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"I've come too far, I've worked too hard!": Reinforcement of support structures among Black male mathematics students

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"*I've come too far, I've worked too hard*": Reinforcement of Support Structures Among Black Male Mathematics Students

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Along with the growth and refinement of our shared discourses on equity, the community of education researchers focused on Black males has developed lenses with which to examine the risk and protective factors related to Black males' participation in and experiences with mathematics. In this paper, the authors focus on the importance of the "supports" associated with mathematically high-achieving Black high school students in urban high schools. Using Critical Race Theory (CRT) and narrative analysis, the authors report findings from semi-structured interviews of mathematically successful Black male students (n = 12) from four urban high schools. Analysis of key themes suggests that high-achieving Black male mathematics students make use of powerful family & peer networks, as well as various features of the school and classroom community as support structures in the course of maintaining consistent mathematics achievement. Recommendations for strengthening support for all Black male mathematics students in urban contexts are discussed.

Keywords: Black males, mathematics achievement, supports

Introduction

> *...and as we were coming back in the house, I didn't know that a guy was trying to run up behind us with a gun... (H)e looked up and told me,"You call the police because we're killing everybody in that house tonight." And I'm like, I've come too far and worked too hard to have everything taken away from me because of the mistake of one person and we moved on from that.*
>
> —Hasani, 12th grade high-achieving Black male

Success in school mathematics seems fairly easy to predict when considering individual factors like race, class, and gender—as well as other contextual factors such as, for example, school and teacher quality. The mathematics education community has, along with our evolving discourse on equity, developed powerful lenses to examine and refine the current pedagogical practices that negatively impact "high need" and "at-risk" students. The National Council of Teachers of Mathematics [NCTM] *Standards* document describes a vision for high-quality mathematics instruction and calls for instructional practice that aids in the healthy development of students' robust understanding of mathematical literacy (Jackson & Cobb, 2010; National Council of Teachers of Mathematics Research Committee, 2006, 2007). However, when it comes to the mathematics education of Black students, some scholars contend that students' civil rights have been infringed upon, in part, due to the constant and systematic assaults on their opportunities to learn (Moses & Cobb, 2001; Esmonde, 2009; Martin, 2009; Oakes, 2005). As a result of well-known disparities in classrooms with low-income Black mathematics students (i.e., lack of qualified teachers; under-resourced classrooms, schools, and communities; low expectations and negative racial stereotypes, etc.), most Black children in these contexts are expected to fail. Mathematics education researchers' attention to the plight of these low-performing students is the unmistakable yield of our equity ethics and the focus of the national attention on achievement gaps. There is, however, a fraction of mathematics students—students like Hasani above—who, because of their unpredictably high achievement in mathematics, may be overlooked or simply

rendered invisible, as our attention has traditionally been focused on 'failing' students.

But what about Hasani? Although he is situated in stressful conditions, Hasani, a Black teenage male, attends a neighborhood high school where he is not only academically successful in general but he is high achieving in mathematics. First, we would like to suggest that students like Hasani—students who should, by most traditional accounts, be failing at school mathematics—offer important opportunities for mathematics educators to develop important insights into the interaction between multiple forms of marginalization and student resilience in STEM disciplines. Second, we believe that focused inquiry into this "under-acknowledged success" can illuminate pathways to intervening in the underperformance of urban Black high school male students in mathematics. Using Critical Race Theory and narrative analysis, the authors report findings from semi-structured interviews of mathematically successful Black male mathematics students (n=12) from four urban high schools. Analysis of key themes suggests, apart from developing rigorous knowledge, skills and understanding in mathematics, high-achieving mathematics students develop and make use of powerful networks of family and peers, as well as mathematics teachers, as support structures and resources in their resiliency. The authors make recommendations for reinforcing these support structures for Black mathematics students in urban schools. Our recommendations recognize and reinforce the building of emotional and mathematical strength of high-achieving Black males to defy "racist societal views of their own competence and worthiness and that of their families and communities" (Delpit, 2012, p. xix).

Literature Review

The disturbingly low levels of mathematics achievement by U.S. students of color (Blacks, Latinos, Native Americans, and some Asian Americans), women, and low-income students have gained increasing attention across the education community (Ferguson, 2001; Martin, 2009; National Center for Education Statistics, 2009; Sabochik, 2010; Varley-Gutierrez, Willey, & Khisty, 2011). For decades, numerous reports have documented underachievement and limited persistence of Black students in mathematics (Fullilove, 1990; Martin, Gholson, & Leonard, 2011; Tate, 1997, 2005). At every stage of the school mathematics pipeline, *remedial* mathematics classes contain disproportionately high levels of Black students, while *advanced* mathematics classes largely enroll White and some Asian American students (Lubienski, & Gutiérrez, 2008; Martin, 2009a, Tate, 2005).

