CrossMark

Understanding Black Male Mathematics High Achievers from the Inside Out: Internal Risk and Protective Factors in High School

Ebony O. McGee · F. Alvin Pearman II

Abstract The gendered and racialized narrative of Black male adolescents in urban spaces is one often fraught with deficit-based assumptions and presuppositions about their abilities, competencies, and proclivities with regard to schooling in general and mathematics in particular. Yet despite these conventional beliefs, compounded by the dearth of Black male representation in many STEM-related careers, there remain Black male adolescents who, during their high school years, nevertheless achieve a high degree of mathematical success. This study endeavors to unpack the internal, interrelated processes and strategies through which a cohort of 13 high-achieving, Black male high school students develop positive mathematical, social, racial, and gendered identities. Drawing on narrative analysis, we utilized semi-structured interviews to identify and explore how internal protective and risk factors operated in their lives. Results identify not only several coping strategies, beliefs, practices, and habits that foster positive mathematical identity trajectories for our respondents, but also several internal challenges that Black male adolescents must successfully negotiate both in- and out-of-school throughout the attainment process. We also discuss how these findings relate to in-school practices that might promote and sustain Black male achievement in high school mathematics.

Keywords Resilience · Black males · High school · Internal factors · Mathematics · Agency

E. O. McGee (✉) · F. A. Pearman II
Department of Teaching and Learning, Peabody College, Vanderbilt University,
PMB 230 GPC 230 Appleton Place, Nashville, TN 37203, USA
e-mail: ebony.mcgee@vanderbilt.edu

F. A. Pearman II
e-mail: alvin.pearman@vanderbilt.edu

🖄 Springer

Introduction

Within an America milieu besmirched by historical and contemporary inequalities that delimit the economic, political, and social trajectories of Black males at nearly every stage of life (Spencer 2006), researchers have asked myriad questions pertaining to why and through what processes Black males are exiled to the margins of many of our nation's institutions. Since practitioners, researchers, and policy-makers—indeed the public writ large—construe schooling as the arbiter of social and economic mobility, particular attention and has been paid to the policies, theories and practices that shape Black male (dis)engagement within the educational system (Martin et al. 2011; Milner 2010; Noguera 2005, 2008). Moreover, concerning the growth and prominence of the science, technology, engineering, and mathematics (STEM) fields in the twenty-first century, researchers have increasingly concerned themselves with the ways in which STEM education has systemically disserved Black males (Ferguson 2001; Martin 2009; Sabochik 2010; Varley-Guitierrez et al. 2011), not the least of which relating to difficulties of retention and the paucity of significant participation (Malone and Barabino 2009).

However, narratives about the underachievement and underrepresentation of Black male students within STEM fields constitute but one dimension of a larger narrative encompassing Black male persistence, sustenance, and resilience in the face of acute, chronic, and structural adversity. These narratives of STEM success and triumph represent an important and growing thread of research that speaks to the racial, masculine, and academic trajectories of Black males at various life stages (Harris et al. 2011; Tyson et al. 2005). Importantly, located within these growing narratives of Black male high achievers is a struggle to develop and maintain a robust academic identity within the context of being true to one's racial and masculine identity (Fries-Britt and Griffin 2007; Harris et al. 2011). Yet there remains a shortfall in research concerning the constellation of internal factors that support as well as challenge the healthy identity development and academic trajectories of Black males *during their high school years*. Building, then, from an earlier paper in which we outline the trajectories of these same high-achieving Black males during their kindergarten through eighth grade experience (McGee and Pearman 2014), the purpose of the present paper is to offer an account of the internal risk and protective factors that influence the racial, gender, and academic trajectories of the same group of mathematically high-achieving Black males during their next transitional stage: high school. The enduring aim of this paper is to contribute to a growing literature on Black male strength and achievement amidst inequities of access and opportunity, while providing an account of Black male achievement that collectively defies "racist societal views of their own competence and worthiness and that of their families and communities" (Delpit 2012, p. xix as quoted in Terry and McGee 2012).

This article begins by exploring the Black male achievement literature, focusing on mathematics achievement during high school. Next we unpack the intersection of race and gender within the context Black male mathematics achievement. Then we discuss the utility of the phenomenological variant of ecological systems theory (PVEST) for conceptualizing internal risks and protective factors while also

discussing how PVEST offers a framework to explore stage-specific outcomes and identity development processes. Next, after outlining the methodology, we operationalize PVEST to explore the life histories of thirteen, high achieving Black male high schoolers.

Literature Review

There are a relatively few but growing number of studies that have highlighted mathematics achievement within and across the experiences and narratives of Black male high school students. McGlamery and Mitchell (2000), in their study of African American males in predominantly White, upper-level, high school mathematics classes, conferred that it was the Black male students' strong rapport with teachers that made it possible for them to be active participants in the classroom. This stimulated positive student–teacher interactions, allowed the students to ask higher-level questions, and supported positive social interaction among students. Likewise, Walker's (2006) investigation of the mathematical experiences of high-achieving, Black and Latino/a mathematics students at an urban high school reported the role of supportive peer, ethnically affirming networks that assist in reinforcing students' mathematical achievements. These high-achieving students also spoke of extensive networks of teachers, parents, and siblings who supported and even served as mathematics tutors in support of their mathematical excellence. Using a case study methodology, Thompson and Lewis (2005) concluded that Malik, a mathematically talented Black high school male, was successful, in part, due both to his enrollment in advanced mathematics courses and the availability of role models. Thompson and Lewis (2005) discussed the limited access many African American students have to advanced mathematics courses, which is problematic when one considers the relationship between high school mathematics and science-related course enrollment and college major attainment. Mathematics and science-related abilities often include skill sets that are in high demand, such as the ability to analyze, investigate, and problem solve, which are gaining more currency in both the STEM and the non-STEM marketplace. Analysis of key themes suggest high-achieving Black male students make use of powerful family and peer networks as well as various features of the school and classroom environment in the course of maintaining consistent mathematics achievement (Marsh et al. 2012; Maton et al. 1998; Reis et al. 2004; Terry and McGee 2012).

Although these studies add considerable volume to our knowledge of factors that aid in mathematics identity development in Black males, they primarily showcase the importance of external influences such as parental support, the availability of advanced placement mathematics classes, and culturally affirming networks. Less investigated is the role of internal features and their impact on mathematics identity development in Black male students. In one recent study of twelve mathematically high-achieving Black males in high school attending four urban charter high schools, Terry and McGee (2012) not only discussed external supports such as involvement in extracurricular activities, but also highlighted the role of internal supports such as agency and self-efficacy in sustaining Black male mathematics

success. Agency, self-efficacy, determination, stress, and anxiety are critically important in the moderating of one's behaviors and in the sustaining of one's actions. Moreover, to the extent that it is consequential for students to contemplate and integrate into their own identities factors including attitudes, values, standards it becomes paramount to understand precisely which of these internal factors and the ideal constellation thereof can promote high achievement in mathematics for Black males. We realize that internal meaning making and subsequent processes are impacted by external factors and influences. However, identifying and naming internal factors involved in Black males' mathematics identity development can afford vital insights for how practitioners and policymakers can better promote and sustain Black male success in a discipline in which Blacks typically face deterring encounters (e.g., stereotypes, teacher bias, lack of role models). Next, before discussing the tenets and utility of the PVEST, we briefly discuss how we conceptualize masculinity, and the ways in which Black males internalize and make meaning of their own masculinity.

