secondary sources of data were the first two questionnaires that each participant filled out during phases 1 and 2 of the book club. All interview and questionnaire questions asked of the boys may be found in the Appendix B. Throughout the book club, I kept a journal of my interaction with the boys, their comments and contributions during the book club discussions, and their performance in the chemistry class. This journal allowed me to make connections between their written and verbal responses and their disposition inside and outside the science classroom. The triangulation of data from the interview, questionnaires, and field notes allowed for a richer understanding and knowledge of the boys and revealed the underlining components of culturally responsive pedagogy that were missing in their lived experiences in science classes (Guba & Lincoln, 1989). The validity of this study is enhanced by prolonged engagement, as I developed close relationships with the boys as their teacher and club facilitator (Clandinin, 2007). After conducting open, axial, and selective coding of the data, I conducted a final member check semi-structured interview by asking follow up questions to confirm my findings (Guba & Lincoln, 1989; Merriam, 2009).

Researcher Role

First and for most, my role in this context is as a learner because I purposely tried to glean information about the cultural diversity and experiences of the boys. This allowed me to enhance my classroom practice as a teacher, deepen my relationship with the boys as their mentor, and discover my findings as a researcher. My role as the facilitator of the book club is to ensure that each member’s contributions were valued by the other members and to maintain high expectations for how participants speak and listen during the discussions. I facilitate

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conversations by “balancing air time” by encouraging participants who are more introverted to share their thoughts with the group. I also monitor the quality of their responses to the online questionnaires by asking them to provide more detail when their responses are only a single word or sentence. As a Black American female science teacher, I also shared my background and experiences as an underrepresented minority student when I was an undergraduate studying biomedical engineering. I generated field notes from ideas that emerged from each book club meeting and each interview. I then used this information to alter the questions I asked at each subsequent club meeting and during each subsequent interview. Throughout the data analysis, I was mindful of my own lens of analysis and of the reality that the lived experiences of the boys in STEM are multifaceted and ever changing.

Data Analysis

A Grounded Theory Approach was used to generate the themes from the data. In the end, a rich description emerged from the individual and collective lived experiences of the boys. I developed categories in the open coding phase, singled out a central phenomenon, conducted axial coding, and subsequently selectively coded to find relationships between categories (Creswell, 2007). During the open coding phase, all artifacts were read over two times and notes were written describing the essence of the artifact as well as the connections between the artifact and the primary research questions (Bogdan & Biklen, 1982). During open coding, all expressions made by the boys were connected to one or more of the five aspects of culturally responsive pedagogy. This strategy was used to conclude how closely the boy’s description of culturally responsive pedagogy aligned with Gay’s (2002) five culturally responsive pedagogical aspects. The primary categories that emerged from open coding were: culturally relevant content, quality one-on-one conversations with teachers, high academic expectations, feeling singled out, lack of academic rigor, and a sense of feeling ignored by science teachers outside of class. The central code or phenomenon that emerged was the presence of or lack of ethos of care by the teacher. During the open coding phase, I relied on “feedback from the field, [to] redefine [my] research questions as [my] understanding of the culture [deepened], and [noted] meanings that participants [attached] to things” (Goetz & LeCompte, 1984, p. 165). Specifically, the boys discussed their relationship with science teachers as the critical component in their lived experiences in science classes. Consequently, I narrowed the focus of the research questions to the interactions between the boys and their past science teachers. After reading each artifact from start to finish, open codes were assigned to each thought in the interview and survey data. Specifically, for each main thought, a line-by-line analysis was conducted and answering the following two questions generated codes: (1) *What is the sentence about?* and (2) *What core concept or concepts are expressed here?* (Strauss & Corbin, 1990). Axial coding followed, where similar coders were tallied for the number of repetitions, similarities and differences, and codes were organized into main codes and supporting sub codes (Guba, 1978; Strauss & Corbin, 1990). Local terms, or words indicating a common vernacular, were isolated and coded to further unveil the essence of the boys’ experiences. From the axial coding, four main themes emerged. Finally, each artifact was read again to selectively code for evidence to support the main themes.