Black students' experiences in schools, including their participation in mathematics classrooms, are shaped by social, psychological, and cultural challenges and barriers that derive from their unique socio-historic identity as "minority" in the U.S. educational system (Civil & Planas, 2004; Dixson & Rousseau, 2003; Gregory, Skiba, & Noguera, 2010; Woodson, 1933). Factors critical to academic/life achievements for Black students cited by researchers include: racism (e.g., racial stereotypes, racialized experiences, unequal access to quality schools); home factors (e.g., family and financial composition, students' responsibility to care for younger siblings, level of community violence); school factors (e.g., rigor of the curriculum, teachers' expectations, school conditions); before- and after-school factors (e.g., feeling of safety commuting to and from school/after school activities, exposure to lead, nutritional intake); and the interrelationships of all these factors (e.g., the relationship between racial stereotypes and teachers' expectations) (Lewis, 2003; Martin, 2009a, 2009b; Moses & Cobb, 2001; Stinson, 2009).

Recently, researchers have noted that the confluence of racism, racialized experience, and gender-based pathologies have undermined the participation of these students in achieving academic success (Ferguson, 2001; Gregory, Skiba & Noguera, 2010; Howard, Flennaugh & Terry, 2011; Noguera, 2003). These insights, gained largely outside of the mathematics education community, can assist in explaining mathematics achievement disparities for Black students. Absent from the larger discourse on mathematics achievement and persistence outcomes, however, is research on mathematically high-achieving Black learners who have successfully negotiated academic, institutional, and social challenges. A small but growing pool of mathematics education research, originating primarily (but not exclusively) from mathematics educators of color (e.g. Berry, 2005, 2008; Leonard, 2008; Martin, 2009a, 2011, 2012; Martin, Gholson, & Leonard, 2011; Moses & Cobb, 2001; Moody, 2001, 2003; Tate, 1997, 2005), suggests that there are narratives of Black and other historically marginalized students who achieve success in mathematics. These mathematics educators challenge dominant epistemic frames in mathematics education, offering qualitative or mixed-methods studies that highlight heretofore unheard narratives from Black students and their teachers. While illuminating stories of success, these researchers have also implicated traditional mathematics education pedagogy, curricula, and research in the reproduction of systems of class, race, and gender-based oppression (Ebby, Reinke, & Remillard, 2011; Gholson & Martin, 2012; Martin & Gholson, 2012; McGee & Martin, 2011a; Terry, 2011; Walker, 2012). Importantly, a critical trend in current research literature moves beyond deficit models that suggest Black students are lacking in ability or potential. Unfortunately, few researchers have documented the voices of academically successful Black male students; much of this inquiry has been limited to general college academic success (Harper, 2010; Howard, 2010; Jackson & Moore, 2006, Lynn, 2002; Stinson, 2009) or compares Black women

to men (Chavous, Rivas, Green, Helaire, & Turner, 2002; Cohen & Nee, 2000; Cross & Slater, 2000). Secondary schooling (grades 6–12) is identified as an exceptionally challenging period for boys to achieve academic success and maintain a masculine status (Berry, 2008; Swain, 2005). For example, scholars report that prevalent male underachievement at the secondary level is closely tied to the estimated 48 percent high school completion rate for male students (National Center for Educational Statistics, 2009).

This article challenges the contention that failure and limited persistence in Black male high school students' learning and participation in mathematics is completely normative and/or pathological. As a critical defense, we highlight the achievement and agency of Black male students who face multiple inequities in their schooling experience. In doing so, our goal is not to place blame on Black students who do not similarly achieve but, rather, to encourage dialogue on how mathematics educators can build the best systems of support for Black students' agency, resiliency, and persistence in mathematics classrooms.

Theoretical Frame

Critical race theory (CRT) provides mathematics educators a useful set of lenses with which to view the racialized experiences of Black males and other marginalized students in the mathematics classroom and society more broadly. The CRT movement originated among legal scholars who argued the need for a more race-conscious approach to critical legal studies—with the goal of delegitimizing the belief that white racial dominance, with respect to legal rights and in social, political, and economic spheres, is *natural* (Crenshaw, Gotanda, Peller, & Thomas, 1995; Dixson & Rousseau, 2005; Ladson-Billings, 1998; Taylor, Gillborn, & Ladson-Billings, 2009). CRT is a valued theoretical frame in education research (Ladson-Billings, 1998; Taylor, Gillborn & Ladson-Billings, 2009; Tate, 1997), among mathematics education researchers (Esmonde, Brodie, Dookie, Takeuchi, 2009; Martin, 2009b; McGee, in press; McGee & Martin, 2011b; Stinson, 2009; Terry, 2011; Varley-Gutierrez, Willey, & Khisty, 2011), as well as for those who study Black males (Harper, 2010; Howard, 2008; Lynn, 2002). Among the key tenets of CRT[1], this study is grounded in three of its themes in particular:

- Recognizing the centrality of race, racialization, and racism in U.S. society and throughout its institutions—here, school;
- The privileging of the experiential knowledge of People of Color in the adjudication of truth and the assessment of our collective knowledge;
- The commitment to social justice through transformative action.