(Re)defining Masculinity

Building from a long line of inquiry and theorization, we submit that masculinity is socially constructed by a racial, economic, and gendered order. By social construction we mean that the various significations of masculinity are socially derived. For instance, despite that Black males might be considered as marginal beneficiaries of an overarching privilege levied to males across society (Neal 2006), Black males remain on the periphery of a neoliberal economic and a white racial system that structures, informs, and limits various forms of gender expression (Brown 2011; Hunter 2010). These expressions of masculinity, which are themselves rooted in the subversive precepts of American racial logic, are often assumed to be arranged hierarchically with White, middle-class, heterosexual, non-disabled, thin men seen as the ideal embodiment of masculinity. This standard includes intellectual aptitude, superior ability, strength, virility, affluence, and bravery, to name a few attributes (Omar 2011). These broad ideals become problematic not simply for their inherent racialized nature, but also in contrast to what some scholars have noted as a collective funneling of Black masculinity. According to Neal (2002, 2006), that Black males encounter and navigate rigid, normative expectations of self-expression, promulgated through a diverse array of media outlets, obscures or otherwise conceals the heterogeneity of Black masculinity, rendering invisible or unnoticed forms of maleness that challenge conventional Black male gender scripts.

In the absence of narratives that highlight transformative features of Black masculinity, several scholars have examined how certain dimensions of Black masculinity that are often misunderstood in academic and media outlets alike are in fact highly functional when one privileges the context in which masculinity is enacted and/or "performed." Spencer (1999), for instance, in investigating how masculine behaviors influence Black males' schooling trajectories, found that Black males viewed their behaviors as an effective way to generate respect outside classroom settings. Other research further confirms that as Black male students

navigate settings both in- and out-of-school, some young Black men appear to be preoccupied with very real threats to their lives, manhood, and families to such an extent that success in school may at times take a back seat to issues of survival (Harris et al. 2011; Majors and Billson 1993; McGee 2013; Wright 2008). In light of the challenging environments that Black males often traverse, one derivative of masculinity that has gained increasing attention is hypermasculinity, which has been described as a vulnerable attitude or a preference for risky or aggressive behavior (Spencer et al. 2004) and has been typically associated with Black males from a deficit perspective. Hunter and Davis (1994) define hypermasculinity as

> [H]yperaggressiveness, hypersexuality, excessive emphasis on the appearance of wealth, and the absence of personal accountability, as a dominant conception of manhood in poor inner-city communities, particularly among youth, is seen as a by-product of the pathology and despair of the "Black underclass." (p. 23)

The complicated mix of racial, gendered, and stereotyped encounters makes Black masculinity a misunderstood and difficult behavior for researchers to explore (Swanson et al. 2003). A primary result is a corpus of theoretical and empirical work that depicts African American men as an especially embattled, vulnerable, and aggressive group. Building from and, in certain ways, critiquing this previous work, we refer to masculinity simply as a performative coping strategy to ensure one's well-being (Thomas and Stevenson 2009). As we will indicate, these processes of coping include adapting and modifying their presentations of self, through internalizing, resisting, and remaining conflicted about Black male gender scripts (Howard 2012).

Theoretical Framework

The intersectionality of race and gender is an important phenomenon for researchers to consider when unpacking the ways African American male high school students learn and succeed in mathematics, and how they experience life in their urban environment (Berry 2008). Because African American male students live varied lives within unique contexts, and since students in general are strongly influenced by their affiliation with a particular racial or ethnic background (e.g., Hispanic, African American, Asian American, etc.), place of residence (e.g., urban, suburban, or rural), and belonging to a particular cultural or subcultural group (e.g., rapper, athlete, or disabled; Cross and Vandiver 2001; Majors and Billson 1993; Seaton et al. 2010), we sought a complex framework flexible enough to account for participants' environmental and contextual situations. Equally important in our attempt to understand the challenges endured by these African American males is their meaning-making processes within and about these challenges, which adds an additional layer of description and understanding into how these individuals make sense of their decision-making. Accordingly, we will employ the PVEST to interrogate the ways participants internalize, react to, and transition from various risk and protective factors that they themselves encounter in and through contextually defined and culturally inscribed experiences (Spencer 2008).

As a lifespan model of human development, PVEST highlights the role of individual perceptions in identity formation processes as they occur within the context of local and extra-local contextual, cultural, and structural influences (Spencer 2008). PVEST presupposes that all humans are vulnerable, varying in accord with one's history, contemporary experiences, and biological and phenotypic characteristics. These characteristics combine to form one's assemblage of risk versus protective factors that constitute one's collective net-vulnerability level. Importantly, PVEST suggests that the presence of risk and protective factors is always mediated by individual perceptions. Over time, an individual's more or less stable response to perceived supports and challenges in the face of adversity permits one to see him- or herself in a particular fashion, and, therefore, an emergent identity begins to form. In the present study, we operationalize PVEST to account for the way in which racialized and gendered encounters shape (1) emergent identities, and (2) stage-specific outcomes. Since we hold stage-specific outcomes more or less constant (mathematics achievement), the framework provides a nuanced way to explore the risks and protective factors that have shaped positive academic identities for a group of high achieving Black males. In short, using the identity formation framework of PVEST enables a more complex depiction of respondents' core identities and academic trajectories.

To be sure, though PVEST has been used primarily for exploring the conditions and meaning-making processes shaping the identity development of African Americans, other researchers might find PVEST similarly useful for examining contextual and phenomenological processes in relation to the identity development of other racial groups (and women), both in school and beyond, and we encourage researchers to do so. This analysis, however, will focus itself on the experiences of Black males.

This study addresses two primary research questions:

1. How does mathematics identity develop during the high school years of mathematically high-achieving African American males?
2. What are the *internal* risk and protective factors that mediate high achievement in mathematics in particular and academic achievement in general during this time period?

We believe our investigation into the various ways in which inner risk and protective factors shape the identity processes and academic trajectories of high-achieving Black males will strengthen an underexplored literature base. Moreover, by better understanding the precise barriers and supports that mediate Black male academic success, we might provide a more nuanced account of resilience in the face of race- and gender-based discrimination (e.g., negative Black male stereotypes). By investigating these research questions through the flexible theoretical framework of PVEST, we are better able to explore the processes by which high achieving Black males negotiate their racial, gendered, and mathematical identities in the midst of diverse and complicated risks and protective factors. Throughout this process, we sought to provide relevant findings to support the academic achievement of high-performing Black males in particular and Black males more generally.

Methods

This paper draws from a larger study of 24 male and female mathematically high-achieving Black students. High achievement in mathematics was defined as involvement in upper-level mathematics classes (e.g., Calculus, Algebra II, Trigonometry, Mathematical Logic, Probability and Statistics). Out of that larger study, 13 Black male students were interviewed at the four charter high schools within the Canvas Public School District (CPSD) and at a summer mathematics academy sponsored by a local university, during the spring and summer of 2010 (Table 1). In 2009, the Center for Research on Education Outcomes published a scathing report on the quality of charters schools, with 83 % of charter schools performing the same or worse than traditional public schools. Additionally, charter schools with high concentrations of Blacks and Latinos performed even more poorly. Canvas Public School District (CPSD) serves a population that is under 10 % White, almost 5 % Asian American, and 5 % "Other." With about 600 traditional schools and 70 charter schools in the district, over 80 % of the students qualified for reduced lunch. It is estimated that <60 % of high school freshmen will graduate and <55 % of those graduates will go on to post-secondary education. Thus, the majority of the district's youth are leaving school (either dropping out or graduating) without the skills and knowledge required for higher-paying professional work (Schott Foundation 2012).

Mathematics teachers were asked to identify the "top" students in the class, who were then invited to a separate room and given a brief informational session about the study. At the summer mathematics academy, brief study informational sessions were given in the two highest mathematics courses offered. At both sites, parental consent forms were given to students upon request and the voluntary nature of participation in the study was reiterated.

The interview protocol consisted of a two-page demographic questionnaire and a combination of semi-structured, open-ended interview questions. This protocol was designed to elicit rich accounts of experiences in home, school, neighborhood, and mathematics classroom contexts. Their school, mathematics, and life experiences where further unpacked through a life-story format interview style by attending to the sequencing of themes within narratives. Thus, we leveraged high school grade level to preserve "the sequential and structural features that are hallmarks of narrative" (Riessman 2008). This study, then, explores emerging identities—racial, mathematics, and otherwise—and the interconnections and co-constructions of these identities that helped to form an individual and collective sense of *being Black as a doer of mathematics* (Martin 2006).