Limitations

The findings in this study are limited to the quantity of data and time constraints. The boys were initially interviewed during week three of the study when they were at the beginning of stage 2 of the book club discussions. When interviewed, the boys presented vivid stories of their interactions with science teachers, but they were not necessarily able to connect their various stories to conceptualize the degree of their desire to pursue STEM. With each meeting, the boys were able to reflect on their past experiences and make closer connections between their

experiences. In addition, even Lance and K-Shawn, who are currently not interested in STEM, desired to be part of the “Men in STEM” book club and invited themselves to the second meeting without my prompting. The findings presented do not include the possible changes in the attitudes Lance and K-Shawn had towards pursuing STEM careers as a result of participating in the book club. In addition, as a research and teacher, I established close relationships with the participants. However, this dual role may have limited my ability to analyze the data separate from my role as the science teacher. During the first semi-structured interview with Jerome, I found myself shying away from asking questions dealing with race and timidly asking questions that allowed the boys to give me feedback on my interactions with them. Though difficult, I quickly acknowledged and reflected on these biases and made concerted efforts to tackle these challenges directly in all conversations with the boys thereafter.

Findings

The boys discussed four main attributes of a culturally responsive teacher- coined in this study as *S⁴ teachers* for short. These four attributes represent the major themes found in this study. To address the research questions, the boys’ perceived culturally responsive science teachers as those who:

- Provide *support* towards attaining academic achievement;
- Exhibit *steadfastness*, by upholding consistent behavior expectations;
- *See me* by infusing culture into science content and reach out to me through one-on-one conversations; and,
- Initiate *stake in the ground* conversations about STEM careers.

Theme One: Science Teachers who “Support” me in Achieving Academically

When asked about their past science teachers, Jerome, K-Shawn, and Lance all remembered and appreciated when their science teachers held them to high academic expectations while also providing support towards meeting these expectations. In fact, when the boys were not held to high academic expectations, they often lowered their own expectations for themselves.

Lance acknowledged that even though he could not appreciate it at the time, his physics teacher held him to extremely high academic expectations and supported him by assigning difficult homework. When recalling his experience in ninth grade physics, Lance states:

[...] even though we didn’t appreciate her enough for it. Like, she [Ms. Diaz] would give us a lot of homework. Like she has given us the most homework out of all the teachers I have ever had and when we would complain she would just say you are strong Black children who like compared to other Black children who are not doing this... you are showing them that they can actually do this and to show society that if you give us the opportunity we will be able to do it. I think she gave us the opportunity. (Lance, personal communication, December 5, 2013)

Holding boys to high expectations requires both communicating those expectations and following through. Currently, Jerome and K-Shawn are failing 10th grade chemistry with less than a 70%. Both boys acknowledged that they need more support from me as their teacher. When comparing his experience in ninth grade physics to this academic year, K-Shawn states “[...] what Ms. Diaz did, she kept me after school and see where I am at with my exit ticket. My exit ticket scores are kinda low [this year]” (K-Shawn, personal communication, December 6, 2013). K-Shawn does

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not want me to lower the bar of excellence for him. In fact, K-Shawn takes full responsibility when he does not succeed. With resolve, he stated, “If anything, if I don’t understand the work, it is because I am not putting my hardest into the work.” What K-Shawn envisions of his science teachers is someone who is willing to check in with him and willing to take a stand and create interventions like after school study hall when he falls short of excellence. Jerome echoes this statement when he declared that what he needs to be successful is “encouraging me at times because at times I don’t feel encouraged because I know I am doing bad and I say she didn’t say anything [about turning in homework] so I am going to leave [my homework undone] at home. That is not a good attitude, but I do it” (Jerome, personal communication, November 27, 2013). Rather than interpreting his off task behaviors as being disinterested, Jerome states that he needs “more rigorous work. Because after a while you learn something and people are going over things and then you start talking to other kids. And then you get a demerit [detention] and it’s like you were talking” (Jerome, personal communication, November 27, 2013).

