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Black Male Success in STEM: A Case Study of Morehouse College

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The purpose of this study is to enhance our understanding of how a Historically Black College and University (HBCU) is cultivating Black male achievement in STEM. In this in-depth qualitative case study, we explore 2 resource-intensive and successful STEM pathway programs at Morehouse College, the only all-male HBCU in this country, as an opportunity to examine the cultivation of Black male STEM scholars. Our study was guided by 2 overarching questions: What opportunities for participation in a rigorous STEM education do the programs provide? What individual and institutional practices contribute to STEM student persistence and learning?

Keywords: Black men, case study, HBCUs, STEM

As the United States recovers from the recession that began in 2008, economists project that between 2008 and 2018 the supply of STEM[1] (Science, Technology, Engineering, and Mathematics) jobs is expected to grow by 17%, whereas the total number of jobs is expected to increase by 10% (Center on Education and the Workforce, 2011). In light of the rapidly growing demand for STEM graduates, federal support from the National Science Foundation (NSF) for STEM education has increased by $1.5 billion (NSF, 2012) over the past seven years. Despite our nation's investments, the U.S. is ranked near the bottom—as compared with developing nations according to the Organisation for Economic Cooperation and Development nations (OECD)—for STEM degree production (NSF, 2006). Demand for a larger STEM workforce continues to outpace the supply.

Although more than 264,000 bachelor's degrees were awarded in STEM fields in 2011 (NSF, 2011), it is projected that by 2018 there will be 979,000 available jobs that require a baccalaureate degree in STEM. This raises serious questions about whether the nation is poised to prepare and graduate a sufficient number of STEM professionals to meet this demand at the moment when the "baby boomer generation" retires in greater numbers and the outsourcing of jobs to other countries has become widespread. The ability to prepare and graduate sufficient individuals to fill those positions is contingent upon the success of our educational system to narrow racial disparities in achievement.

Contributing to the challenge of educating more individuals for the STEM workforce is the unequal distribution of STEM degrees across

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[1] STEM includes the following fields: Agricultural sciences, Biological sciences, Computer sciences, Earth, atmospheric, and ocean sciences, Mathematics and Statistics, Physical Sciences, and Engineering.

racial, ethnic, and gender lines in this country. Consistent with the gap in attainment across postsecondary education (Kao & Thompson, 2003), the underrepresentation of Blacks in STEM is troubling. In 2010, Blacks represented 13.6% of the U.S. population (United States Census Bureau, 2011). Roughly 20% of Blacks who enter a 4-year college intend to major in STEM, yet Blacks students earned only 6% of total bachelor's degrees in STEM in the same year (NSF, 2011). In contrast, 23% of White students beginning college had intentions to pursue STEM and 66.3% of total bachelor's degrees in STEM were awarded to them (NSF, 2011). And even *within* STEM, Black students remain underrepresented in the baccalaureate degrees awarded across STEM fields: physical sciences (6%), engineering (4%), and mathematics (5%). These data are quite alarming as evidence suggests that Blacks students are more likely than their counterparts to believe they would achieve a degree in STEM (Colbeck, Cabrera, & Terenzini, 2001; Hanson, 2004; Perna et al., 2009). At the graduate level, Blacks account for only 3.8% of master's degrees and 4.7% of doctorates awarded, whereas Whites earn 39% of master's degrees and 69% of the doctorates in science and engineering.

Black males earn only 34% of bachelor's degrees awarded to all Blacks in STEM. Compared with Black women, the distribution of these degrees to Black men among the agricultural sciences (41%), biological sciences (30%), and physical sciences (42%) remains unequal (NSF, 2011; see Table 1). In 2010, Black males were underrepresented in earned STEM baccalaureate degrees at 5% (see Table 2), as they made up 13% of the U.S. male population (United States Census Bureau, 2010).

These summary statistics indicate a persistent problem in the STEM education pipeline. Confronted with the need to produce more STEM graduates, STEM programs in our nation's colleges and universities often fail to guide and educate Black students who are interested in earning a baccalaureate degree in STEM. If the United States is to make a substantial dent in the STEM shortage, our colleges and universities must take increased responsibility for ensuring the success of Black males in STEM fields of study. Ameliorating the bleak prospects for Black males interested in STEM degrees and the shortage of STEM graduates across the nation rests in no small measure on understanding what educational experiences provide openings to Black male achievement in STEM and how these openings address the gaps in STEM education and, ultimately, the workforce.

The purpose of this study is to enhance our understanding of how a Historically Black College and University (HBCU) is cultivating Black male achievement in STEM. In this in-depth qualitative case study, we explore two resource-intensive and successful STEM pathway programs at Morehouse College, the only all-male HBCU in this country, as an opportunity to examine the cultivation of Black male STEM scholars. Our study was guided by two overarching questions: What opportunities for participation in a rigorous STEM education do the programs provide? What individual and institutional practices contribute to STEM student persistence and learning?

Literature Review

Since Oake's (1990) seminal review of the literature on women and minorities in STEM, little has significantly changed: this underrepresentation and underachievement of women and minorities has persisted to the present day (although it has improved somewhat for women). These poor outcomes can be attributed to several factors. First, access to quality K–12 edu-

Table 1
Distribution of Bachelor's Degrees Awarded to Black U.S. Citizens and Permanent Residents, by Field and Gender, 2010

Gender	All sciences	Agricultural sciences	Biological sciences	Computer sciences	Earth, atmospheric, and ocean sciences	Mathematics and statistics	Physical sciences	Engineering
Female	66%	59%	70%	32%	40%	51%	58%	26%
Male	34%	41%	30%	68%	60%	49%	42%	74%

Note. Source: NSF (2011).