Data Analysis

The aim of our analysis was to "map" resiliency in the lives of our participants. In order to do so, we utilized narrative analysis to unearth the complexity within the academic trajectories of our high-achieving participants (for a detailed description of the coding structure, see "Appendix"). Narrative is one fundamental strategy used historically to illuminate both marginalizing and empowering experiences and

Table 1 High achieving high school Black male student participants

Participants	Grade	Age	Gender	Primary caregiver(s)	Grade point average (GPA)[a]	Mathematics GPA[b]	Colleges considering	Career aspiration(s) 1st choice/2nd choice
Brian	12	17	Male	Mother	3.1	3.7	Northwestern, University of Oregon, University of Cincinnati, Texas Tech	Pro-football player/electrical engineer
Brice	12	18	Male	Mother	3.5	4	Morehouse College, Florida State University, Clark Atlanta University	Financial advisor
Charles	10	15	Male	Mother, father	2.9	3.5	University of Miami	Engineer, pilot
Damani	12	17	Male	Mother	4	4	Grinnell College	Psychologist, entrepreneur
Eddie	10	16	Male	Mother, father	2.3	3.5	Aims to attend college in Italy or France	Business entrepreneur, dancer
Gerald	11	16	Male	Mother, grandmother, grandfather	3.4	3	University of Illinois at Chicago	Own a law practice, choir
Harper	10	16	Male	Aunt, mother	2.7	3	Michigan State University	Chef
John	11	17	Male	Mother	3.5	3.7	Michigan State University	Graphic designer
Leon			Male	Mother, father			University of Illinois or an HBCU	Pro-football player/civil engineer
Michael	12	16	Male	Mother	3.2	3.3	University of Illinois, Northern Illinois University, University of Michigan, Ohio University, Northwestern University	Football/navy
Nicholas	10	16	Male	Mother, father, sister, uncle	3.12	4	Morehouse College, Southern Carolina State University, Florida A&M University, Ohio State University	Surgeon

Table 1 continued

Participants	Grade	Age	Gender	Primary caregiver(s)	Grade point average (GPA)[a]	Mathematics GPA[b]	Colleges considering	Career aspiration(s) 1st choice/2nd choice
Randy	11	16	Male	Mother, father	3.1	3.7	Butler University, Drake University, Northern Illinois University	Professional athlete/career in criminal justice
Trashawn	10	16	Male	Mother	2.9	3.4	Michigan State University	Police officer/fireman
Walter	11	17	Male	Mother, father	3	3.7		Music producer

[a] Values in this column represent student's cumulative grade-point average in all courses taken

[b] Values in this column represent student's cumulative grade-point average in all mathematics courses taken

is often analyzed through "storied lives". Narrative analysis provides a constructed reality that includes perception, reflection, and subjectivity (Cortazzi 1993) and privileges the importance of one's meaning-making process in constructing and understanding one's own experiences.

This study followed a general inductive data analysis format (coding, categorizing, thematizing) for re-sorting and managing data. The initial set of codes revolved around the students' narratives of being academically (mathematically) successful in the face of structural and social challenges found within their Black urban neighborhoods and schools. Through the lens of PVEST, we extracted rich accounts of identity processes that unpacked patterns of coping and resiliency (or lack thereof) that students developed over time (Spencer 2008). Students' vulnerabilities, resilience, challenges (identified by risk factors), and supports (identified by protective factors) in their social and academic lives, in line with the PVEST framework, were, in part, identified by the students themselves, based on their individual perceptions and meaning making (Spencer 2006). For each student, we were able to identify a complex pattern of behaviors, characteristics, opportunities, and barriers that supported the development of a positive mathematical identity while permitting a high degree of academic achievement.

This methodology recognizes that students may be the best experts for understanding their own classification and coping efforts with multiple and sometimes overlapping forms of risk and protection in their lives. The first set of codes focused on the perceptions of their own agency and self-efficacy in navigating success. Another related set of codes detailed the strategies used by students to negotiate successful learning and participation in mathematics.

Results: Internal Protective Factors

These students, schooled in Canvas's urban school system, shared similar stories of challenges and supports. The high school years present familiar and new tensions. Since all the students in this study attended high schools that are both charter and classified as urban, the dynamics of negotiating charter urban high school education are presented through the eyes of its attendees. The students spoke of using both dominant narratives and counter narratives, as they complicated the ways that triumphs and disappointments may simultaneously operate within the same space. They continued to develop and redefine their agency as they are still confronted with multiple forms of risk and discouragement.

Below, we outline the constellation of risk and protective factors instantiated within and experienced by participants themselves during their high school years (see Fig. 1 for visual representation).

Although participants differentiate between the internal (or personal) and external (or environmental) elements that punctuate their academic and identity trajectories, we focus exclusively here on internal risk and protective factors.
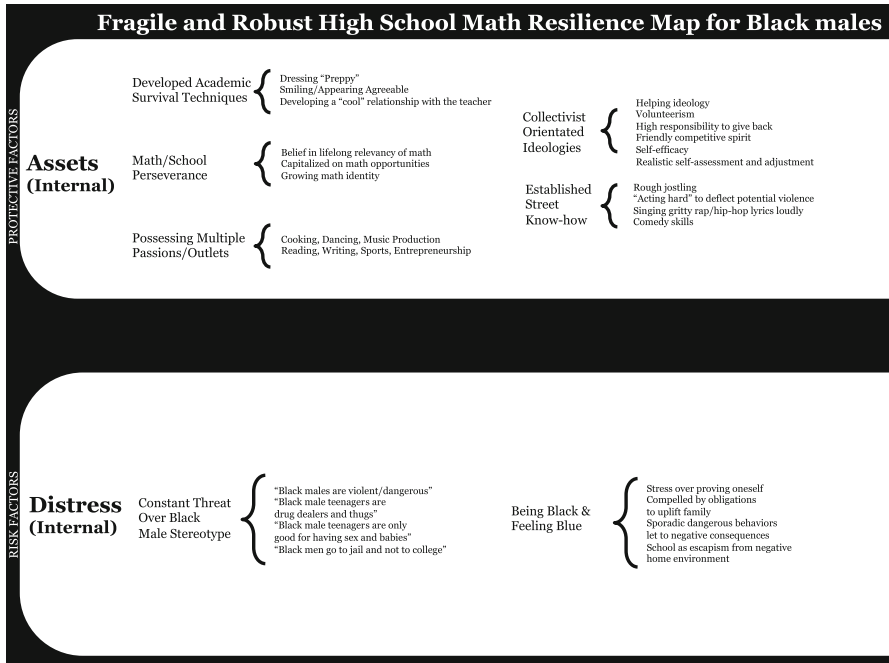
Fig. 1 Fragile and robust high school math resilience map for Black males

Protective: Street Know-How

A common theme expressed across our participants was the importance of street savviness. Participants perceived street credibility as functionally protective in potentially violent or debilitating situations. For instance, participants stated that they regularly adopted strategies such as rough jostling with friends, "acting hard," expressively singing gritty rap or hip-hop lyrics, and utilizing keen comical abilities to deflect violence. Nine students cited responding to potentially threatening situations with quick wit and timeliness as key to staying safe and building a reputation of being "boss," meaning cleverly cool. Gerald was one of those students:

> I've become a school legend for treatin' [a way of signifying with quick and comical expressions and sayings]. But I try to use my treats for talkin' about tripped out stuff like the weather or celebrities, but I am strategic about not getting started on my peoples. 'Cause the folks who jon [talk] on each other have to constantly keep up with the latest flames [jokes] and are always the ones g'tting' flaming on.

Some of the males actively demonstrated their street credibility by joining with other African American males to exude an individual and collective male bravado, a

performance that actually protected them against perpetrators who, if they sensed weakness, might find reason to attack.

These males seem to understand that negative stereotypes that may function to delimit and proscribe potential learning trajectories might also be leveraged to thwart real acts of violence or threat that students encounter both in and out of school. For instance, Jermaine, an aspiring graphic designer, suggested that during dangerous walks home, in order "to stay alive," he needed to adopt certain "protective" behaviors including aggressive posturing, sagging his jeans, carrying a concealed weapon, and loudly singing hostile rap lyrics.