As shown above, the boys value teachers who do not lower the bar for academic success. On the contrary, they call for culturally responsive science teachers who provide supports in the form of after school tutoring, challenging homework, encouraging words, and differentiated classwork to assist them in reaching their highest possibility. In fact, the boys revealed that when their teachers lowered the bar of excellence, they mirrored this sentiment and lowered the bar of excellence for themselves. Jerome mentioned the outcome when his ninth grade physics teacher failed to consistently provide support for his academic achievement. The result was that Jerome failed science exams and entered the next grade without learning important science content.

He did actually push me because it was not academically but behaviorally [...] I never used to do his homework and he would never shout me out or ask why I did not do his homework because first of all I don’t think he ever graded the homework and um and I used to get bad grades on his test but I passed his class. And I was like what. And even though I wasn’t proud of myself, I didn’t care because I was like I passed his class. (Jerome, personal communication, November 27, 2013)

Theme Two: “Steadfast” Science Teachers who Uphold High Performance Expectations

Similar to academic supports, the boys called for culturally responsive teachers who walk the tight rope of holding a high bar for student character while also wiping the slate clean when students learn from their breaches in character. Jerome described this steadfast approach to coaching students on character when he conveys appreciation for his favorite elementary school science teacher.

Even though we had times; we had our bad situation [...] And that didn’t feel good all the time. [...] Because a lot of the time if you have a relationship with the teacher, they actually like single you out because they have so much expectations for you. They like to be hard on you. So she did that a lot and I mean. That is a good thing for me. Right now. Before it wasn’t. (Jerome, personal communication, November 27, 2013)

In hindsight, Jerome is appreciative that his science teacher was steadfast about her expectations for his behavior. On the other hand, Lance experienced science teachers who did not consistently hold him to high expectations.

I think they [middle school science teachers] always had a pre-determined way they saw me... like... like the teacher Ms. Ross... like I think she always saw me

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as a trouble maker or always up to something and I am like... I am not even doing anything. I remember some teacher... I mean some student was asking something... I think she asks what does Neanderthal mean and I was like giving the sign of a human who was in the past who has a lack of knowledge and stuff and she [Ms. Ross] automatically thought I was calling her [the student] dumb. And I was like if you just let me have the time to explain to you or if you give me the benefit of the doubt that I was trying to tell the truth that I wasn't calling her dumb ... I just got in trouble. (Lance, personal communication, December 5, 2013)

Even when Lance tried to contribute positively to classroom conversations, his teachers' mindset prevented Lance from feeling welcomed and supported in the classroom. K-Shawn noted that at times, it appears that when teachers hold high expectations for achievement, the boys may, at times, perceive this care as a method of control. This form of management does not support the boys, as the experience is of the teacher watching the students for faults. When asked how science teachers may care more about you, K-Shawn notes "I mean they all care. I don't see any problem with it. I don't want them to care too much because then they are just watching me too much. I don't like that." Similarly, Jerome discusses similar experiences of when teachers focus in on a student's achievement, when he says "Because a lot of the time if you have a relationship with the teacher they actually like single you out because they have so much expectations for you. They like to be hard on you." Culturally responsive science teachers must navigate a delicate nuance between zoning in on students to support their achievement without exploiting high expectations as a method of controlling student behavior.

Theme Three: Science Teachers who "See me"

The boys in the study called for science teachers who balance both truths, which are teachers who hold high expectations for achievement and form authentic, lasting relationships with their students. Unfortunately, most boys remember having little or no contact with science teachers outside of class. When reminiscing about his middle school science teachers, Jerome stated, "All of them were okay. I mean they... outside of class... it was hi or bye. Or if it was my birthday. What are you doing? It wasn't like they said their life story to me and I said my life story for them and we were just close. It wasn't things like that" (Jerome, personal communication, November 27, 2013). K-Shawn describes his relationship with science teachers as "Um... it was just hi and bye. Respectful" (K-Shawn, personal communication, December 6, 2013). Lance's experiences echo those sentiments when he said "I have only seen science teachers in class. I would just go to their class and just leave. That's about it" (Lance, personal communication, December 5, 2013). In fact, the questionnaire data reveals that 13 of the 20 participants in the "Men in STEM" book club experienced one or less science teachers who had conversations with them outside of class.