Table 2
Racial/Ethnic Distribution of Bachelor's Degrees Awarded to Male U.S. Citizens and Permanent Residents, by Field, 2010

Race	All sciences	Agricultural sciences	Biological sciences	Computer sciences	Earth, atmospheric and ocean sciences	Mathematics and statistics	Physical sciences	Engineering
White	69%	83%	63%	64%	85%	70%	71%	70%
Asian or Pacific Islander	11%	3%	17%	8%	3%	11%	11%	11%
Black	5%	3%	5%	9%	2%	5%	4%	4%
Hispanics	7%	4%	8%	8%	4%	7%	6%	8%
American Indian or Alaska Native	1%	1%	1%	1%	1%	0%	1%	1%
Other or unknown race or ethnicity	7%	6%	6%	10%	5%	7%	7%	6%

Note. Source: NSF (2011).

cation remains out of reach for many racial minorities, including Black males. Minority students are least likely to be enrolled in appropriately funded districts (Condron & Roseigno, 2003; Ladson-Billings & Tate, 1995), exposed to quality teachers and schools with low turnover rates (Jackson, 2009; Oakes, 1990), and provided opportunities to explore and advance academic interests through diverse course offerings in mathematics and science (Wang, 2013), and honors courses, Advanced Placement, International Baccalaureate courses (Klopfenstein, 2004; Kyburg, Hertberg-Davis, & Callahan, 2007). Second, while in school, minority students often become susceptible to negative stereotypes that justify the lack of and/or the poor performance of minorities in STEM (Steele, 1997, 2011) and institutional mechanisms, such as tracking (Oakes, 1990), which have been shown to negatively affect the academic performance of Black males in STEM (Muller, Stage, & Kinzie, 2001). Third, many Black and Hispanic students come from disadvantaged backgrounds, where parents and the home may lack "science-specific capital" to support student interest and engagement with STEM. In a recent study (Archer et al., 2012), researchers found that students from advantaged backgrounds are more likely to come from families that provide their children early on with "science-specific capital," where the family's values, attitudes and behaviors are "in alignment in favor of science . . . enabling them [the child] to occupy a strong and privileged position from which to potentially pursue these aspirations" (p. 903). Because many Black students come from disadvantaged homes, their families' may lack the "know how" to encourage and support their interest in STEM (Chang et al., 2008), which may contribute to these students high attrition in earning a STEM degree.

Despite limited preparation and opportunities before college, the aspirational rates—the percentage of students intending to pursue a STEM degree—of Black students remain relatively high (20%; NSF, 2011). Unfortunately, this rate does not reflect similar rates of actually attaining a baccalaureate degree in STEM. Indeed, this suggests that once Black students enter into the STEM pipeline, they encounter additional challenges that tear at their possibility of succeeding. Studies posit that the fundamentals of science, or more commonly known as "gateway courses," remain the largest barrier in earning a STEM degree because they are framed around an aggressive culture that "weeds out" students unable to perform successfully in those conditions (Gasiewski et al., 2012; Seymour & Hewitt, 1997).

According to Seymour and Hewitt (1997), "'Weed out' is a long-established tradition [that] is dominant in all S.M.E. (Science, Mathematics and Engineering) majors [and] parallel[s] the hazing practices of military academies and fraternities" (p. 122). In their study, students who were weeded out attributed this outcome to "problems with curricular pace and load, the effects of assessment and grading practices, and the competitive atmosphere to which these practices contribute" (p. 123). And equally critically, these same students perceived the faculty that taught these "weed out" courses as "indifferent, uncaring or unapproachable, and at worst, positively hostile toward them" (p.124). Gasiewski et al. (2012) suggest that improving the academic engagement of students—by finding faculty that employ more active pedagogy, solicit feedback, or use new technologies, and provide out of classroom learning experiences in the form of tutorials and structured peer tutoring programs—can in fact reduce the effects of this culture and improve students' performance in gatekeeper courses.

According to the findings of Chang et al. (2008), all students—irrespective of race, academic preparation, and motivation—are at risk of failing in their first two years in STEM courses at high selective institutions where the undergraduate student body is primarily White and Asian, suggesting that 'weed out' culture plays a role in shaping students' chances of persisting. However, this was not true for students attending highly selective HBCUs. In fact, Black students attending highly selective HBCUs had a greater rate of completing their STEM courses, thereby improving their chances of earning a STEM degree. As they concluded, "more selective HBCUs appear to approach the process differently and seem to focus less on further 'weeding out' students . . . they seem to do a better job of socializing and cultivating that talent to improve students' chances of succeeding in the sciences" (p. 455). Why might this be the case?

The central mission of HBCUs is to mediate and support the achievement of Black students (Allen, 1992; Palmer & Gasman, 2008). Founded in response to the unequal opportunities in social and economic life (Gasman, Baez, & Sotello Viernes, 2007), HBCUs have a history of providing Black students with learning environments that are affirming of their talents and potential (Gasman, Baez, & Sotello Viernes, 2007). Attributing factors for this nurturing environment include committed faculty and staff and a campus climate that embraces and centralizes the historical and contemporary experiences of Black communities, which is why it comes as little surprise that Black students at HBCUs enroll in STEM programs at higher rates than Black students at predominantly White institutions (Wenglinsky, 1997).

The notion that Black students at HBCUs experience more frequent and meaningful interactions with faculty has been empirically established (Hurtado et al., 2009, 2011; Kim & Conrad, 2006; Palmer & Gasman, 2008). In a study of social capital and Black males at an HBCU (Palmer & Gasman, 2008), students who transferred from a PWI found that "professors are [more] available and demonstrate a willingness to build relationships with students" (p. 64), suggesting that HBCUs may represent a more accessible network of support for faculty. Hurtado et al. (2011) found that certain structural qualities of a campus—faculty racial composition—lend themselves to a culture of support that can be seen in the quality and frequencies of interactions with faculty. In the case of first-year STEM students at HBCUs, this was indeed their experience where they had an easier time identifying STEM and same-race faculty willing to mentor them, thereby bolstering student motivation and persistence (Chang et al., 2008; Hurtado et al., 2009).

Racial composition at HBCUs matters a great deal for student achievement. Being surrounded by same race peers and faculty is significant for Black students, many of whom struggle to persist in the face of unwelcoming climates or racial microaggression at PWIs (Chang et al., 2011; Harper et al., 2004). High achieving Black students in STEM at PWIs often have to deal with stereotypes that undermine their achievement (McGee & Martin, 2011) and are hampered by stereotype threats and negative stereotypes that question their place and abilities in the STEM disciplines (Steele, 2011; Steele & Aronson, 1995). In his qualitative study of 32 Black male students, Harper (2006) found that same race peer support was "essential to their success in college" (p. 352). Same peers and faculty are perceived to be more open sources of support because oftentimes they are more sensitive to the struggles encountered by (other) Black students (Colbeck, Cabrera, & Terenzini, 2001; Kim & Conrad, 2006; Palmer & Gasman, 2008; Perna et al., 2009); in effect, feelings of isolation may be minimized. And because HBCUs are major producers of Black STEM graduates (NSF, 2011) and faculty

(Perna, 2001), it is possible that attending an HBCU can blunt the effects of stereotypes that negatively shape the advancement of Black students in STEM at other institutions.