To be clear, we consider *street know-how* a protective factor in the process of academic achievement because, frankly, it allowed participants to attend school safely. However, we are aware that *street know-how* may provide complications to the process of in-school learning and in those streets, which we explore further in an upcoming paper (McGee & Pearman, in preparation). In essence, knowing when and to what extent one might deploy behaviors consistent with street credibility often proved difficult to manage, and at times presented challenges to learning. Brian, an aspiring chief financial officer, succinctly described the tension between regulating aggressive-protective behaviors on the one hand and trying to learn as a student on the other:

> Acting rough it's hard to turn…off. When I walk into school, the danger does not end at the school door. I always have to stay on guard, even when I don't want to. It is difficult trying to learn under all that pressure.

Complications to learning processes notwithstanding, since hostile environmental (including schooling) conditions demanded that students "be on guard," street savviness afforded high-achieving students a degree of access that permitted them to traverse more easily academic spaces in pursuit of their mathematical aims.

Protective: Mathematical/School Perseverance

Students spoke of a curiosity and desire to learn more about mathematics and its related fields (science, technology, and engineering) to draw on the skills and passions they had already developed in their K-8 schooling years (McGee and Pearman 2014). They desired deeper conceptual understanding of mathematics topics with hopes that this knowledge would assist them in building lifelong skills that they expect to carry through college and beyond. We have included a series of quotes that speak to the benefits of learning and mastering mathematics over a lifetime:

> *Eddie:* Well, in first grade all of my dudes [male friends] liked math. Now as a senior, none of my guys, well just a few, like math. What happened to them? I'm not sure but I will continue to do mathematics because I see it in my future as a CEO and it will help me make a lot of money, which I can mange better with accounting.

> *Randy:* I like always learning about mathematics because people think I'm more interesting because of the way I present mathematics make sense to the

folks around me, which makes me more interesting. I like it when my family has a mathematics question they always come to me. I always want to be seen like that.

Damani: Because I'm good in math, my school connects that with leadership skills. So I keep enhancing my mathematics knowledge so I can continue to be seen as a leader.

John: I see those games online that help you keep your brain tight [analytically grounded] and I don't need to do those. Learning mathematics keep my brain right!

Harper: Why do I continue to learn mathematics [repeating the interview question]? Because it makes me happy!

Additionally, these students demonstrated significant agency in gaining the material resources needed to maintain mathematics high achievement (e.g., online resources, flashes cards, tutoring, teacher support). Relationally, seven of the thirteen students spoke of the benefits of group work and collaborative mathematics activities. This highlights that the participants may learn as much from their peers as they do from their teachers. Trashawn explains:

I like group work most of the time. *[Question: Why is that?]* Because, like if somebody needs help I can help them without always having to ask the teacher. And if I need help I can ask too.

For seven students, mathematics achievement resulted from their own self-determination to succeed along with a culmination of family motivation, peer support, and interesting and engaging teachers. Six of the students confessed to loving mathematics, four said they like mathematics, and three said that they did not have a strong emotions about liking mathematics but were good at the subject. Only one student thought he might not like mathematics; however, he mostly complained about, "this hard ass geometry course… It's killing me."

In high school mathematics courses, the students discussed the importance of understanding and manipulating numbers and other numerical expressions toward purposeful ends. In other words, participants spoke of the benefits associated with applying strategic thinking in their attempts to solve classroom-based real world problems, which further provided students meaningful justification in terms of understanding the world in which they live. Many of the students, for instance, described specific classroom-based activities (what they termed "field studies") that supported students' practical, real-word application of learned mathematical competencies. In answering the question, What is the best thing about your high school experience?, Eddie responds:

The best thing so far was winning my conference for football, but for school, probably field studies. That's where we go out in [the city] and learn about like mathematics and relate it to real world situations. Like when we went to [a popular and expensive mall] and in groups we had to figure out how we would spend $5,000 dollars. Then we went to Walmart and had to do the same thing.

It taught us about mathematics and the financial "joy" [he gestures the quotes] of being frugal [laughs out loud].

In sum, students' mathematical resilience derived from the availability of contextual resources, relational supports, and the prevalence of mathematically relevant career aspirations. Moreover, as our participants indicated, perceiving mathematics as central to one's academic, social and economic trajectory seemed to strengthen a sense of mathematical "grit" in the face of adversity.

Protective: Possessing Multiple Passions/Outlets

Multiple Passions and Outlets is considered both an internal and external asset, because some of the students' passions/outlets were self-motivated, self-driven, and self-initiated, while some of these passions and outlets developed from external supports in their schools and communities. Nine of the fourteen students discussed with much liveliness their involvement in a number of activities including: guitar playing, soccer, track, cooking, acting, dancing, archery, knitting, drawing, basketball, football, and mentoring and tutoring other students. All four charter high schools offered some type of before and after school activities, most of which included music (but not necessarily band), academic clubs (reading, math, robotics, science), and sports. Participants who involved themselves in school-based activities discussed the values of teamwork, particularly being responsible for their team members' success, perseverance and endurance, competition, diversity, and a sense of community.

For these males, the majority of their activities revolved around sports, and sports participation counted heavily in their happiness and positive outlook on life. Nicholas discussed that playing basketball helps him cope with his boring classes. Furthermore, he surmises that playing basketball actually assists in affording him a more well-rounded education. As Nicholas suggests, "I'm more likely to pay attention in my World History class, because I know when I pay attention the time goes by a little faster and that means less time [spent] wishing I was at basketball practice." Treshawn related the toughness associated with being on the track team to the challenge in mathematics classes:

I run track. That's challenging too [like math]. At my school, I be telling people if you want to run track on our team it has to be something that you really want to do, 'cause it's hard. We run so much. Like we have to be in shape for it and I wasn't in shape for track this year so we started earlier to condition and it was hard… I have been to some track meets but I haven't come in first yet. But I plan to get there.

Treshawn's determination in track seems to match his determination in mathematics. Students also are drawn to activities that are traditionally outside of the perceived norm for African Americans in urban spaces. Harper proudly boasted that, "I play volleyball, I do soccer, I'm in book club, I'm in newspaper. Nobody really knows this, but I like to knit for some reason and I draw, I read, I do a lot of stuff." It appears that Harper chose his activities via personal interest, rather than

obligation to engage in these activities, which is further supported by the participants' involvement in activities that they describe as interesting, exciting, and fun.

In relation to their classmates, these Black male students discussed the ability to make healthy decisions through critical reflection of their own positionality, both in and out of school. They discussed the ability to more effectively manage their own academic and social lives. As Michael described:

> I just know how to think. I mean to really think with my brain and not my body or my adrenaline. I can calm it down and reflect like that [he snaps his fingers]. Like if they say, "Go left man, let's go left." But I can just tell that left ain't looking so hot. So I say, "Naw man, I'm going over here." And they say, "You a punk" and I say, "I'll be a punk, nigga." And usually I'm feeling that they would beat me down or something, but there [is] always someone in the cut [within the group of boys] that says something like "leave that fruity-ass nerd to go and suck on his books." Now that may seem like a slight [insult] but that dude right there just saved me. And I silently thank him as I walk to the right.

In sum, students drew upon self-described character resources to build more cohesive mathematic identities in the process of enduring and overcoming adversities that impacted their learning trajectories.

Protective: Capitalized on the Available Mathematics Opportunities

We consider as an internal asset that respondents endeavored themselves to *capitalize on the available mathematics opportunities*. These opportunities were not mandatory, thus, students (and their families) had first to determine that these programs would benefit them, and, secondly, take the initiative to apply and participate. These students proactively sought out and took advantage of opportunities that could enhance their mathematics achievements through acquired knowledge, recognition, and new mathematical skills. This often happened in the form of summer STEM employment or STEM summer camps, which provided additional real-world STEM experiences. Students talked about several summer opportunities on which they capitalized that seemed to enhance their academic resumes. Brian described a STEM camp being instrumental in teaching him about the purpose, function, and skills necessary for a career as an engineer:

> This summer I went away to this STEM camp at the University of [Midwest] and we spent the whole summer doing engineering and stuff. It was really helpful 'cause there I really found out exactly what an engineer does. *[Question: What does an engineer do?]* An engineer is a person who applies their scientific knowledge, mathematics concepts, science concepts, geography, and environmental stuff, to solving technical based problems. I also realized that even though I will major in electrical engineering I really want to [be a] football player.