Reaching out to have one-on-one conversations with boys is not enough. The boys call for culturally responsive teachers who seek to understand and implement culture into the science classroom. The boys' interest in pursuing STEM was tied to their experiences with the infusion of their culture in science content. Lance, who has no interest in a STEM career, experienced an instance in middle school science class when his culture, specifically his religious beliefs, were criticized and secluded from the science classroom. "So we would be taught about evolution and then the first thing even before we even be taught the weeks of coming instruction they would be like keep that religion out of this and regardless of what your faith is this is what is right" (Lance, personal communication, December 5, 2013). This is significant because cultural identity extends beyond race identity to incorporate one's gender, religious beliefs, socioeconomic status and other identifying characteristics. This teacher criticized and devalued part of Lance's cultural

identity, which is counter to the goals of culturally responsive caring. Lance's only other memorable experience where science learning was contextualized to explain his lived experiences was when he explored the kinematics of a basketball thrown at a net in his ninth grade Physics course. However, he admits that teachers have never infused his cultural background as a Haitian American.

K-Shawn only remembers two instances where his lived experiences were infused in science content, which included making bread in elementary school science and learning about the mechanics of roller coasters in ninth grade physics. He notes, "It [learning about the mechanics of roller coasters] taught me how things were running for the roller coasters and what people have to do to build those things and I thought it was really fascinating because all those people have to do a lot of math work in order for the rides to actually work and function" (K-Shawn, personal communication, December 6, 2013). It is important to note that K-Shawn viewed scientists as "those people," who are separate from his background or experience. Infusing culture into science content must be done in such a way to empower students to feel like they are members of the scientific community and capable of gaining access to STEM professions. K-Shawn struggled with passing high school physics, which reinforced his mindset that he should not pursue a STEM career. In fact, before ninth grade, K-Shawn was still open to a STEM career. His decision to pursue psychology was solidified while taking an advanced ninth grade New York State (NYS) Regents Physics course. K-Shawn failed the NYS Regents in ninth grade with a score of 63%, two percentage points away from passing. This is a significant accomplishment for a ninth grade student because students generally enroll in Regents Physics during the junior or senior high school years after passing the NYS Regents Chemistry, Earth Science, and Living Environment courses. In addition, in 2003, only 47% of small-sized New York City schools offered a Regents Physics course (Kelly & Sheppard, 2010). Further, the 2012 statewide pass rate on the NYS Physics Regents was 68% (Evans, Gebeloff, & Scheinkman, 2012). Overall, K-Shawn's conceptualized his experience in high school science as one of struggle and failure, which in turn shaped his perception of scientists as an exclusive community where he did not belong.

On the contrary, Jerome's interest in a career as a forensic anthropologist was enhanced by rich experiences with culturally responsive science learning. In fifth grade science, Jerome recollected a class project where he had an opportunity to "look up where we descended from or where we came from and how many earthquakes happened there. My grandma is from Trinidad and my great grandma is Venezuelan. I like to learn about where I associate from and so forth." (Jerome, personal communication, November 27, 2013). Unfortunately, 16 of the 20 book club participants recalled none or only superficial experiences where their lived experiences was infused in science learning. I refer to superficial experiences as those where students recalled teachers telling funny jokes in science class.

Theme Four: Science Teachers who Facilitate "Stake in the Ground" Conversations

The boys' degree of STEM interest is closely connected to the nature of the one-on-one conversations they had with science teachers. Lance only remembers having extensive conversations with a science teacher, Ms. Ross, who viewed his behavior as a hindrance to his learning. Lance recalls not making the best choices regarding his behavior outside of class in middle school and recalls his science teacher reinforcing this behavior in class. "If she saw me in detention a lot she would be like ... 'Oh, if you want to get in trouble all day and get detention all day then you don't deserve help in class'" (Lance, personal communication, December 5, 2013). Lance's middle school science teacher isolated him from being a full participant in science class.