Faculty members at HBCUs are reported to be more available and willing to meet with students and are also more likely to involve undergraduates in research than their peers at PWIs (Eagan et al., 2011). According to Chang et al. (2011), faculty and student relationships can be managed through structured research programs in STEM, which offer students real-life experiences to apply what they have learned in classrooms and improve and reinforce the learning of these concepts along the way. Participating in research also exposes students to the inner workings of the scientific profession by providing them with experience conducting and presenting original research and opportunities to publish their work in peer reviewed journals (Maton, Hrabowski, & Schmitt, 2000).

This review of prior literature has established that Black students often struggle in pursuit of a STEM degree. It has also demonstrated that under the right circumstances HBCUs can be sites of opportunity to significantly advance the presence of Blacks in the STEM workforce. However, several gaps abound which this study addresses. First, the influence of same race and gender peer support on Black male achievement has yet to be examined. Although the studies referred to above have alluded to shared understanding and struggles, no benefits with respect to learning in STEM derived from these peer relations have ever been identified. Second, faculty relationships are perceived as a major contributor to student persistence in STEM, and yet we know little of the nature and quality of these relationships on student learning, may it be in the form of mentorship or through structured research programs.

Our case study of two STEM pathways at an HBCU takes up these underdeveloped areas of research. We asked of the Peer-Led Team Learning (PLTL) and Minority Biomedical Research Support-Research Initiative for Scientific Enhancement (MBRS-RISE) programs at Morehouse College: What program features promote STEM achievement among Black males? In what ways do these programs improve student learning, sustain interest in STEM and counter the persistent racial inequality that anchors Black men at the bottom of the achievement ladder?

Conceptual Framework

Although multiple frames have been used in the higher education literature to understand program impact, they rest on broadly shared theories about student development or institutional impact (Davis & Murrell, 1993; Pascarella & Terenzini, 2005). Theories of student development—including theories of psychosocial development and identity formation, cognitive-structural theories, typological models, and person-environment interaction theories—focus on the emergence of self-understanding and awareness of self as learner and on the growing appreciation of the roles of others, a sense of obligation to others, and a growing sense of individuality (Pascarella & Terenzini, 2005).[2] Predominantly sociological theories of institutional impact—in their review, Pascarella and Terenzini, 2005, consider those of Astin, Tinto, Pascarella, and Weidman—seek to explain how institutional and individual attributes shape change and growth by influencing "behaviors, attitudes, values, beliefs, interests, and even cognitive preferences" (p. 51).[3] The focus is on socialization determined by student responses and environmental intensity and student change resulting from interactions between traits, social structures (in and out of the learning environment), and effort/intention.

Rather than focusing on psychological development or the impact of program structures, this study frames educational experience in terms of participation in a situation (Gee, 2004, 2005; Lave & Wenger, 1991; Lave, 1993). The national study (further explained in the Method section) from which this case is drawn is a study

[2] Psychological self-definition and development is typically conceived of as a cumulative and relatively continuous and orderly process toward complexity that is dependent on the completion of prior stages. Cognitive readiness is a necessary but not sufficient trigger of developmental change, and higher-level development is increasingly complex. Progress down this path is often thought to be motivated by a challenge to a current state and determined by the nature of the challenge.

[3] Pascarella and Terenzini (2005) acknowledge a bias in this literature toward seeing change as developmental, explaining away regressions, and failing to account for the malleability of the organism, the complexity and diversity of contexts, or the impact of symbolic tools (p. 51).

of practices. That is, the MSI Models of Success study set out to explore the routine, goal-directed sequences of activities through which students, staff, faculty, and institutions make use of tools, knowledge, and skill (Scribner & Cole, 1981, p. 231). The project was developed to identify and highlight models of success at Minority-Serving Institutions—specifically Historically Black College and Universities, Tribal Colleges and Universities, Hispanic-Serving Institutions, and Asian American and Native American Pacific Islander-Serving Institutions. Drawing on a growing consensus about contributors to student success (for a review see Kuh, Kinzie, Buckley, Bridges, & Hayek, 2007), the MSI Models of Success study describes the ways in which signature institutional practices contribute to student behaviors associated with persistence, degree attainment, and learning. As we visited a dozen MSIs over three years, our inquiry became increasingly focused on the ways in which programs scaffold collaborative participation of students, staff, and faculty within their institutional context. Accordingly, our inquiry was guided by what stakeholders and institutions did—their collaborative practices—that, from their perspectives, contributed to the documented success of a program or initiative. The MSI Models of Success Project aimed to understand and call attention to these practices.

In this case study of STEM pathways at Morehouse, we frame two academic programs as sociocultural contexts in which individuals are collaboratively helping each other to become more skillful participants. Influenced by recent work on organizational routines (Becker & Zirpoli, 2008; Feldman & Pentland, 2003; Pentland & Feldman, 2005) and activity and practice (Cole, 1996; Deil-Amen & Tevis, 2009; Gee, 2008; Kuntz & Berger, 2011; Lave & Wenger, 1991; Saunders & Serna, 2004), we understand practices as at once shaped by abstract routines established by program policies and social norms and values and at the same time shaped by the everyday activity of individual agents. Individuals and groups take up practices—often by way of the various artifacts available in a context—to participate in a context and achieve goals. Although we assume that students, staff, and faculty are learning STEM as individuals and are to varying extents reproduced by social structures, our study focuses on how changes in student and faculty participation are associated with students' persistence and achievement in rigorous Morehouse STEM programs.

Thus, this study gathered qualitative data about what students and faculty are doing individually and collectively in two programs that are opening a rigorous STEM education to Black males who came to college interested in STEM.

Method

Because of the exploratory nature of this study and the uniqueness of our setting, we approached our study of two resource-intensive STEM pathways at Morehouse College with a single case study design. Morehouse is clearly an unusual setting to study the educational experiences that contribute to the persistence and learning of Black male STEM students (Stake, 1995). The college is a top producer of Black STEM graduates (NSF, 2011) and an all-male HBCU. In addition, we could approach the PLTL and MBRS-RISE programs with the assumption that they offered a unique educational experience even as Morehouse. Institutional assessments of PLTL demonstrated that individuals who attended at least 77% of the workshops, compared with those who attended less, were associated with higher course grades across Calculus I & II and Biology I. Moreover, almost two thirds of MBRS-RISE scholars aspire to a STEM Ph.D. program, as compared with two-fifths of the comparison group (Morehouse College, personal communication, March 21, 2011). A case study enabled us to explore and make sense of a pair of interlinked educational programs in a single bounded context. This design served one additional purpose. It allowed us to elucidate and examine an unusual approach to STEM education "within its real-world context" (Yin, 2012, p. 5) rather than reducing it to a production function of student characteristics and abstract program components. In so doing, we took a positioned subjects approach (Conrad, Millar, & Haworth, 1993), one that assumes that people, as positioned subjects (where subjects refers to people with particular needs, perceptions, and capabilities for action, and position refers to the environment in which they are located), actively interpret and make sense of their everyday worlds.