Although this camp did appear to have an influence on Brian's college major, his career aspirations as a pro-football player remain undeterred. However, the capitalization on these opportunities seemed to provide the students a greater sense of empowerment and to enhance their learning processes and critically evaluate their future college trajectories.

It is important to note that family constraints prevented some students from accepting STEM-enrichment opportunities. For instance, having to babysit younger siblings and relatives or that families determined public transportation to and from the STEM summer camp location to be too dangerous of a commute were reasons that a few students could not capitalize on STEM opportunities. Respondents felt most comfortable participating in STEM enrichment programs wherein the demographic composition of the program (students and staff) was reflective of their own background. For example, Michael enrolled in a summer program for mathematically high-achieving students on a prestigious college campus. Although the program was touted as a student of color initiative, Michael was one of only 3 Blacks in a cohort of 75. He felt uncomfortable in that environment, and, after 2 weeks, he dropped out. In other words, the prospect of learning college-level mathematics was not enough to overcome an environment that Michael perceived as unwelcoming and had already caused harm to his racial identity.

Protective: Developed Academic Survival Techniques

In efforts to succeed academically, 8 of the 13 respondents discussed strategies to manage, counteract, and safeguard against negative Black male stereotypes. Strategies included exhibiting excessive friendliness, associating themselves with other "smart" students, and "dressing preppy." For instance, John, an aspiring entrepreneur, discussed the ways he leveraged his personal style to mitigate others' perceptions of himself as a "threat" while increasing the likelihood that his teachers would consider him "respectable" and teachable against the stereotypical backdrop of the "troubled" Black male:

> Sometimes I dress straight preppy. I rock Lacoste, Polo, L.L. Bean's duck boots, sweater around the collar, all that! I used to be adamant about wearing it because I like it, but I realize now, it was more to look smart, or at least look different. And guess what? My teachers and stuff, they did treat me better. It was like they respected me a bit more. So, now even though my style has changed, when I come to school I still go preppy. I ain't never seen no dude in detention dressed preppy.

A number of students took special care in developing relationships with their teachers in ways that still maintained their "coolness" with their peers. For instance, Gerald and some of the other participants used strategies like being cleverly comical and serving as an in-class tutor (aiding the teacher and the students). Gerald called it a "dance" that he performed with his mathematics teachers and peers as he became more and more valued by his teacher, without compromising his peer status:

See I gotta play it real wise. I crack jokes in class but they are intellectual jokes directly linked to the [mathematics] problem at hand. See this way, my teacher knows I listening, and my friends know I can still be fresh. And let's face it; everybody could use a good laugh or two. It usually works out unless I get a teacher who is miserable. In those cases, nothing works, except for acting dead.

In short, in order to succeed academically, participants actively constructed strategies, mannerisms, styles, and behaviors that mitigated the enduring effects of negative Black male stereotypes.

Protective: Collectivist Orientated Ideologies and Actions

In 2011, the national volunteer rate was 26.8 % (U.S. Corporation for National and Community Service 2012). However, for these participants, all except one discussed the importance of volunteering and helping others in general. They also spoke passionately of a strong desire they acquired about giving back to their communities or to future generations of historically marginalized students. These young African American males play or desire to play a prominent role as mentors and aids in youth-orientated and other social programs that impact the African American community.

A varied sense of connection to their community was central in explaining why participants subscribed to a helping ideology and engaged in various volunteer activities. Students with strong connections to their urban, mostly Black communities spoke of their current and future efforts, through leadership and academics, to make these communities stronger. Brice discussed the instrumental, "pass-it-forward" model of a youth mentorship program focused on training young men of color for leadership, achievement, and service:

I am mentored by the men from Kappa Alpha Psi's [Historically Black all male fraternity] The Kappa Leadership Development League they guide us [a group of Black high school males across the city] and encourage us to mentor youth in our neighborhoods. So I tutor mathematics at an elementary school once a week. If they [the men from Kappa Alpha Psi] can invest in me and my abilities, then I can do the same for the students I tutor.

Brice proudly cites that 100 % of the senior class students involved in The Kappa Leadership Development League will attend a 4-year college institution. His teachers in this program have provided a living example of Black male success, one that Brice is honored to emulate.

The majority of the participants did not consider themselves as "special" or brighter than their peers (e.g., "I'm normal, just like everybody else, I just get some concepts and ideas faster"). The respondents expressed compassion and empathy for others, particularly those who they viewed as less fortunate, even while their own circumstances were far from optimal. They often served as school or community volunteers, and although the respondents were often chosen for these positions by school and community administration, they often spoke of their service

altruistically. John, one of the top students in his algebra class, enjoyed this position because it gave him the opportunity to help his peers: "It made me feel good because then I started to help other people. Like, she put us at these groups at tables and I helped people who needed help. So I do that in all my classes."

In addition to the importance of volunteerism and peer-assistance in their own mathematics trajectories, the high-achieving, mathematically successful Black males in this study indicated that competition was an important part of their own successes, and made mention of their own competitive characteristics:

> We [my male peers and I] sometimes compete to finish the [math] problems the fastest but we get shorted [bragging rights are diminished] if [the answers] are not correct. So we gotta be fast and right. It's kind of cool because it gives us an adrenaline rush. It actually makes the mathematics more exciting 'cause me and my crew get a chance to wild out on Algebra but it's all in fun while we learn and grow.

In this sense it seemed as though this mostly male-friendly competition in their mathematics classrooms brought excitement and a sense of camaraderie to being excellent and was reminiscent of the quick wit they employed to deflect potential violence in other mostly Black males situations (Terry and McGee 2012). Collectivist ideas and actions seemed to be shaped not only by a desire to see both themselves and others rise above difficult circumstances in the moment, but also by a sense that actions in the moment have implications for future students like them.

Risk: Anxiety Over "Being" a Black Male Stereotype

The respondents expressed disdain for the surplus of stereotypes that plagued their experiences as Black high-achievers in mathematics and, more generally, as Black males in urban spaces. Most of the stereotypes were about the financial and psychological conditions of Black Americans, particularly in predominantly Black, low socio-economic communities. Students cited many stereotypes, the most cited being the following: "All Black people have a link [food stamps] card," "Black people are lazy," "Black people are stupid," etc. However six of the thirteen respondents reported stereotypes about Blacks not achieving in mathematics and science. Although they were high-achieving and had managed to maintain high levels of academic success, stereotypes still deeply impacted their psyche. Damani critiques the generalizing of Black people based upon stereotypes:

> Black people always get connected to the word ghetto. Black people can't think straight. We [Black people] are always feeling like we're always in a mess that we never dig out of. Even like Barack Obama is Black and he's the president, he is not Ghetto. It doesn't matter. Automatically when you think of a Black person, even the president, and his power is always situated against his Blackness, especially when you talk to old people. They say things like it's going to be Kool-Aid in the White House and just make fun of his entire family. I'm used to that type of stuff.

Damani, feels the pressure associated with being perceived and judged by stereotypes largely associated with Black low-income population but could not help but feel despair that even the upper-income and powerful President of the United States could also be a frequent victim of stereotypes. Brice sums up his displeasure like this, "If the Barak Obama can get dogged out [stereotyped] ain't no hope for us in the 'hood."