K-Shawn, who had a former interest in STEM, recalled his one-on-one conversations with STEM teachers focused specifically on helping him avoid academic failure. When describing the support he received in eighth grade algebra, K-Shawn remembered that "He [his

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eighth grade math teacher] would take a handful of scholars. Like whoever was failing the class at first would have to stay after class and they would try to review some work. So it was like a study hall session basically. So like he would do that and that is where I got my growth from there and that is how I improved.” K-Shawn’s experience in ninth grade Physics mirrors this experience. When describing Ms. Diaz, K-Shawn admits, “So anytime we had rapid dismissal, she would really leave me after school. Like...it would just be me and her sometimes. And if you are not really finished or I am still not getting the work or anything, she would keep me after and she would help me out with this work” (K-Shawn, personal communication, December 6, 2013). K-Shawn interpreted out of class conversations with STEM teachers as reactive attempts help to him avoid failure. K-Shawn is an advanced mathematics student who successfully passed the NYS Algebra Regents in middle school. In addition, K-Shawn was two percentage points from passing the NYS Physics Regents exam, a test that many high school seniors cannot pass. In fact, K-Shawn interpreted failure as what others would consider academic success. It is possible that K-Shawn may have interpreted this experience of failure differently if STEM teachers had interactions with him outside of class that did not strictly involve remediation of learning objectives.

Jerome, K-Shawn, and Lance’s interactions with science teachers differed significantly in experiences with stake in the ground conversations. The differences in these experiences are highlighted below (Figure 1).

	Jerome (Interested in STEM)	K-Shawn (Formerly Interested in STEM)	Lance (No Interest in STEM)
No communication with most science teachers outside of science class	X	X	X
One-on-one conversations with at least one science teacher outside of class	X	X	
Discussed STEM careers with at least one science teacher outside of class	X		

Figure 1. One-on-One Conversations with Science Teachers

At stake in the ground conversations, science teachers positively acknowledge a student’s academic achievements and directly connect a student’s academic capabilities to a career in STEM. Lance, along with 14 of the 20 boys in the “Men in STEM” book club, never experienced a stake in the ground conversation with a science teacher. K-Shawn’s only stake in the ground conversation occurred with Ms. Diaz, his ninth grade physics teacher during freshman orientation.

I think she just told me at the beginning of the year when we had first started orientation. She had pulled me aside and said I saw that you were somewhat

interested in mechanical engineering and she would give me a few pointers about it. I can't really remember the pointers. But she had gave me some pointers about it. And she said she had done that in college and when we got the class and we had did it I said I am not really interested. (K-Shawn, personal communication, December 6, 2013)

The timing of this conversation is significant, as Ms. Diaz never again mentioned a career in STEM to K-Shawn during the numerous conversations she had with him during one-on-one tutoring sessions. This left an impression on K-Shawn that because he struggled with physics, he should consider a career outside of STEM.

Jerome's conversations with his elementary school science teacher truly reflected a stake in the ground conversation. His elementary science teacher, Ms. Gehr, had conversations with Jerome encouraging him to succeed academically. Even more, Ms. Gehr, reached out to Jerome multiple times outside of class to meet Jerome's family and had explicit conversations about STEM careers.

She actually took me out of school a few times. She got to know my mother and my family. [...] Because a lot of the time if you have a relationship with the teacher, they actually like single you out because they have so much expectations for you. They like to be hard on you. So she did that a lot and I mean. That is a good thing for me. Right now. Before it wasn't. And so she, we grew a close bond. She was the one who helped me pursue the um the profession that I want to pursue. And I used to ask her a lot about biology and psychology and um things like that because she took majors like that in college and she actually started to explain it to me and it started to become more of a one-on-one thing and it was actually eye opening to me. (Jerome, personal communication, November 27, 2013)

Discussion and Implications

The findings from this study build a comprehensive vision of a culturally responsive science teacher from the perceptions of Black American high school boys. Specifically, the boys in the study call for science teachers who: (1) provide *support* towards attaining academic achievement, (2) exhibit *steadfastness* by upholding consistent behavior expectations, (3) *see me* by infusing culture into science content and reach out through one-on-one conversations, and (4) engage in *stake in the ground* conversations about STEM careers. The overall structure of the book club and theoretical foundation of this study support the need for a paradigm shift in science teacher preparation and professional development to build teachers' culturally responsive pedagogical practice as a linchpin to successful teaching. This study challenges the notions of pedagogy of poverty, where teachers do not support boys of color with academic risk taking and do not provide opportunities for boys of color to engage in the intellectual activity in a classroom (Haberman, 1991). The previous discussion presents the findings in three specific points: (1) authentic caring garners the science achievement of Black boys, (2) successful science teachers of and Latino boys engage in stake in the ground conversations rooted in asset based mindsets, and (3) teachers must seek to understand the culture of Black and Latino boys when planning science curriculum.