Site and Sample

This case study is drawn from a national study called the Minority Serving Institution (MSIs) Models of Success. In a competitive process, the MSI Models study selected 12 institutions—three HBCUs, three Tribal Colleges, three Asian American and Native American Pacific Islander-Serving institutions, and three Hispanic-Serving Institutions—with promising initiatives to support minority student achievement—including learning, retention, and degree attainment. Morehouse College is one of three HBCUs involved in this project. Morehouse College is a selective, private, and 4-year college founded in 1867 in Atlanta, Georgia. Currently ranked the third best HBCU in the nation by *U.S. News and World Report* (2013), Morehouse College has an endowment of $105 million and a total enrollment of 2,553 students (NCES, 2010). Ninety-five percent (95%) of students identify as Black. For full-time, first-time students, the 6-year graduation rate is 60%. Of 105 HBCUs, it is the only institution devoted solely to the education of Black males.

We selected Morehouse College to participate in our larger study on the basis of their compelling narrative and supporting data with respect to institutionalized practices that have gained tremendous success in helping students succeed in STEM. In 2011 (NSF), the top 20 academic institutions awarding African Americans bachelor's degrees in science and engineering included 10 HBCUs; Morehouse College was ranked number 15. Our study focused on two programs that STEM faculty and program administrators at Morehouse believe to be central to STEM student success. Given the important role that HBCUs have played in Black student achievement and given Morehouse's commitment to innovative STEM education and its position as the only all-male HBCU, the college represents a unique opportunity to observe and document program practices that promote the persistence and learning of Black males in STEM programs.

Consistent with our case study design, we used stratified purposeful sampling to gather documents and recruit participants—students, faculty, staff, and administrators—who represented various stakeholder positions within both the PLTL and MBRS-RISE programs. We recruited students who were persisting and moving ahead and faculty who were contributing to building and implementing the initiatives. With the assistance of the senior administrators, we recruited and conducted interviews with 12 students, five faculty, both direct participants in the programs, and one faculty/administrator and one provost over the course of several days. Students were all Black and consisted of sophomores, juniors, and seniors. In addition to meeting with the director of the PLTL program, who is also a professor of chemistry, a panel interview was also conducted with the two interim codirectors of the MBRS-RISE program, both of whom are assistant professors, one in mathematics and the other in psychology. Single interviews were also conducted with two professors of biology who serve as faculty mentors in the MBRS-RISE program. Lastly, we met with two senior-level administrators, the Dean of the Division of Science and Mathematics and the College's Provost and Senior Vice President for Academic Affairs.

Data Collection and Analysis

Although we learned much about the programs from internal documents, the principal method of data gathering was semistructured interviews. Through this process, we were able to gather broadly comparable data across stakeholder positions (Bogdan & Biklen, 2007) and, at the same time, to create spaces in which participants could give voice to their unique experiences and interpretations of their experiences. In each interviews, follow-up questions focused on opportunities for participation and practices (patterns of participation) across stakeholder groups that contributed to student persistence and learning.

As positioned subjects, we viewed our interviews as conversations and presented ourselves not as "invisible" observers but as participants in a conversation while encouraging participants to do most of the talking. To that end, we met participants on campus in private settings and, as much as possible, in locations familiar to participants. In some cases, our interviews took place in the rooms where PLTL groups met. We began by asking open-ended questions to explore, document, and give expression to participants' stories of success. These questions invited participants' perspectives regarding why the program was having such a positive influence on student achievement. Each interview lasted 45 to 60 min and was semistructured (Glesne & Peshkin, 1999). We developed lines of questioning to encourage study participants and researchers alike to recall and narrate and also to interpret social action (Bogdan & Biklen, 2007; Yin, 1994). We frequently invited participants to make sense of a story or observation or to connect a story or observation with a comment and phrase that had come up earlier in the interview.

During and after the interview process, we developed and shared notes and memos—sometimes with participants—to capture the concepts, categories, and relations between concepts and categories that were emerging for us as we interviewed. Once interviews were complete, we uploaded the data to a secure cloud drive. A reputable agency was hired to transcribe the data. To analyze the data, we conducted open coding (Creswell, 2012) focused on opportunities to participate in STEM education and practices that contributed to persistence and learning. Specifically, we each used In Vivo codes (Charmaz, 2006) to highlight participants' interpretation of educational opportunity and process codes (Bogdan & Biklen, 2007) to identify activities that they recognized as empowering students to persist and learn. Codes were compared and refined through several rounds of review and deliberation. Final codes supported three major themes.

Throughout the study, we took several measures to ensure the validity of the findings. First, the MSI Models, principal investigators engaged in frequent conversation in the field during and after the interviews to sense and tease out potential and personal biases (Conrad, Haworth, & Millar, 1993). Memos developed in the field became part of our database. Second, every member of the team spent a substantial amount of time reviewing and evaluating the data to determine coding categories and themes, thereby ensuring interrater reliability (Yin, 2012). Third, as we analyzed transcripts, we held regular team meetings to share codes we had developed individually. In these meetings, we tested one another's codes and emerging themes against transcripts and one another's interpretations. Finally, we collected documents from several sources that were used to triangulate data collected through our interviews. This step enabled us both to use institutional research from Morehouse to validate our findings and also to build on the findings of institutional researchers at Morehouse.

Limitations

With any study, especially one grounded in a single-case study, there are several limitations we would like to address. First, because of the nature of this study, the interventions and its outcomes are unique to Morehouse College. HBCUs are often treated as a single, homogenous community, but we know that several differences—financial resources, institutional control, alumni relations, graduation rates and student enrollment, to name a few—abound among the 105 HBCUs. It is unlikely that any one HBCU, or institution, can replicate similar outcomes from their interventions in STEM education because of these differences. As a highly ranked HBCU, Morehouse College enjoys several benefits derived from their reputation of producing STEM graduates, such as frequent federal and philanthropic funding and the ease of recruitment of high-achieving Black students. Second, our findings cannot be generalized to the educational experiences of Black students or Black male students across the country. Just like institutions, students cannot be solely defined by their racial identity, as class status, gender, religious affiliation, ability, and sexual orientation contribute to how students respond and perform in different spaces. Because Morehouse attracts some of the brightest Black men in the country, the significance of our findings is limited by selection bias. It is difficult to know whether the students interviewed entered college with a high achieving background. And third, the scope of our analysis does not provide a comprehensive examination of factors outside these programs that may contribute to the learning of STEM students. Because of the qualitative nature of our study, it is inherently difficult to control for the various outside forces that certainly shape these students experiences.