The theoretical framing provided by CRT is core to our conception of what equity must look like in mathematics education. In this article, as we attempt to foster a deeper understanding of the role students' support structures play in their high mathematics achievement, we give overdue privilege to the voices of the Black male youth who participated in this study. We contend that the identities our participants are developing—as Black males, as high-achieving students of mathematics, as members of their communities—are reflected in their stories, their voices, and their narrative views of their respective experiences in their classrooms, schools, and communities.

Method

This research is part of a larger study that investigated the development and formation of identity among mathematically high-achieving Black high school students from several urban charter schools to determine those factors that lead to resilience and success in mathematics (McGee, 2009). The goal of this paper is to re-visit the possible connections between the salient supports that these high-achieving students made use of and further examine how practitioners, education researchers and policy-makers might more productively approach the underperformance of Black male students in our mathematics classrooms. By taking another look at the various structures and practices that mathematically high-achieving students found helpful, the authors hope to develop a fresh look and renewed strategy for supporting their non-high achieving counterparts.

Participants and School Context. The participants were students at one of four charter high schools in Canvas City[2], an urban center in the midwestern United States, during the spring and summer semesters 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. While the authors acknowledge that charter schools differ from traditional publics in some significant ways that may have impacted our findings, we do not take up an analysis of those differences in this paper. Canvas Public School District (CPSD) serves a population that is approximately 50 percent Black, 40 percent Latino/a, just under 10 percent White, almost 5 percent Asian American, and 5 percent 'Other'. With about 600 traditional schools and 70 charter schools in the district, over 80 percent of Canvas Public Schools' student population qualifies for free or reduced lunch. It is estimated that less than 60 percent of

[1] See Dixson & Rousseau (2005) for a discussion of six CRT themes relevant for education.

[2] All city, district, school and participant names in this paper are pseudonyms.

Table 1. Black Male Participant Demographics

Participant	Grade	Age	Primary Caregiver(s)	Grade Point Average (GPA) [a]	Mathematics GPA [b]	Colleges Considering	Career Aspiration
Bomani	10	15	Mother	3.5	4.0	Morehouse College, Florida State University, Clark Atlanta University	Financial Advisor
Booker	10	15	Mother, Father	2.9	3.5	University of Miami	Engineer, Pilot
Demetrius	12	17	Mother	4.0	4.0	Grinnell *College*	Entrepreneur
Ernest	9	14	Mother, Father	2.3	3.5	Aims to attend college in Italy or France	Business Entrepreneur, Dancer
Hasani	11	16	Mother, Grandmother	3.4	3.0	University of Illinois at Chicago	Own a Law Practice, Choir
Hezekiah	10	16	Aunt, Mother	2.7	3.0	Michigan State University	Chef
Jayson	9	14	Mother	3.5	3.7	Michigan State University	Graphic Design
Lonnelle	11	16	Mother	3.2	3.8	University of Illinois, Northern Illinois University, University of Michigan, Ohio University, Northwestern University	Undecided
Michael	10	16	Mother, Father	3.12	4.0	Morehouse College, Southern Carolina State University, Florida A&M University, The Ohio State University	Undecided
Ryun	11	16	Mother, Father	3.1	3.7	Butler University, Drake University, Northern Illinois University	Professional Athlete
Sameen*	12	17	Mother	3.3		University of Illinois at Chicago	Teacher
Tommy	10	16	Mother	2.9	3.4	Michigan State University	Fireman

* Some demographic information not available for this participant.

[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

high school freshmen will graduate and less than 55 percent 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, including careers in STEM fields (Knapp, Heuer, & Mason, 2009).

This paper draws on data from interviews with 24 mathematically "high-achieving" Black students (male and female). "High achievement" in mathematics was defined as having a mathematics GPA of 3.0 or higher on a 4.0 scale and identification as the top student in their upper level mathematics classes (e.g., Calculus, Algebra II, Trigonometry, Mathematical Logic, Probability and Statistics). The second author conducted on-campus interviews with 11 students (male and female) at the four CPSD sites. An additional 13 interviews with students (male and female) representing all four schools took place at a summer mathematics academy sponsored by a local university. Of the 24 students participating in the original study, 12 students were Black males—these represent the subset of participants considered in this paper. At the CPSD sites, the mathematics teachers chose the top three to five students in classes that contained approximately twenty students. These "top" students were invited to a separate room and given a brief informational session about the study; recruitment from the four CPSD high schools yielded 5 Black male participants. At the summer mathematics academy, brief study informational sessions were given in the two highest mathematics offered. Recruitment from these two classes yielded an additional 7 Black male participants. At both sites, parental consent forms were given to students upon request and the voluntary nature of participation in the study was reiterated.