The results of this study demonstrate that boys who develop authentic relationships with science teachers outside of school are more academically successful. Jerome was spot on when stating that " [...] if you have a close relationship with the person outside of the professional environment then inside the professional environment you're more likely to succeed because if ... let me give you an instance. There are a few teachers I haven't been cool with inside of school

and outside of school I really didn't like them so it's like... I don't really want to be in their class" (Jerome, personal communication, November 27, 2013). Jerome and K-Shawn both described instances where they were inspired to achieve academically when a science teacher spent numerous hours in one-on-one conversations with them. The literature shows that when teachers provide social support for Black American boys, they are more likely to succeed academically (Foster, 1997; Ladson-Billings, 1994; Lee, 2000). The interactions between Black American boys and science teachers must stretch beyond providing help with understanding science content. Jerome's interaction with Ms. Gehr reflects the transformative power of science teachers when they engage students in "stake in the ground" conversations. "Stake in the ground" conversations are initiated by teachers who have asset based mindsets about the academic capabilities and cultural capital of student. Specifically, in a "stake in the ground" conversation, a teacher exhibits culturally responsive caring by forthrightly recognizing a child's STEM aptitude and recommending the child consider careers in STEM. Conversely, Haberman (1995) asserts "academic performance suffers when Black boys believe their teacher does not care" (p. 778).

This study reveals that interest in STEM is directly related to the level of care that Jerome, K-Shawn, and Lance experienced in their lived interactions with science teachers. Lance's interactions with science teachers reflected the opposite of culturally responsive caring. In contrast to Gay's (2010) description of caring, Lance's past science teachers reinforced long standing assumptions and the culture of poverty by equating Lance's potential success in science to his level of behavioral compliance. Lance has no memory of a science teacher making him feel recognized and respected and has no interest in pursuing a career in STEM. Though K-Shawn had a former interest in STEM, his curiosity diminished after repeated experiences where science teachers invited him to office hours to prevent him from failing. Though these teachers prevented his academic failure, they did not cultivate a space where K-Shawn felt recognized for STEM related talents. Jerome's love for science and interest in STEM is due in part to Ms. Gehr's authentic caring. This teacher directly challenged the "pedagogy of poverty" mindset by making Jerome feel successful in science class and capable of success in a STEM career (Haberman, 1991).

The findings indicate that building a teacher's culturally responsive pedagogical competence will require renewal of the mind and practice. Engaging in "stake in the ground" conversations with Black American boys will be unsuccessful unless science teachers possess sociocultural consciousness and are able to uncover their own biases. When describing star teachers, Haberman (1995) denotes 14 key attributes of successful teachers of children in urban poverty, which include persistence and approach to "at risk" students. At the root, Haberman describes a star teacher's approach as "bearing the primary responsibility for sparking students' desire to learn" (p. 780). Young (2010) documents unsuccessful attempts of researchers to support teachers with implementing culturally responsive pedagogy. What these teachers lacked are asset-based mindsets about the potential of all students to learn regardless of background or ethnicity. Milner (2009) describes examples where teachers lacked conceptual repertoires of diversity or positive mindsets about students of color and the result was a null curriculum or one that lacked engagement and rigor. On the contrary, Jackson, Sealey-Ruiz, and Watson (2014) document findings from a study where mentors of young Black and Latino men displayed an ethos of care. Consequently, the male students embodied positive dispositions towards life and eventually became positive mentors for others in their communities. Further studies are needed to explore how to coach and build the capacity of pre-service and in-service teachers to have authentic stake in the ground conversations that reflect care and persistence.