Results

In exploring Morehouse's role in promoting Black male achievement in STEM through the PLTL and MBRS-RISE programs, we identified three kinds of participation that contributed to student STEM persistence and learning: peers and brotherhood, faculty investment in each student, and research opportunities. Before we develop those themes, we will describe what happens in the programs.

PLTL and MBRS-RISE: Opportunities for Black Males to Participate in STEM

Peer Led Team Learning (PLTL) is an innovative alternative to conventional peer learning. Faculty in PLTL use a facilitated learning approach in which individual faculty members develop and provide learning content "modules" for PLTL workshops that are tied to relevant course content. The Minority Biomedical Research Support-Research Initiative for Scientific Enhancement (MBRS-RISE) program has substantially increased the number of Morehouse graduates majoring in science disciplines and the number of graduates choosing to pursue graduate study in biomedical research. The three major aspects of the program are as follows: developmental activity during the freshman/sophomore year that includes intensive academic advising, mentored research during the sophomore year, and participation in a biomedical research seminar series; developmental activity during the junior/senior year that includes academic mentoring, graduate school advising, and peer mentoring of students in their freshman or sophomore year; and developmental activity designed to enhance the research culture through science enrichment activities.

Peers and Brotherhood: A Supportive Network of STEM Leaders

There is now a widely shared consensus that peer interactions affect student engagement and progress (Kuh et al., 2007). It is also the case that many of the relatively few Black males who enter postsecondary education often find themselves alone with little opportunity to interact or befriend those of a similar racial background. This is especially the case in STEM programs (Oakes, 1990). Across our interviews, students told us again and again that participating in a network of successful Black male students was a central part of their Morehouse education. As one student told us:

> When I came to Morehouse, seeing so many Black males achieving, I think that really hits home for a lot of people because they do not really have those male role models. But when you come to Morehouse, you have not only . . . famous alumni, you have teachers right in front of you, you have older students.

In our interviews at Morehouse, several students told us that they were from predominantly White high schools or communities where they felt alone and tokenized as the single high-achieving Black male. For these students, it has been very affirming to attend an institution where success is not limited to a White majority, and to see how that success has carried across generations.

In our interviews, participation in this network of Black males, especially in STEM programs, was linked to several outcomes. Foremost, being part of the network appears to transform the object of a college education. The goal of achievement and not just survival becomes a distinct possibility. According to one student we interviewed:

> Now you're in an opportunity where everybody's the best and everybody's helping each other and striving together to be the best from that bunch. And I feel like that's why a lot of people are attracted here; because [at] no other school [do] you see the graduation with 500 Black males, specifically against status quo.

At Morehouse, students want to be successful, but they also desire the same outcome for their peers. Attending Morehouse College ensures that Black male students do not have to persist through college alone. According to another student, "It's nice to see other students that look like me in an academic setting who have the same goals that I have, have the same aspirations as me, all working together to achieve that goal." When it seems that society is working against Black males, success in this case is achieved when relationships forged between students reflect the prioritization of the needs of the community as opposed to the individual; this underscores a culture of collaboration as opposed to one that is competitive. In the words of one student, "I'm my brother's keeper, got my brother's back and all that."

Being part of a Black male brotherhood has a positive impact on STEM students' views of the process of completing courses. This is particularly clear in the way that students in the PLTL program view "gatekeeper" courses, courses that "weed out" students. One student explains its primary purpose this way:

> [T]he Gatekeeper courses . . . are the courses where they install PLTL in the first place. And when students hear gatekeeper they think of a daunting task that they will not be able to beat. But PLTL to the students, to kind of take a step back and it kind of, like they'll learn it in lecture and then PLTL will allow them to technically learn a lecture and then just have a student teach them from their perspective.

These courses in the fundamentals of science and mathematics can be a large hurdle for students to surmount (Eagan et al., 2012). First year and bridge programming has shown to aid in the success of students (Murphy, Gaughan, Hume, & Moore, 2010; Pascarella & Terenzini, 2005). The PLTL program effectively broadens students' opportunities to participate in gatekeeper courses. Each PTLT session, typically, consists of seven to eight students and a peer leader. Throughout each session, the peer leader facilitates a collaborative effort among the group to complete a series of problems related to the subject matter.

The PTLT director, a chemistry professor, explained the underlying premise of the program as follows:

> [T]he peer leader is charged to never answer a direct question. That's to separate PLTL from tutoring. So what we know and when we go through the training I try to talk about the experience of learning how to drive a car. If somebody else tries to tell you how to drive a car then that doesn't give you mastery. You can still watch somebody drive for years and years but then you'll crash if you go out the first time and try to drive on your own . . . As opposed to going to a driving school where there's somebody who is kind of facilitating and telling you what you need to do but the onus is on you. You're behind the wheel and you have to drive.

The student driver refers to the student requiring additional assistance in a subject matter, whereas the "driving school" refers to the peer leader or his fellow peers. Notably, this program embeds STEM students in a network of peers who are taking additional time and making conscious use of support to improve their understanding of the material without sacrificing their self-sufficiency. In other words, the PLTL program prepares students to address the challenges they are likely to face by ensuring that they have opportunities to practice with the tools they will need to face those challenges. According to one PLTL student:

> It's [PLTL] helped me bouncing ideas and mechanisms for a certain reaction, let's say, through my other peers when they talk about it. So I think that definitely helps in this situation . . . having peers all around and you're talking and sharing your ideas, and asking, did it work this way? I think in that situation because organic is more advanced than general chemistry that my learning comes from my peers when they go to the board and try to solve a problem.

Being surrounded by one's peers while approaching difficult material can be very helpful to students because peers may suggest new approaches to a problem in a manner that is supportive and affirming. In the STEM programs at Morehouse, one's peers are seen as a source of support; everyone wants each person to succeed.