Although these students have had many encounters with stereotypes, they also developed self-determination against academic disengagement. Michael's mathematics teacher was the "sweetest lady" until she made the following comment to him:

> Sometimes my teacher may say something like, "For a Black guy from the *ghet-toe,* you are really on the ball. You go boy!" And I be sayin' in my mind, don't you know how stupid you sound saying that? But I don't doubt my own abilities and my mom always told me that when I grow up I can be whatever I wanted to be and if I try I can succeed at anything that I want to. So her ignorant comments, they don't make a difference to me because I still know that I can do it.

Three students discussed the stereotypes that Black teachers are not as smart or do not care as much about Black students as White teachers. Walter thought this was an especially damaging stereotype, and in his opinion it seemed like the principal and school administrators treated the Black teachers poorer than the White teachers. Walter discussed how this stereotype hurt him:

> Some people look at the stereotypes and conclude that White teachers will help Black students more than Black teachers because Black people mostly just want to get paid. Just people in general stereotype, they just talk about Blacks in general. *[Question: How do you feel about that stereotype?]* I feel it's bad because there are really some Black teachers, they really want to help us to make sure we go to college and be successful.

Seven of the students discussed the damage that is caused by the Black male stereotype. Gerald sums up his sentiments on the stress of living as a young Black male in urban spaces:

> I love it and I hate it. I love that I'm being copied across the world. They all want our style, our language, our finesse, our bodies, but they don't want to shit do with our minds. Sorry, I had to say it just like that. That's the part I hate.

Faced with the aforementioned perceptions and generalizations about their own abilities and those of their Black teachers, both the prevalence and management of negative stereotypes produced significant anxiety across respondents' mathematical trajectories, both in- and out-of-school.

Risk: Being Black, Male, and Feelin' Blue

The participants' experiences with persistent violence and despair have created a fear and anxiety that seemed consistent with symptoms of Post Traumatic Stress Disorder, made evident through prolonged exposure to highly stressful situations. Stress was not from violence alone but also from the obligation that people within the community have placed on these high achievers to serve as uplifters for the community. These youth describe this as both a blessing and a curse. Charles expounds,

> My mom parades me around to anyone [in the neighborhood] and they always say that I must finish college and come back to the community to help all the Black boys, girls, their moms and dads, grandmas and grandpas, everybody. I'm still trying to make it myself. It does make me strive to do my best but it's still a lot of pressure on me. So, I don't know.

Another student, Walter, shared comparable sentiments. He wished his teachers and school personnel could really understand the heavy level of responsibility that they have burdened him with, and how these anxieties define his movements, thoughts, and life. John agreed and summed up his feelings with the simple but powerful statement, "It's hard being a role model when you are 17 years old and still strivin' for survival in the 'hood. I, myself, need a role model, not to be a role model." In other words, Walter and Charles where overwhelmed by expectations that emerged from having academic potential while living in a chronically distressful neighborhood.

A frequently cited risk factor was the anxiety over the violence and perceptions of violence the respondents experienced in their respective neighborhoods. We are careful to note that a critical analysis of the causes of community violence is beyond the scope of this paper; suffice to say that any analysis of the roots of community violence must necessarily interrogate the policies, practices, and bylaws that have created underserved, economically-depressed, hyper-segregated communities of color (Spencer 2011).

Seven students were impacted by negative consequences and untoward perspectives associated with living in Black underserved urban neighborhoods. John explains:

> We did not live in a good area, we're not living in a good area and we're living in [Reshin] Park. *[Question: And what's rough about [Reshin]Park?]* It's like always deaths and gunshots. Just this past summer a guy got killed in front of our house. So yeah we're outside the window and then we see the guy with this knife and we're like oh, go call the police, call the police. So like it's not – like another guy got killed in the back of our alley. All around it's just dangerous things and I feel, I'm the oldest and my father isn't there, so I have to be the man of the house you know, I have to take care of my little brother I have to be a good role model.

Like John, five other students complained about not feeling safe after dark (which in this urban area could mean as early as 4 p.m.) and three male students had very

restrictive involvement in after school activities. The nighttime commute home, sometimes involving an hour or more in commute time, posed a dangerous or potentially violent threat to their personal safety. As a result, they felt cheated out of their childhood. Eddie discussed why he could only participate in his schools' afterschool activities 2–3 days a week:

> I can walk home from school [after participating in after school activities] on Mondays and Tuesday only. It's like the thugs take those days off. Wednesday is a possibility but I have to pretend not to care about the bullcrap that is happening all around me. If I act somewhat nonchalant then usually they will leave me alone. On Thursdays and Fridays, if I don't get a ride, I don't go [to the afterschool activities]. That's why I can't play football cause working out five a days and trying to get home was impossible.

Ironically, four other students discussed using school as an escape the conditions of their personal lives. Charles was quick to explain how the sudden loss of employment turned his joyful household into a distressed household:

> Because both my Mom and Dad lost their jobs [within 3 months of each other] there was not arguing or fighting per se. But it was an incredibly tense situation at home. They were depressed and when I was home, I was depressed. But at school I was the man. I have a great girlfriend, I'm in a bunch of clubs, and the Principal loves me. I just got to the point that I wished I could live at school.

Charles' story is important as it showcases his sense of escapism not from a destructive household or neighborhood but the personal effects of unemployment. Several students have responded to the chronic despair in their communities by aspiring to work to achieve law and order. Trashawn is one of those students. He decided, against the advice of his teachers and principal, to not major in biology and become a doctor but opted for another career path in law enforcement. He explains his reasoning:

> I want to be a police officer and a U. S. Marshall. *[Question: Why not a doctor any more?]* Because it's been a lot of violence going on ever since I was brought up – I hate crime, I hate it, because it stops youth. I [had] seen this poster that really got into me. It was like a boy saying, "Don't shoot, I want to grow up." My uncle is a plain-clothes police officer so he helps me out. He gets permission from his sergeants to take me to the jails to show me the criminals. Next year I'm going to the Police and Fire Academy and he is going to take me to court on internships, that's mandatory. I'll be learning the law so I'm going to have a good resumé.

The traumatic impact of experiencing anxiety was far too common across respondents' narratives. Some anxiety emanated from the pressure of being a Black male high achiever and feeling both compelled and grateful to protect and uplift their families and communities. These experiences ironically appeared to both limit and expand their mathematics trajectories (and schooling trajectories more broadly) by minimizing feelings of safety, both in and out of school; notions of school as a

form of escape from their out-of-school personal lives; and a burden and opportunity to serve as a role model and better their communities.

Discussion

This study paints a complex picture of the internal risk and protective factors that influenced the mathematical trajectories of a subset of high-achieving, Black male high schoolers. That respondents were able to overcome varied risk factors does not speak to the negligibility of encountered risks but rather (a) to respondents' resolve, creativity, and resourcefulness, and (b) to the quality of internal supports in respondents' lives. The predominant form of internal risk encountered by respondents pertained to those of ecological origin, to which respondents reacted in diverse, though often resilient, ways. Consider, for instance, Trashawn's response to the violence he experienced in his community. Against the advice of teachers and other school staff members who recognized Trashawn's STEM potential, Trashawn perceived the relevance of a STEM career as peripheral to the everyday demands, constraints, and concerns that circumscribed life within his community. Due to his unfortunate exposure to myriad forms of neighborhood violence, his STEM aspirations gave way to those of law enforcement. Put differently, by experiencing a lack of law and order, he felt himself compelled to pursue a career that would restore law and order.

Trashawn's law enforcement aspirations were certainly influenced by his uncle, who was a police officer himself, but the degree to which he decried neighborhood crime, and the extent to which this response influenced his career aspirations raises the concern of whether neighborhood violence more generally might function as a systemic barrier to increasing future STEM participation of promising young Black males growing up in urban environments. The effects of neighborhood crime on various life indices have been well documented; however, research documenting that neighborhood crime might also function to restrict or moderate STEM aspirations has been largely non-existent from the literature on Black male STEM participation. In researchers' attempts to increase Black male STEM participation, this logic is important to consider. Neighborhood crime is indeed a functional barrier to a litany of quality of life indices, but how neighborhood crime influences STEM participation might concern less its limiting capacities on student exposure to and growth within STEM subjects than perhaps by inspiring otherwise capable STEMists to rather commit themselves to help their community in more perceptively-pertinent ways. In the context of pertinence amid the sheer intractability of neighborhood violence, it is not shocking that a would-be doctor would choose rather to become a police officer.