Table 2. Categorization of Supports Black Males Use to Sustain High Mathematics Achievement

Open Coding Category	Axial Coding	Selective Coding [a]	Code Description
Home/Community	Family Supports	Parent/Caregivers (24) Extended Family (6)	• Work, provisions, expectations, discipline, knowledge, encouragement, attendance at events, advocacy at school all seen by students as necessary supports for their success.
	Community Supports	Black male role models (22)	• Provide positive and encouraging examples that students identify with; negative examples also function as deterrents.
		Church (2)	• Provides nurturing environment that encourages accountability; scholarships and prizes as motivation.
Mathematics classroom	Teacher Supports	Instruction/Management style (11)	• Teacher availability, flexibility, rigor, monitoring of learning, discipline, attitudes toward fun, and lesson structure are important features of supportive teaching.
		Teacher quality (4)	• High-quality, knowledgeable teachers pivotal in student learning.
		Expectations (3)	• Focus on individual achievement, with explicit expectations for success, is seen as necessary support.
	Peer Supports	More knowledgeable peers (8)	• Students make use of more knowledgeable peers to understand difficult content and/or help others.
School	School Climate	School quality (15)	• Schools' reputations for rigor, achievement, and providing post-secondary access seen as key asset in student's academic success.
		Competitive & encouraging peer relationships (6)	• Students promote climate of encouragement among one another; competition among peers also serves as stimulus for individual achievement.
	Institutional Support	Co-curricular & Accelerated programs (5)	• Mathematics programs that are geared towards conceptual exploration, skill development, and advanced learning motivate student achievement support students' goals.

Note. This table is based on coding architecture derived from student responses (n=12) to semi-structured interview questions.

[a] Values provided in this column represent the number of student response segments assigned this code across all interviews.

Methodology. The authors hold that individuals and their experiences should be studied and understood contextually—and, further, that identities are rooted in important ways in the cultural practices that constitute students' experiences of daily life (Nasir & Hand, 2006). The analysis conducted in this paper is a result of an examination of students' experiences relayed through semi-structured interviews that attempted to elicit the rich detail of those experiences in narrative form. We employed a grounded theory approach (Corbin & Strauss, 2008; Creswell, 2007) to understanding the unique experiences of the participants. The authors used an *open coding* procedure to develop an initial sense of the students' experiences as presented in the interviews. From these initial codes, we described several open coding categories (Table 2), ultimately focusing on the central phenomenon of "supports." Axial coding gave insight into the elements of their educational experience that have enabled success in school mathematics for the Black male participants; several types of supports emerged. The authors conducted an additional round of selective coding and analysis that allowed us to structure a broad narrative that describes the strategic roles that various supports played in facilitating their successes in mathematics classrooms. This process formed the basis for the results shared below.

Results

The three major categories of supports for high mathematics achievement found were *home & community* supports, *mathematics classroom* supports, and *school & institutional* supports. In the following narrative, we feature student voices in order to frame the significance of each major theme from participants' perspectives.

Home & Community Supports

The mathematically successful Black males who participated in this study asserted that key support for their successes stemmed from their personal families and communities. While the connections that exist between the home and school community are often fragile, the Black males in this study conceptualized home, family, and community as important pillars of their success.

Family Supports. Many participants emphasized the roles that their parents (or primary caregivers), siblings, and extended family members played in both their academic and mathematics success. Families supported students by creating and maintaining expectations for high academic achievement, selecting the schools the students attended, advocating for students' rights and needs in schools, providing resources, and engaging in protective behaviors in the home/school community. Consider excerpts from three interviews below. The first student, in describing the need to select a university close to home, gave a detailed sense of how his family made his success in the school and community possible. The two students who follow make important points, more specifically, about the role of parents in academic life:

> **Interviewer**: (You're selecting that university because it's) close to home?
>
> **Hasani (Senior, 17 y/o)**: Yeah, my family has a real big piece of me and like, if I move away from them, I think I would be less successful at school because they help me get through…I'm very stressed out and I'm very tired, my grandma is always there to help me... My mom helps me, my aunt helps me, and I'm like, *you know, this is my support system. If I go away I have to find a new support system and there's no guarantee that these people (will be) reliable like the people that I have here at home…* They attend meetings with me...When I have award ceremonies, they're there; I can look out and just, "Oh, there's my grandma, here, look, look." When I'm doing good, they acknowledge it; they don't give me gifts but they acknowledge that I am doing good. They have high expectations of me and it helps me have high expectations of myself, and it helps to motivate me to just keep going…They have my back fully on anything that I want to do. All the programs that I am in and that I have done…. My grandma took me to work the first week of work. She didn't have to get up every morning at 6 o'clock to make sure that I'm getting up and to make sure that I got my lunch and I'm ready and at work on time (but) she does that for me. My mom takes me and she waits in the car for two and a half hours while I'm at meetings, like today.
>
> ***
>
> **Interviewer**: Do you know why you were admitted into this school? Did you have to take a test? Did your parents have to—did you know somebody?
>
> **Sameen (Junior, 16 y/o)**: My mom–it was like a lottery pool and, my mom, she called to get us in. She told us she wanted us to leave our other school but I didn't want to leave… She was like, "Well, if we find another school, you're going." And, then, she just happened to find this school. She told us that the school had a lot higher percentage rate of people going to college and it's a charter school. I thought about it; I'm like, "No, I don't want to leave. I still don't want to leave"…The next day, I woke up and there was a new shirt on my dresser. I'm like, "What is this?" She said, "You going to a new school." So I came here and then I started to like it. It was okay.
>
> ***
>
> My mom tells me that (school) is the only way to get a good job; that the only way I can succeed in life is by going to get a good education. Actually, she went back to get her GED–she dropped out of high school because she got pregnant. Now she works at a bank. She tells me that she wants me to experience high school and *go straight to college* because, once you stop, you're not gonna want to go back to college–so go straight to college. Some homework assignments she could help me with but most of the time she'll be at work. She could help me but she has to go to work early in the morning, like 5 a.m. Sometimes, she's there until 11 at night. She has different schedules. (**Tommy, Sophomore, 16 y/o**)
>
> ***

Typical of the students in this study, Hasani, Sameen, and Tommy described family as being instrumental in their achievement. In Hasani's description, we read a clear articulation of the connectedness he perceived between his ability to engage with, participate, and achieve his goals and the supports his mother, grandmother, and aunt provided for his in-school and community-based activities. Students described parents, caregivers, and extended family as important components of their own development as well-rounded students; family provided supports for the students' development as conscientious, responsible, and dedicated workers.

While it was rare for the Black males in this study to indicate that their parents contributed directly to their undertaking and understanding of mathematical tasks or other academic work (due to either availability or ability), students like Sameen and Tommy argued that family provided positive examples that contributed to their motivation and outlook on the difficult academic terrain they faced. Despite his protests to remain in his favored former school, for example, Sameen's mother took authoritative action to get him into a successful charter school in the city known for facilitating students' college access. Tommy's mother, in turn, coupled her personal example of persistence in her own education with an affirming narrative about the value of education. Reports of these kinds of advocacy

were common in the students' descriptions of their families' support.

Community Supports. While the presence of family was clearly important for many of the participants, students also felt that members of their larger community played a significant role as well. While for some students this meant local church support, students more commonly spoke about how the presence (or absence) of Black male role models in their homes and in the community served as an important motivating factor.

> **Interviewer**: And what's rough about (your neighborhood)?
>
> **Demetrius** (**Senior, 17 y/o**): It's like always deaths and gunshots. Just this past summer a guy got killed in front of our house…. like another guy got killed in the back of our alley. All around there are 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. Um, my mom, like—I don't want to say "suffers" but every day she's on her job you know? She has to be at work at a certain time and leave a certain time and she does that (because) her kids need her. And I can't do other but honor her for that—so I feel that I have to go to college, I have to be successful, I have to–I have to get my mom that house with the white picket fence and the perfectly mowed lawn, and a little dog. I have to do that.
>
> ***
>
> **Bomani (Sophomore, 15 y/o):** Every once in a while, I do community service–and then, I want to do this (fraternity program) called "Kappa League."
>
> **Interviewer**: What's that?
>
> **Bomani**: It's like…they're teaching and mentoring younger Black males to focus in school and things like that; to focus on other things and let them know that the materialistic isn't everything...
>
> ***
>
> Seventh grade year, at my other school, we a got a Black teacher and a Black male teacher. What happened was, when we moved up to seventh grade, I had a whole year of Black teachers. I was actually glad to have that because you don't come by Black male teachers. And it kinda made me mad because he quit because of the (student) behavior. The students were just disrespectful. I mean, we had a nice teacher and he quit… Come to find out, he's at a Caucasian school—they are paying him better than what they were paying him here, and he's over there teaching them and they love it. So I thought like, "Wow, they accepted him—why can't we accept him?" He took the time every day to put up with, you know, teach Black kids… he knew it was going be problems when it came to that. I had to get out of that school because I personally did not want to be held behind. **(Michael, Sophomore, 16 y/o)**

***

It was clear from comments like Bomani's above that student did, in fact, rely on the programs offered through local churches, fraternal organizations, and community-based organizations to enter into positive mentor/mentee relationships. Students indicated that this presence of Black males in the community was a helpful support. Perhaps more interesting, however, was the notion—echoed in comments from Demetrius and Michael—that the absence of "father figures" and other such men in their lives was in some ways also a positive support. Not treating lightly the difficult emotional, physical, and financial circumstances that can be exacerbated by the absence of Black male role models and providers, the authors note that the students in this study used those *absences* as motivation to mature, to take on important roles in their households, and to adopt protective, proactive, and resilient attitudes and actions in their schooling experience. As such, the authors recognize the strength of these communities—both women and young men–in adapting to and utilizing difficult socioeconomic conditions in a way that created motivation and expectation for success.