A third characteristic of the Morehouse Black male STEM network is a new role for STEM students: a peer leader. We came to see PLTL leaders as a key component of the program. These Black males play the role of STEM student who motivates peer members and supports the collective effort of a group to keep each member accountable for his own achievement. The peer leader also serves as the liaison between faculty and students. Many students approach the sciences with a strong sense of fear that slowly erodes their confidence, and subsequently their academic performance. Many of the students who first enroll in the PLTL program are no different. Moreover, students in the program often enter college with poor study and time management skills, which can exacerbate current academic challenges. The role of the peer leader is thus two fold in addressing those challenges. According to the director:

> Oftentimes B [he is referring to the letter B on an academic scale] students will make for the ideal peer leader. I say that because in addition to having mastered the content they also have to have good interpersonal skills, have to be patient and understand how to ask questions and somewhat cognizant of when people are understanding the material and when they're not. . . . Anecdotally B students are better at doing that because they've done well in the course but they also have struggled. . . . So they're cognizant of how other students who are currently in the course might stumble. So a B student actually oftentimes makes for the best type of peer leader because they have a different sense for why students may not be performing well.

Peer leaders—students who have earned a "B" in a STEM course and are prepared to serve as leaders—introduce into Morehouse STEM programs the role of student who both "struggles" and "achieves." As students have experienced both ends of the spectrum, B-student

PLTL leaders make explicit the challenges that students need to address and also find ways to address these challenges. According to a student we spoke with, peer leaders are

> able to explain and break things down the way that they understood it from the teacher. I know that teachers are not always able to focus and constantly break things down but it's always like I can go to my friend and say hey I do not understand this. How is this possible and they'll be speaking in layman terms almost.

Another student told us: "It's a lot more comfortable because you don't have the pressure of asking questions during the class." Because the peer leader has already worked toward mastering the material, he can have a good sense of how a lecture can be better communicated to students—such as breaking down the material into more digestible forms.

As leaders on the inside of a network, PLTL leaders clearly seem to interpret STEM student progress for the network in new ways. Peer leaders are in a unique position to gauge how students are doing. As a faculty member put it:

> The peer leader kind of keeps track of how the students in their workshops are doing. So they'll do regular check-ins to make sure just to see how students are performing in terms of their letter grades but they'll also kind of do this attitudinal check in. So how are you feeling about your performance in the course? What are the problems? Is there anything that I can tell you about my experience that would help you right now? That turns out to be really important because in the sciences . . . [t]here's always this resistance to performing in the science class. People come in this mentality that oh this is chemistry; I cannot do this or I'm going to fail. Everybody else fails this class. We try to deal with that up front. The peer leader does the check in to try to get everybody in a sober state of mind so that they can actually perform and go out and do their best work every week.

Through the PLTL leader, the Morehouse STEM network keeps a pulse on each group member and consequently has begun to identify psychosocial barriers and find ways to bolster motivation and confidence.

To begin with, peer leaders are academic coaches. The STEM fields are highly unwelcoming (Oakes, 1990; Steele & Aronson, 1995) to minority students, and unfortunately STEM operates in a competitive and cutthroat environment that stymies student persistence. STEM is challenging, and students who pursue a STEM major may find it increasingly discouraging. Peer leaders motivate their group members by regularly monitoring their academic performance, experiences in individual classes and attitudes; he keeps each peer in check and primes them to be in the best position to learn. Second, peer leaders are also role models. As one faculty member put it:

> [W]hat's important is behavior, so the habits that are required for students to be successful in the sciences. If I can be more concrete that means things as practical as every time you step foot in the science classroom make sure that you have a calculator. Make sure that you have your notes. Make sure that you show up on time. If there's something that you do not understand ask a question. . . . Oftentimes students aren't in the practice of doing that coming out of high school and they do not know that they're supposed to study differently or what it's going to take for them to be successful as a college student. The peer leader is kind of the buffer that allows them to make that transition more successfully.

In the network, success is not attributed to mastery of the content alone. With the peer leader as the role model, students have opportunities to observe peers employing critical study skills and to practice with these skills in a space where formative feedback is available. In interviews, students and faculty pointed to such skills as organization and time management. Even more important, the PLTL program seeks to cultivate in each student the importance of asking questions. Many students will not ask questions for fear of being perceived as unintelligent or slow.

By establishing a network of brothers, the PLTL program reworks what it means to complete a STEM degree. Within this network, achievement is not reduced to individual ability to master content or prior achievement. Instead, by establishing a less threatening space, the program involves each student in Black male achievement in STEM. Courses are opportunities to find ways to make use of STEM content, and every STEM student is a potential leader who can represent STEM knowledge and skill in ways that his brothers can understand and can take up and practice skills that support learning. According to one student we interviewed: "With a professor you have to be more formal but with someone you actually have taken a class with or you live next to then it's a different feel. You can be less formal, which changes the way you learn the material." Through PLTL, achievement in STEM is promoted by helping students appropriate the right tools and attitude to preserve through a long and arduous academic process within a culture of brotherhood that obligates each member to everyone's achievement.

An Expanded Role of STEM Faculty: "Teacher Scholars" Who Mentor

The role of faculty, above and beyond the lecture hall, in student success is critical. As teachers and advisors, inside and outside the classroom, faculty members are positioned to equip students with advice and the knowledge to succeed in STEM. Although substantial empirical evidence suggests that faculty interactions matter, less is known about the qualities of student-faculty interactions. Our interviews at Morehouse point to an expansion of the traditional role of STEM faculty. Beyond being discipline area experts who present content and assess student performance, the faculty members involved in the PLTL and MBRS-RISE programs play the role of "teacher scholars" who guide students into college and STEM programs and come along side them as research partners.

According to the Dean, his Division has been hiring "a number of junior faculty who really are leaders in active learning and they're doing research." Without sacrificing their responsibilities to research, faculty members are to be "teacher scholars." Unlike many other liberal art institutions or even large research universities, Morehouse College does not lean one way or another as it relates to the ongoing tug-a-war between teaching and research commitments. At Morehouse, conducting research improves faculty teaching and the ability to mentor because in STEM, learning is emphasized through research as opposed to purely lectures and recitations. The Dean of the Division of Science and Mathematics explains his teaching philosophy:

> So when I teach, I teach about how we do science. I talk a lot about experiments. I try to minimize just recall, factual information. So I actually talk about Nobel Prize winning experiments and I try to involve the students in thinking through.