As the chemistry teacher and the primary researcher, I developed close relationships with the boys who participated in the "Men in STEM" book club. Therefore, by using narrative analysis in the form of gathering personal stories, I acquired knowledge about the boys and the meanings they made of their past and current lives related to science learning. This book club provided a context by which I could accomplish the first component of Gay's (2010) culturally

responsive pedagogy framework, which is to understand the cultural diversity of students. The boys provided a rich description of their ideal science learning experience, which enabled me to reflect on my classroom practice as a chemistry teacher. In addition, I interwove their narratives on science with my own narrative as a developing science teacher (Huber & Whelan, 1999). Specifically, though I have talked a lot about the achievement gap in science education in my classroom, I have not taken purposeful steps to get to know and include the cultural experiences of my students when planning my chemistry course curriculum. Furthermore, it is not a coincidence that Jerome, K-Shawn, and Lance are failing my class. Until this study began, I had never had a stake in the ground conversation with them. There is a need to further develop the structure of the “Men in STEM” book club in order to document how participation in this community of learners influences the decisions of Black American boys to pursue STEM and succeed academically in high school science classes. In addition, the boys in this study confirm the need for descriptive models of how to actualize culturally responsive pedagogy in the science classroom. All boys requested a desire to see their out of school lived experiences and cultural identity infused in science learning.

Conclusion

The achievement gap for men of color in the STEM fields reflects a need to incorporate CRP based practices in science teaching and learning. In addition, further studies are necessary to document how to situate CRP based practices, garner STEM interest, and facilitate “stake in the ground” conversations with men of color. Otherwise, the literature will continue a “shoulda, woulda, coulda” conversation about what we wish we could have taught men of color in science education. Likewise, it is a tragedy to listen to Lance and K-Shawn’s stories of the interactions they “shoulda, woulda, coulda” had with science that resulted in their lack of interest in STEM. This narrative study shows how science teachers who show an ethos of care, by having “stake in the ground” conversations with students, provide gateways into the STEM pipeline. The “Men in STEM” book club provided a context to: (1) understand the cultural diversity of Black American boys, (2) demonstrate caring, and (3) foster “stake in the ground conversations” for all boys. A paradigm shift is needed to build “culturally responsive pedagogical competence” in pre-service and in-service science teachers (Gay, 2010, p. 251). The boys in this study were inconsistent in their remarks about whether it was necessary to infuse their culture in the science classroom. However, Jerome’s transformative experience with this 5th grade earthquake project is a salient example of the enhanced experience boys will have in science classrooms if they feel valued and their cultural, lived experiences are incorporated into the learning process. In fact, the other boys in this study may not see the value of infusing their culture in the classroom because they lack this lived experience. This study reveals that culturally responsive caring is the key ingredient in the secret sauce of culturally responsive science teaching and has the potential to garner Black boy’s interest in STEM careers.

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Appendix A

Questionnaire #1: What is my story?

1. What is your ethnicity or race?
2. Describe your past science teachers. Describe science teachers from K-10th grade.
3. Who was your best science teacher in life?
4. Describe your teacher. What did he or she look like?
5. Who was your worst science teacher in life? Describe your teacher. What did he or she look like?
6. Where did you attend elementary school?
7. Did you take science classes every day in elementary school?
8. Where did you attend middle school? Did you take science classes every day in middle school?
9. How would you categorize your desire to pursue STEM in college and as a career?
10. Are you interested in studying STEM in college? Explain why or why not.
11. Did you enjoy your middle school science classes? Why or why not?
12. Do you enjoy your high school science classes? Why or why not?
13. Do you have family members who in the STEM field? If so, describe what they do in their profession.
14. Are you good at science? Why or why not?
15. Can you be yourself in science classes? Why or why not? When can you be yourself in science class?
16. What would you want to change about science class?
17. What was your favorite science lesson this year? Why was your favorite lesson?
18. What was your least favorite lesson this year? Why was your least favorite lesson?
19. Why is it important to study science in high school?
20. Do your parents encourage you to succeed in science classes in high school? Why?
21. Do your parents encourage you to study STEM in college? Why?
22. What is your intended college major? What is your dream job? How did you choose this major?