Mathematics Classroom Supports

The Black males in this study also pointed to supports in their mathematics classrooms that were instrumental in their mathematical success. We developed two thematic categories of supports for the mathematics classroom: teacher and peer supports.

Teacher Supports

Students recognized the role teachers and the dimensions of their professional practice that contributed to their achievement. Students felt that teacher quality was an important part of creating classroom environments where high mathematics achievement was both possible and expected.

> Well, (our math teacher) Mr. C is the Renaissance man. First of all, he got a real high score on the ACTs–we feel that he knows everything and he say he don't. But every time we ask him something about math, he know the answer….to us, we feel like we need to get to his level, and everybody in my class wants to go to college. We all compete on

> who gets the best grades and… I feel, I don't look at other people. When I need to know something, I ask it myself. (**Hasani, Senior, 17 y/o**)
>
> ***
>
> I remember last year, me and my friend, we used to argue over a math answer, that's how, that's how much we used to be into school. We used to argue over a math answer! We was disturbing the class by arguing...we would get up and we would go to the board, take the marker from the teacher–teacher be looking at us like, "What are you doing? This is the right answer." …my friend was like, *"This* is the answer.*"* …then we proved it. The teacher liked (our argument). He liked that we wasn't fighting over nothing stupid…. He liked that we was so into his teaching. (**Sameen, Junior, 16 y/o**)
>
> ***

Hasani, when asked about the role his teacher played in shaping his identity as a mathematics student, pointed out that he and his peers looked up to their teacher's mathematics content knowledge and worked to model their own learning after his. Hasani and his peers, as a result of the leadership of their teacher, did not struggle with being seen as "nerds" or "geeks" (in part) because of the competitive climate that was established and encouraged in the classroom. Additionally, Sameen's comment above highlights the instrumental role that mathematics teachers' flexibility with classroom management and instruction can play in developing powerful socio- mathematical norms. Students like Sameen appreciated being able to have space in the mathematics classroom to construct arguments, offer proofs, and have fun during instructional time.

Peer Supports. In addition to the role that teachers' instruction played, Black males draw upon support from their peers to sustain their mathematics achievement. Students in this study reported making strategic decisions about who they befriended in school and in the community, often leaning on more-knowledgeable peers to support their learning, while avoiding peers they felt were academically distracting or "up to no good."

School Supports

The school, more broadly, was the source of a third major category of support for the Black males' success and high-achievement in mathematics. Black male participants spoke specifically about two types of school supports—school climate and institutional supports.

School Climate. The most common element of school climate cited by students in interviews was the support students drew from school quality and encouraging peer relationships. Students were highly critical of the quality of the schools in their communities, particularly those not seen as successful. They placed value in schools with reputations for academic rigor and high college-going rates—and worked diligently to get into and succeed in such spaces. Part and parcel with these reputations for excellence, however, were the presence of peers that were like-minded in this regard.

> We going at it, we like to stay on the top! It's like a friendly competition. "I just got an A on this test! *What did you get*?" I believe that (if) everybody had a mindset like that to compete with one of their friends, everyone would succeed in school. Everyone…if you didn't have a jealous mindset, but a friendly competitive mindset… So when I started going here, it was a big difference. (**Michael, Sophomore, 16 y/o**)
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While students recognized their own agency and responsibility for their mathematics and academic success, they also indicated that peers with whom they established a friendly-competitive spirit and mutually encouraging habits had positive effects on their success in mathematics learning and overall academic achievement. This was a characteristic element of the school climate according to many of the students.

Institutional Supports. The mathematically successful Black males in this study also pointed to the importance of the co-curricular and accelerated programs they participated in. Students discussed the positive effect advanced placement courses, summer mathematics camps, and other accelerated programming had on their performance in classes and their overall outlook on school and achievement.

> **Interviewer**: Tell me about the math camp.
>
> **Bomani (Sophomore, 15 y/o)**: It was an accelerated summer math program. I was an intern there… they challenge you on another level, a higher (level)—like, (I am in the 10th grade so), then, they would challenge me on the 11th or 12th grade level. So, yeah it was challenging.
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> ***
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> **Interviewer**: Did anything exciting happen to you this summer?
>
> **Michael (Sophomore, 16 y/o):** Yes it did. I did an accelerated math program and I kinda got a better understanding and went a little deeper into math. And (the program) was (taught by) other teachers, so I saw *how they taught* and the different methods and the different shortcuts towards getting their answers. It was at the University.
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These students believed that being in an accelerated academic environment had a very positive impact on their

outlook. Accelerated programs affirmed their intelligence and ability to participate in rigorous mathematics experiences. They also exposed them to different teachers and mathematicians, giving them access to different instructional approaches and, ultimately, deeper conceptual understanding in mathematics.