Teaching and research work in tandem for the benefit of the student. Drawing on contemporary issues can engage students with the material. According to one of the interim codirectors of the MBRS-RISE program: "Most of us [are] not didactic teachers, so it's very rare that you would see any of us whether it be in the classroom or in meetings lecturing to the students, it's a conversation." Learning is a two-way process, and by no means are students expected to be complacent. Students are expected to engage with faculty in scholarly discourse.

For students in PLTL and MBRS-RISE, these teacher scholars serve as guides to student achievement. To begin with, faculty members at Morehouse College that we met with have high expectations for all their students and actively engage with them while serving as mentors. From the first day of class, faculty members clearly state their expectations and operate under the convention that each student has the intelligence and talent needed to be successful. According to the Dean of the Division of Science and Mathematics:

> So we talk to them even during freshman week. We talk to them about the importance of mentoring, the importance of doing research and opportunities to do research. We talk to them about international experiences. We talk to them about the importance of active learning.

Many of the students we spoke with hope to pursue a career in medicine or graduate education in the sciences; for many students this includes majoring in a STEM field. Faculty understand that the road ahead is likely to be a difficult one, which is why they begin to share their thoughts—such as pursue research opportunities and seek out mentors—early on so that students enhance their chances of succeeding. Because the achievement of these students hinges upon the presence of faculty, equally committed to mentoring and research, the Division of Science and Mathematics has charged itself with recruiting those who can meet those requirements.

As guides, Morehouse faculty members provide PLTL and MBRS-RISE students frequent opportunities to talk informally about what it means to become a working scientist. According to one of the interim codirectors of the MBRS-RISE program:

> We create an environment where they can ask open questions that lead to fruitful discussion and inquiry about subtle cultural aspects of being an academic, about research, that you're just not going to get in the curriculum.

Conditions are created to allow students the opportunity to forge meaningful relationships with faculty. These conditions include openness on the part of the faculty to share their experiences and insight as it pertains to achievement in STEM. Faculty of color, particularly other Black men are able to provide students with role models in a field where the number of Black males is small.

Outside the classroom, Morehouse faculty members play the role of research partner or lab manager for PLTL and MBRS-RISE students. Regarding the influence of faculty members, one PLTL student told us: “So as a mentor, I think he’s really helped me grow as a student and as a person.” “They want you to make it,” according to another student. Faculty members, along with students’ peers, are also motivators, especially because they embody and are able to communicate how best to address the struggles of pursuing studies in STEM. According to one student:

> I really enjoyed his lab [speaking of a faculty member]. His lab is . . . more laid back, It’s more so he talks, we sit down and we ask what do you think should be the next step. We’ve done this, we’ve done that, what’s next. It just helps me I guess as a person and thinking about becoming a researcher. I’m learning all of this right now the whole research process. He’s very helpful. I can access him easily, he’s pretty quick with the e-mail.

The pressure in STEM to succeed is considerable. Mentorship from his professor eases those strains by talking about STEM in a more casual manner, or “on a very common-level, ”as one student put it. Rather than telling students what to do, this particular faculty member engages with the student to determine what needs to be accomplished in order for the student to do STEM in the classroom and the lab. As a research partner, the faculty member helps to demystify STEM and potentially to reduce the pressure commonly experienced by students. Moreover, the student develops more holistically as a person and a future scholar.

The students that we interviewed often described their interactions with faculty in terms of email exchanges, conversations at regular program meetings, and informal conversations following meetings. Across modes of interactions, faculty members as research partners communicate more than academic content and expectations. As one student told us, a faculty member

> starts telling you more so about life lessons and just more so I feel like all of my teachers I know that I encounter or run across have some kind of way, some kind of push. They have some kind of influence on me to basically be better than I am and to go to the next level.

Several students described interactions in which faculty helped them frame challenges that students were facing, challenges that often extended well beyond the classroom or lab. These interactions consistently came back to ways to overcome barriers, whether those barriers were academic or emotional. By interacting with students as a fellow researcher, Morehouse faculty members motivate PLTL and MBRS-RISE students “to basically be better.”

Faculty members wear multiple hats to serve the various needs of students inside and outside the classroom. First, they work under the assumption that all students have the potential to succeed. Second, faculty members are clear about their expectations and requirements. Third, students experience faculty members who are both engaged teachers and scholars and committed to fostering relationships that break down barriers to success.

A Lab-Based STEM Education

In PLTL and especially MBRS-RISE, there is a strong emphasis on engaging students in research as critical to not only success in college but postcollege academic success as well. Mentorship and research work in tandem, according to a professor of biology:

> I got interested in this [biology] because I was able to do the research at the undergraduate level, and I do not think had I not gotten the opportunity I probably wouldn’t be where I am today. So I think getting them in the lab very early at the undergraduate stage and understanding the importance of research, and what you can do in a career in research, I think that’s very important.

For students and faculty in the PLTL and MBRS-RISE programs, mastering key concepts within any field of STEM is not confined to books and lectures. Instead, they describe STEM learning more as ‘doing’ than anything else. The talk about undergraduate research as a means of enhancing understanding of material and also of affirming students’ interest STEM and motivating students to persevere when coursework and life become challenging.

Students who start their STEM education in the MBRS-Rise Program, for instance, cannot help but to see their education as participation in STEM research. This approach, faculty members and students agreed, provides critical continuity and consistency in an educational experience of students who might otherwise find a summer break or the need to work off campus or even the "chilly" climate in many STEM departments to blunt their motivation and slow their progress. Students, a professor of biology and program mentor explained, "select a research mentor" upon starting the program:

> They work in our labs. . . . The [MBRS-Rise Program] allows the student to have finance, so they can focus on their academics as well as research without having to have an outside job. And it also provides supplemental instruction for them. They meet with advisors, I think biweekly, and they're able to go to scientific meetings. They also go on different trips and those kinds of things.

MBRS-RISE effectively subordinates completing rigorous college coursework to working closely with a faculty mentor who connects students with "real-world" professional opportunities such as attending academic conferences. During the summer students either apply for, or secure through the network of their mentor, additional research opportunities. Faculty members mentioned losing "very good students" during the summer. This is indicative of the limited infrastructure for conducting complex research at smaller liberal arts schools. But through this program, students are able to pursue research and their scholarly interests without interruption, while being guided by their mentors during the academic and summer terms. As one student told us, summer research opportunities can be helpful, "especially for making different connections with grad school level." His faculty member added that the summer experiences are equally important as a means of sustaining academic momentum and building professional skills—from lab skills to interpersonal communication skills. As mentioned earlier, many students become susceptible to the effects of a weed out culture within STEM fields that can erode their confidence and make it more challenging for students to consider the possibility of being a scientist or medical doctor (Seymour & Hewitt, 1997). The research opportunities laid out through the MBRS-Rise program is structured to maintain student engagement, and ultimately, student interest in STEM.