The notion that violence might beget law enforcement aspirations extends into a discussion of respondents' commitments to volunteerism. In much the same way that a lack of community safety might influence future ambitions, an awareness of specific community needs seemed to produce in respondents an immediate sense of personal responsibility for community service and uplift. This overarching motive speaks both to the enduring inequities related to issues of access, resource

allocation, safety, and opportunity that continue to plague many urban spaces as well as to the communal logic characteristic of the Black male high achievers in this study. The essence of how respondents' perceived their own future success revolved less around mainstream notions of capital accumulation or status achievement and more with how well respondents might leverage their own skills in ways to improve the lives of their neighbors.

In thinking through how to best mobilize Black males in the STEM disciplines, a consideration of this deep sense of communal responsibility is key. In other words, to increase the interest of and improve Black male representation in the various STEM fields, the question becomes how to best weld the community enhancement aspects of STEM trajectories with the community empowerment impulses of a young cohort of Black male students. In other words, teachers, administrators, and STEM recruiters at various levels may do well to make explicit those ways that the pursuit of a STEM-based career might have direct social, environmental, economic, and infrastructural implications in students' own communities. For instance, a civil engineer may be better framed as one who not only improves the design of future neighborhood facilities, but also one who functions to rehabilitate and repurpose otherwise vacant, underused, or blighted infrastructures on a neighborhood-scale, improving a community's collective efficiency, quality of life, and economic viability. Reframed in such a way, students might see a career-based answer to the community-based impulses that engender both a commitment to volunteerism and the improvement of neighborhood safety.

As future possibilities are influenced by community contexts, it is important to consider how neighborhood experiences compelled distinct behavioral adaptations. For instance, the majority of our Black male respondents considered their environment—both in and out of school—as hostile and dangerous. As a result, respondents felt that in order to survive, they had to adjust their behaviors in ways to mitigate threats of violence. These behaviors varied, but were most often described in terms of establishing street credibility, or street savviness, or acting in a way that demanded the respect of others while warding off potential dangers. That our high-achieving respondents were able to establish street credibility allowed them to traverse more freely both in- and out-of-school contexts in ways that supported or made more available their own objectives within those spaces, albeit in complicated ways.

Previous research has indicated that Black males who attend urban high schools often contend with issues of hypermasculinity as they navigate through hazardous environments that may place them at heightened sense of danger or threat. As we discussed earlier, hypermasculinity is often associated with maladaptive behaviors including acts of anger, embracing street culture, and engaging in high-risk behavior. This study problematizes not so much what defines hypermasculinity, but rather the in- and out-of-school ramifications of deploying aspects of "performance masculinity" (Howard 2012). Similar to Terry and McGee (2012), this study has indicated that those who demonstrate hypermaculinity may not necessarily identify with or embody the aggressive behaviors often associated with it. Rather, as our respondents indicated, such behaviors are often performative

coping responses that allow them to realize better their own objectives within a social space. As our respondents generally maintained high achievement aspirations in their mathematics pursuits, hypermasculinity provided one pathway through which they could avoid direct threats of violence in their attempts to attain this objective.

Paradoxically, the necessity of hypermasculine behaviors for safely navigating a learning environment precluded the sort of learning experiences most conducive for high achievement. For instance, Brian indicated that a "hard persona" was difficult to "turn it off" when in class, even though, at times, such a posture made learning more difficult. That Brian had to adopt behaviors that were, in certain respects, counterproductive to an optimal learning experience speaks to the difficulties and complications associated with navigating a school environment (and a broader community) in which one feels unsafe. In short, for our respondents, feeling safe justly presupposes learning. Researchers and practitioners, then, might do well to consider the ways in which the social organization of school life might operate to exacerbate feelings of threat since the effects limit the learning trajectories, no less, of its highest achievers.

Lastly, our research seems to indicate the pedagogical value for Black males of leveraging competition within mathematics classrooms. Despite earlier critiques of the general role of competition within the academic lives of Black students (Ladson-Billings 1998), our research highlights competition's utility in a more specific sense. To the extent that competition is culturally grounded as well as affirming of both self and others, competition appears as though it can become a powerful vehicle to increase student motivation, heighten a sense of classroom community, and increase overall class performance. Culturally grounded competition might resemble what our participants described as playful bantering to solve a problem the fastest or explaining the answer the quickest; after a few moments of enjoying victory, the triumphant student aides whoever who may be struggling. Similar to Brandenburger and Nalebuff (2011) we might better describe such collective behavior as "coopetition"—a portmanteau of competition and cooperation. We believe this form of competition—coopetition—is culturally affirming because it builds from student's discursive and competitive practices to create a healthy environment in which students can learn and benefit from each other.

Such are the narratives of 13 Black males during their high school years who developed specific coping strategies, self-concepts, beliefs, and practices that enabled them to traverse more suitably the physical, emotional, and psychological dangers that circumscribed their in- and out-of-school contexts, while achieving in mathematics. It is our hope that their narratives provide a glimpse into the internal struggles and triumphs that must be acknowledged and addressed when designing programs and policies to better support Black male participation, continuation, and success in the STEM disciplines.

Appendix

Open coding category	Axial coding	Selective coding	Code description
High school years	Risk/ challenge	Instructional issues	Limited advanced placement classes
			Non-rigorous "honors" level classes
		Aggressive behaviors	Anger over injustices. Little management of anger
			Aggressive behaviors and tactics to avoid violence (males) hypermasculine by necessity (could be consider a protective factor as well)
		Responsibilities that limited STEM summer opportunities	Babysitting and watching elders limiting their participation in afterschool and summer activities (females) had to assume more at home responsibilities
		No STEM mentors/few role models	No strong mentorship relationships
		Anti-Black ideologies	Critical of "Black" behaviors, desire to associate with people other than African Americans
		Academically unsupportive households	Households where focus on children's academics is difficult due to intense goings-on
High school years	Protection/ support	Multiple passions/outlets	Involvement in extra-curricula activities (in school and in their homes)
		Black racial pride/identity	Celebration blackness and other cultures
			Ideologies and adherence to a helping ideology/ high rate of volunteerism
		Exhibition/generosity	Healthy balance between self-confidence and area improvement
			Self-efficacy (proactive and reactive)
		Realistic self-assessment	Parents, and athletes (males)
		Student agency	Characteristics resilience, strong work ethic
		Role models	Using school to escape negative home environment
		Academically sound	Strong support from school teachers and administrators
		School as an outlet	(Males) sports connected to high-achievement
			(Males) driven by the competitive sprit in their mathematics classes
		(Females) robust school support system	
		Participating in sports where good GPA was required	

Open coding category	Axial coding	Selective coding	Code description
Future selves (high school males reflecting on their future)	Protection/ support	Multiple sources to gaining STEM competencies	Capitalized on summer math/science camps, math/science based opportunities
		Mathematically resilient	Able to recover and recoup from negative mathematics experience (undeterred)
	Risk/ challenge	Believed in the lifelong relevancy of math	Participated in mathematics games other real world activities
		Connect sports passions with college enrolment (males)	Desires for college enrolment are connected with desires to be professional athletes
		Connect helping ideology with college degree attainment	Desire to pursue helped-based careers such as nursing and guidance counsellor
		Pressure to uplift the family	Pressure of being successful and as means of providing financial stability for the family
			Very sporadic studying, limited study skills
		Inadequate study skills	No advanced placement classes
		Limited college-level classes and curriculum	Virtually no career guidance
		Narrow career trajectories	

References

Berry, R. Q. (2008). Access to upper-level mathematics: The stories of successful African American middle school boys. *Journal for Research in Mathematics Education, 39*, 464–488.

Brandenburger, A., & Nalebuff, B. (2011). *Co-opetition: A revolutionary mindset that combines competition and cooperation*. New York: Doubleday.