Recommendations

In this article, the authors have argued that a comprehensive equity focus in mathematics education dictates that researchers and practitioners focus not only on the perennial underperformers in our mathematics classrooms, but also think more carefully about how the experiences of successful students may shed light on how to better support the learning and achievement of all students. The authors contend that the act of ensuring equity means fighting against exclusion and the racialized injustices that fuel societal, community and school marginalization (Zion & Blanchett, 2011). The students in our study, through their creative navigation towards success, have helped us redefine the challenges and opportunities associated with Black males in urban spaces. The authors would like to close this paper by offering some strategic recommendations for developing the kinds of supports that the mathematically successful Black male students relied upon.

Recommendation #1

Develop culturally responsive connections to parents, caregivers, and/or extended families of the Black male mathematics students in your classroom and school community.

By far, the most prominent supports discussed by the participants in this study were family and community supports. Given the challenging socioeconomic conditions many families face in their communities, practitioners and teacher educators must develop expanded conceptions of parent support that extend beyond traditional notions of parent involvement. A first step to developing supportive connections to homes is to reject deficit views of parents and families through a principled acknowledgement of the likelihood that no one is more desirous that students succeed than their own families and communities. Practitioners should recognize that "parent support" is first and foremost support *of their own student*—and secondarily, of those directing the mathematics education of their student. A thorough review of classroom and school policies and resources may be necessary to ensure that those students who do not have access to relevant cultural capital are accommodated and not punished. Communication between home and school should aim to discover and acknowledge the ways that families can and do support high mathematics achievement in school, as well as to provide opportunities for reciprocal forms of support.

Recommendation #2

Structure opportunities for students to develop positive relationships with successful Black males in STEM industries and the community.

Although these students have potential to pursue careers in STEM fields, only one student (Booker) articulated aspirations to pursue a course of study in a STEM discipline. We believe this may be because mathematics teachers do not train themselves to regularly think of Black males as future engineers or scientists. Enhanced access to real-world learning for students through building and engaging a network of community partners such as STEM companies, neighborhood organizations, and local higher education intuitions holds great promise. We encourage schools to collaborate and develop sustainable partnerships in order to better serve the needs of students who demonstrate the drive and talent to succeed in STEM. Additionally, internships and other work related commitments could further expose these youth to the employment avenues within STEM.

Practitioners must respond to the strengths (as well as the weaknesses) of the communities from which they draw their mathematics students. The presence or absence of Black males significantly impacts students and how they view their present and future. It is incumbent upon mathematics teachers and school administrators to *know* the Black males in their classrooms, as well as to discover and understand the relationships they may or may not hold with the Black males in their communities—and what additional responsibilities students may carry as a result of those relationships. The authors recommend practitioners work to structure opportunities for Black male mathematics students to enter into mentor relationships with "successful" Black men; relationships that may help Black male mathematics students develop a vision of their futures with mathematics. Further, students must also be encouraged to act as mentors themselves—as evidence of the valuable knowledge and experience they themselves possess.

Recommendation #3

Aim for a mutually encouraging, culturally-affirming competitive excellence as a defining characteristic of school and classroom climates

The high-achieving, mathematically successful Black males in this study indicated that competition was an important part of their own successes. We are aware that competition in mathematics education has been previously defined as problematic for Black students, thus reflecting the ideology of the White male middle class (Ladson-

Billings, 1998). However, we would like to expand the definition of competition, to demonstrate the motivating effect that culturally grounded competition has on fueling these students' drives. For example, many of the students in this study demonstrated their competitive nature in this way: *they engaged in playful bantering in solving a problem the 'fastest' or explaining an answer the quickest; after a few moments of basking in their success, they assist other students in the classroom that where struggling.* We believe this type of competition is culturally affirming because it incorporates peers motivating each other to succeed through healthy competition and incorporates assistance for students who could benefit from the extra peer-initiated support.

The authors view this as an important strategy and recommend that administrators and mathematics teachers encourage climates of competition among students as they occur *in situ*, insofar as they are productive to facilitating mathematics understanding and achievement. This recommendation comes with an important caveat, however. Practitioners should note that not all students respond positively to competition, particularly if they are struggling academically. As such, practitioners must work to develop a competitive spirit that is not simply for its own sake, but that tends toward the goal of *excellence*. When students understand that competition is designed to develop excellence, as opposed to perfection, they can more clearly discern an individual road leading to academic improvement—one that allows them to participate in a broader culture of competitive excellence and captures helpfulness to their peers as well.

Recommendation #4

Develop evolving instructional and classroom management strategies that are student-centered and adapt to the changing needs of Black mathematics students.

If Black male students are to continue to be successful and develop patterns of high achievement in mathematics, highly knowledgeable mathematics teachers must adopt instructional strategies that aim for, expect, and encourage intellectual rigor in mathematics classrooms. The students in this study felt that these expectations, coupled with teacher's attention to individual progress, were indispensable aspects of their achievement. As practitioners target students who may be underperforming, it is critical that they provide students with appropriate instructional scaffolding that simultaneously acknowledges student capability, while providing a path towards increased mathematics achievement.