Questionnaire #2: What Are My Past Interactions with Science Teachers?

1. What is your name?
2. Did your middle school or high school science teachers try to get to know you as a person outside of class?
3. In your own words, describe in detail what a "culturally responsive" science teacher looks like.
4. What are the qualities of a good science teacher?
5. How did your middle and high school teachers incorporate your culture into the science classroom?
6. How would you like your science teachers to incorporate your culture into the science classroom?
7. Would you like your science teacher to talk about the impact of science on race, society, history, and hegemony (power)?
8. In what ways did your middle school and high school science teachers have high expectations for your achievement? Please tell specific stories.
9. In what ways did your middle school and high school science teachers not hold high expectations for your achievement?
10. Describe how your science teachers can create a more caring learning environment.
11. In what ways would you like your science teachers to hold you to higher expectations for your achievement?

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12. Do you feel like you can be 100% of yourself in science class? Why or why not?
13. How can science class be improved so you can be yourself in the classroom?
14. How does communication in science class differ from the ways you communicate with friends and family?
15. What would you change about science class?
16. What are some classroom routines you would like to change in science class? Why?
17. What routines or things do you do in science class every day that makes learning easy and fun?
18. Have you had any experiences where race or ethnicity impacted your success in science class? Please explain.
19. Why are you participating in the Men in STEM book club?
20. Looking into the future, how will you be different as a result of participating in the book club?
21. Have you had a past teacher get you excited about student STEM (science, technology, engineering, and mathematics) in college? What did that teacher do that made you hype?
22. Categorize your interest in pursuing a career in STEM.

Appendix B

Semi-Structured Interview Questions:

Developing a Knowledge Base about Cultural Diversity

1. How did your middle school science teachers sought to get to know you as a person?
2. How has your high school science teachers sought to get to know you as a person?
3. Did you interact with your science teachers outside of class? Do you have a desire to interact with your science teachers more outside of class?
4. Does your response differ based on the race or ethnicity of the teacher?

Including ethnic and cultural diversity content in the curriculum

1. How did your middle school science teachers incorporate your culture into the classroom?
2. How did your high school science teacher incorporate your culture into the classroom?
3. How would you like your high school science teachers to incorporate your culture into the classroom?
4. How did your middle school science teachers talk about the relationship between science and society? This could be by discussing issues of race, historical atrocities, and hegemony?
5. Would you like your science teachers to talk about the impact of science on race, history, and hegemony?

Demonstrating caring and building learning communities

1. In what ways did your middle school science teachers have high expectations for your achievement?
2. In what ways did your high school science teachers have high expectations for your achievement?
3. In what ways did your middle school science teachers not have high expectations for your achievement?
4. In what ways did your high school science teachers not have high expectations for your achievement?
5. In what ways would you like your science teachers to build a more caring classroom environment?
6. In what ways would you like your science teachers have higher expectations for your achievement?

Communicating with ethnically diverse students

1. Did you feel that you could be yourself in middle school science classes? Do you have a voice in science class?
2. Did you feel that you could be yourself in high school science classes? Did you feel that you could be yourself in middle school science classes?
3. How do the teacher and students communicate in middle school science classes?
4. How do the teacher and students communicate in high school science classes?
5. How does communication in science class differ from the way you communicate with friends and family outside of school?

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6. How can communication in science class be altered to incorporate the authentic ways you communicate outside of school?

Responding to ethnic diversity in the delivery of instruction. (employs the other components)

1. What activities / classroom routines do you do habitually or repeatedly in high school science class that are fun and help you learn?
2. What activities / classroom routines did you do habitually or repeatedly in middle school science class that are fun and help you learn?
3. What activities / classroom routines do you do in science classes help you learn but are not fun?
4. What are some activities/ classroom routines would you like to do in science class on a daily basis that would help you learn better?
5. What would you not want to change about science class?
6. What would you like to change about science class?
7. Did the race or ethnicity of the teacher impact how comfortable you feel in the teacher's classroom and how successful you are?