Brown, A. L. (2011). Same old stories: The black male in social science and educational literature, 1930s to the present. *Teachers College Record, 113*(9), 2047–2079.

Cortazzi, M. (1993). *Narrative analysis*. London: Routledge Falmer.

Cross, W. E., & Vandiver, B. J. (2001). Nigrescence theory and measurement: Introducing the cross racial identity scale (CRIS). In J. G. Ponterotto, J. M. Casas, L. A. Suzuki, & C. M. Alexander (Eds.), *Handbook of multicultural counseling*. Thousand Oaks, CA: Sage.

Delpit, L. (2012). *Multiplication is for white people: Raising expectations for other people's children*. New York, NY: The New Press.

Ferguson, A. (2001). *Bad boys: Public schools in the making of Black masculinity*. Ann Arbor: The University of Michigan Press.

Fries-Britt, S., & Griffin, K. (2007). The black box: How high achieving blacks resist stereotypes about black American. *Journal of College Student Development, 48*(5), 509–524.

Harris, F., Palmer, R. T., & Struve, L. E. (2011). "Cool posing" on campus: A qualitative study of masculinities and gender expression among Black men at private research institution. *Journal of Negro Education, 80*(1), 47–62.

Howard, L. C. (2012). Performing masculinity: Adolescent African American boys' response to gender scripting. *Men's Studies Press, 6*(1), 97–115.

Hunter, S. (2010). What a white shame: Race, gender, and white shame in the relational economy of primary health care organizations in England. *Social Politics: International Studies in Gender, State & Society, 17*(4), 450–476.

Hunter, A. G., & Davis, J. E. (1994). Hidden voices of Black men: The meaning, structure, and complexity of manhood. *Journal of Black Studies, 25*(1), 20–40.

Ladson-Billings, G. (1998). Just what is critical race theory doing in a nice field like education? *International Journal of Qualitative Studies in Education, 11*, 7–24.

Majors, R., & Billson, J. M. (1993). *Cool pose: The dilemmas of Black manhood in America*. New York: Simon & Schuster.

Malone, K. R., & Barabino, G. (2009). Narrations of race in STEM research settings: Identity formation and its discontents. *Science Education, 93*(3), 485–510.

Marsh, K., Chaney, C., & Jones, D. (2012). The strengths of high-achieving Black high school students in a racially diverse setting. *The Journal of Negro Education, 81*(1), 39–51.

Martin, D. B. (2006). Mathematics learning and participation as racialized forms of experience: African American parents speak on the struggle for mathematics literacy. *Mathematical Thinking and Learning, 8*(3), 197–229.

Martin, D. (2009). Researching race in mathematics education. *Teachers College Record, 111*(2), 295–338.

Martin, D., Gholson, M., & Leonard, J. (2011). Mathematics as gatekeeper: Power and privilege in the production of knowledge. *Journal of Urban Mathematics Education, 3*(2), 12–24.

Maton, K. I., Hrabowski, F. A., I. I. I., & Greif, G. L. (1998). Preparing the way: A qualitative study of high-achieving African American males and the role of the family. *American Journal of Community Psychology, 26*(4), 639–668.

McGee, E. O. (2013). Threatened and placed at risk: High achieving African American Males in urban high schools. *Urban Review, 45*(4), 448–471.

McGee, E. O., & Pearman, L. A. (2014). Risk and projective factors in mathematically talented Black male students: Snapshots from K through eighth grade. *Urban Education., 49*(4), 363–394.

McGee, E. O., & Pearman, F. A. (in preparation). Contextual resilience and the ecology of black male mathematics achievement.

McGlamery, S., & Mitchell, C. T. (2000). Recruitment and retention of African American males in high school mathematics. *Journal of African American Men, 4*(4), 73–87.

Milner, H. R. (2010). *Start where you are, but don't stay there*. Cambridge, MA: Harvard University Press.

Neal, M. A. (2002). *Soul babies: Black popular culture and the post-soul aesthetic*. New York, NY: Routledge.

Neal, M. A. (2006). *New black man*. New York, NY: Routledge.

Noguera, P. (2005). School reform and second generation discrimination: Toward the development of bias-free and equitable schools. *Journal Race Relations*, *30*(3), 30–33.

Noguera, P. (2008). *The trouble with black boys…and other reflections on race, equity, and the future of public education*. San Francisco, CA: Jossey-Bass.

Omar, A. R. (2011). *Masculinity and the acceptance of violence: A study of social construction* (Master's thesis). Retrieved from ProQuest Dissertations and Theses (Order No. 1496326, The University of Iowa).

Reis, S. M., Colbert, R. D., & Hébert, T. P. (2004). Understanding resilience in diverse, talented students in an urban high school. *Roeper Review, 27*(2), 110–120.

Riessman, C. K. (2008). *Narrative methods for the human sciences*. Thousand Oaks, CA: Sage.

Sabochik, K. (2010). *Changing the equation in STEM education*. Retrieved January 7, 2014 from http://www.whitehouse.gov/blog/2010/09/16changing-equation-stem-education.

Seaton, E. K., Caldwell, C. H., Sellers, R. M., & Jackson, J. S. (2010). An intersectional approach for understanding perceived discrimination and psychological well-being among African American and Caribbean Black youth. *Developmental Psychology, 46*(5), 1372.

Spencer, M. B. (1999). Social and cultural influences on school adjustment: The application of an identity-focused cultural ecological perspective. *Educational Psychologist, 34*(1), 43–57.

Spencer, M. B. (2006). Phenomenology and ecological systems theory: Development of diverse groups. In R. Lerner & W. Damon (Eds.), *Handbook of child psychology* (6th ed., Vol. 3, pp. 829–893). Hoboken, NJ: Wiley.

Spencer, M. B. (2008). Phenomenology and ecological systems theory: Development of diverse groups. In W. Damon & R. Lemer (Eds.), *Child and adolescent development: An advanced course* (pp. 696–735). New York: Wiley.

Spencer, M. B. (2011). American identity: Impact of youths' differential experiences in society on their attachment to American ideals. *Applied Developmental Science, 15*(2), 61–69.

Spencer, M. B., Fegley, S., Harpalani, V., & Seaton, G. (2004). Understanding hypermasculinity in context: A theory-driven analysis of urban adolescent males' coping responses. *Research in Human Development, 1*(4), 229–257.

Swanson, D. P., Cunningham, M., & Spencer, M. B. (2003). Black males' structural conditions, achievement patterns, normative needs, and "opportunities". *Urban Education, 38*(5), 608–633.

Terry, C. L., Sr., & McGee, E. O. (2012). "I've come too far, I've worked too hard!": Reinforcement of support structures among Black male mathematics students. *Journal of Mathematics Education at Teachers College, 3*(2), 73–85.

Thomas, D. E., & Stevenson, H. (2009). Gender risks and education: The particular classroom challenges for urban low-income African American boys. *Review of Research in Education, 33*(1), 160–180.

Thompson, L. R., & Lewis, B. F. (2005). Shooting for the stars: A case study of the mathematics achievement and career attainment of an African American male high school student. *The High School Journal, 88*(4), 6–18.

Tyson, K., Darity, W., & Castellino, D. R. (2005). It's not "a black thing": Understanding the burden of acting white and other dilemmas of high achievement. *American Sociological Review, 70*(4), 582–605.

U.S. Corporation for National and Community Service. (2012). 2012 Volunteering and Civic Life in America. Retrieved from http://www.nationalservice.gov/impact-our-nation/research-and-reports/volunteering-america.

Varley-Guitierrez, M., Willey, C., & Khisty, L. (2011). (In)equitable schooling and mathematics of marginalized students: Through the voices of urban Latinas/os. *Journal of Urban Mathematics Education, 4*(2), 26–43.

Walker, E. N. (2006). Urban high school students' academic communities and their effects on mathematics success. *American Education Research Journal, 43*(1), 43–73.

Wright, B. L. (2008). Racial-ethnic identity, academic achievement, and African American males: A review of literature. *The Journal of Negro Education, 78*(2), 123–134.