Additionally, mathematics teachers must be flexible in exercising classroom management. Because students overwhelmingly view school as a social space shaped by stereotyping, varying levels of expectation, and often-conflicting messages of discipline and academic excellence, teachers must employ culturally responsive classroom management strategies that create a social space in their classrooms that accommodates Black males both as individuals and as members of larger cultural groups (Milner & Tenore, 2010). For example, hyper-masculine behaviors can be understood as a necessary self-defensive strategy to protect oneself against perceived and real violence, which often materializes inside classrooms (Swanson, Cunningham, & Spencer, 2003; Thomas & Stevenson, 2009). Taking time to investigate ways some Black males demonstrate certain behaviors may allow for more culturally responsive mathematics classrooms. Mathematics teachers and administrators should take the initiative to learn and understand the experiences of their students, particularly the specific challenges that Black males may face in their local communities.

Recommendation #5

Support high mathematics achievement by increasing access to advanced curricula and rigorous co-curricular and accelerated programs.

An inescapable reality of high academic achievement is that students must be exposed to more-capable peers and teachers, advanced curricula that stretch their mathematical thinking and skill, and opportunities that engage them outside of traditional mathematics classrooms. Most of the students in this study did not have access to AP, IB, or consistently rigorous mathematics curricula that might have assisted in creating more robust mathematics identities. The development of a robust mathematics identity has the potential to expose these youth to additional opportunities (e.g., STEM summer camps, after school robotics programs) that may have propelled more of these students to pursue STEM fields in college or in life. The authors further believe that advanced placement courses, co-curricular programs that involve non-traditional and dynamic uses of mathematics knowledge, and other forms of accelerated academic programs are in short supply in the communities that need them most. In addition to creating more broad-based access to advanced placement curricula, administrators and STEM faculty should work to partner with local colleges and universities, small business, and corporate industry to create the kind of programs that give Black males challenging opportunities to learn and apply mathematical knowledge.

Concluding Remarks

This study advances important and understudied considerations regarding participation and mathematics learning for those Black male high school students who have been successful in mathematics. The authors acknowledge that supporting these students is an important

equity goal that encourages additional research that can provide a basis for thinking about how to meet the needs of both high achieving and non-high achieving Black male mathematics students. The recommendations offered here stress a culturally sensitive framing that affirms the needs, experiences, and multiple identities of Black male students of mathematics.

The economic vitality of the United States is derived in large part from the steady stream of scientific and technical innovations produced by highly trained individuals and teams in STEM research, development and industry. Black males are noticeably missing from these enterprises. However, there is plenty of evidence suggesting that high-achieving Black males are also quite capable of functioning on the cutting edge of the intellectual work from which the entire world benefits. Equity in mathematics education translates to giving whole-hearted and considered support to these students. In doing so, we address the large-scale loss of innovation experienced in our STEM endeavors—a loss brought on by a lack of diversity and representation of Black males who have the opportunity, desire and ability to achieve in STEM. However, this research is also positioned to more effectively remedy underachievement of those who have been traditionally positioned as having the highest need.

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Promoting Equity: Examining a Model of Success for African American Women in Mathematics

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A model of success (MoS) is proposed by the researcher for African American women and women in general, who are pursuing degrees in the field of mathematics. The model was developed by examining the historical and present-day experiences of African American women mathematicians. This model describes extrinsic and intrinsic factors that mediate the educational experiences of African American women in mathematics.

Keywords: African American women, mathematics, model of success

Introduction

When considering issues of equity in mathematics, researchers often talk about the need to increase women and underrepresented racial and ethnic groups in science, technology, engineering, and mathematics, i.e., STEM fields (Marra, Rodgers, Shen, & Bogue, 1999; National Science Foundation, 2011; Towns, 2010). For example, there is a dearth in the number of African American women attaining STEM degrees at the collegiate level, despite the fact that a substantial percent of African American women have the intention to major in STEM fields upon matriculation. In 2008, about 32% of first year African American women reported their intentions of majoring in a STEM field (National Science Foundation, 2011); however, this percentage decreases for African American women by the time of graduation. Several reasons have been suggested as to why women and other underrepresented groups shy away from STEM arenas, such as lack of role models or mentors, lack of advising, feelings of isolation, and lack of community (Joseph, 2012; Towns, 2010).

By exploring the experiences of mathematicians who are African American women, a Model of Success (MoS) was developed, specifically, for African American women pursuing their education in mathematics. The MoS organizes various factors that mediate the educational experiences of African American women who sought their doctorate in pure and applied mathematics. This model continues a conversation for educators, researchers, and others invested in increasing the number of African American women and other underrepresented groups with degrees in mathematics.