Beyond keeping students focused on moving into a STEM field, Morehouse's lab-based STEM pathway programs serve as spaces for students to try out new identities. According to a chemistry professor, who is also a faculty mentor in the MBRS-Rise program, students have no "idea of what it means to be a scientist, so MBRS and programs like that expose students to what it means to be a scientist and shows them this career path." "To be a scientists," the program encourages students to see themselves as scientists. One of the interim-co directors of the MBRS-RISE program explains how a scientific identity is developed:

> We want our scholars to also strongly identify with being a Rise scholar. And so we do that. I think that's achieved through the biweekly meetings, seeing them regularly . . . so there's time. . . . [T]hey'd linger after the meeting's over, and they share with each other, we end up talking about course work. A lot of them are in the same courses. And so it's sort of an opportunity that goes beyond those formal biweekly meetings where they are building this community.

Through faculty mentoring and meetings with other STEM students, the program is used to mediate and define a space where a student can engage in research and scholarly discourse that helps the student see himself as part of a scientific community. Being a part of this community offers students a tangible sense of possibilities in the STEM workforce.

The program enriches these new professional identities with research skills. During a session in the lab, students are given meticulous guidance and training to conduct research. A professor of biology provided this in-depth example:

> So basically we do all of Cell Biology, we do all of Protein Biochemistry, and there's one big project in the lab and students have pieces of that project. And so the idea is that a student who is in my lab will get experience in developing a research question and designing experiments, actually carrying out those experiments, analyzing data, and presenting those data. And, while we do not expect that the students will have publication, some of them are actually going to be in an upcoming publication, they will have experience presenting such that when they go to the next level they will be more knowledgeable on how to conduct scientific research. (faculty interview, 2012)

Starting with one research idea, students learn to break it down in a systematic manner, thereby providing students with platform on which to build further research. Through this process, students are able to see their projects through to fruition. Conducting original research also opens up further opportunities to disseminate research findings through conferences or the publication of a manuscript. Learning to conceptualize a research question, employ appropriate methods to address the question, and then present one's findings are significant skills to possess.

Mastering these skills can be affirming to students. As one student explained:

> And when I actually got into a research lab and I did research, I actually liked it. But I never would have known that I liked it. So I had that moment where I was like, wow, this actually exposed me to a career that I'm considering now that I was not before because I didn't know what it was really about. So I feel like I had that moment.

From the outside, scientific research can be mystifying. Once students are given exposure to research with multiple opportunities to refine their skills, especially under the guidance of a faculty mentor, their perspectives on science often changes; in this case, it was for the better. But the main point is this: structured research programs provide students with consequential and meaningful exposure to scientific research, thereby helping them affirm possible interest in STEM as a career. How will students know unless they try? Students who realize success in this program find themselves with additional opportunities. According to one student, once interest in STEM is established, students are in the prime position to consider the ample opportunities after college:

> I've definitely become more focused on my future, what I want to do with my degree and what type of graduate schoolwork I want to do, where I want to go and research wise as well, more focused on the types of research that I want to do over the summer and making sure that I do research over the summer.

Students enter college with myriad interests; coursework alone cannot help most students focus their interests. With our student participants, many found participation in research, mediated through the program, to be a positive factor in their future plans. Not only does it confirm their interest in STEM, but they are able to develop more defined postcollege goals and determine what they need to accomplish to achieve them.

Discussion

In Oakes' (1990) review on women and racial minorities in the sciences, she concluded their performance in the sciences can be partly attributed to the discouraging conditions of their schools and called on future researchers to focus "on filling out our understanding of how schooling conditions may relate to minority students' learning opportunities, achievement, and decisions about their future careers" (p. 206). Our findings demonstrate that the interventions examined in this study are meaningful opportunities to improve student participation and learning and to maintain interest in STEM among Black males. Three major themes can be gleaned from our findings: brotherhood, the expanded role for faculty, and lab-based education. The concept of brotherhood includes a network of peer achievers that encourage and keep each person accountable for their work and commitment to this community of peers. Faculty, considered an extension of this network, develop relationships with students outside the classroom that, in effect, provide students with STEM guides and research partners—lighting a path toward STEM achievement and maintaining student interest with intimate, and nurturing conversations and research opportunities. And lastly, lab-based education provides students with structured opportunities to develop a STEM identity and learn crucial research skills along the way.

Our findings illuminate and support several ideas to develop meaningful interventions in supporting Black male achievement in STEM. First, our study extends the evidence pertaining to the importance of same race peers as sources of support (Harper, 2006; Palmer & Gasman, 2008) and explains how and why they remain important factors in these students' academic journey. Many of our students spoke to Morehouse College's high ideals of academic excellence. To be around those who look like you, and to know that they are at Morehouse to receive an education, speaks volumes to the students we interviewed. The overwhelming presence of Black men in college sets a tone of high achievement for themselves and each other. They see attending Morehouse College, and participation, in the PLTL program, as a way to undercut the negative notions of Black males and the competitive nature in STEM by aligning one's success with the success of their community (Chang et al., 2008). And because their relationship is forged by a shared understanding of their racial circumstances in the U.S., the PLTL program is able to operate because it is a system that is based on shared struggles as a Black man in a space dominated by their White counterparts. This finding supports Palmer and Gasman's (2008) research, which shows that a relationship between students established by race can improve students' ability to seek resources and support more openly. However, this is not to argue that learning happens best when students are segregated by race and gender. This sense of brotherhood and community expressed among the participants is an indication that the success of a peer academic support system to improve their learning is not contingent upon the involvement of *any* peers. It is the system's ability to be sensitive to the unique and shared characteristics—both cognitive and noncognitive—of students that determine how effective it may be in improving student learning (Topping, 2005).

Although students in the PLTL program report that participation in the program has improved their performance in their STEM coursework, our findings suggest that the program also improved their *way* of learning. Gasiewski et al. (2012) found that peer collaborative study groups were a meaningful way to maintain student engagement and persistence in STEM. Our findings confirm the same, but they also extend the narrative. Because the PLTL leader is selected by his struggles to achieve, as opposed to a high achiever with little experience of struggle, he is capable of helping his peers workout challenging problems, as well as socializing them to be in their best state of learning. For instance, leaders encouraged their peers to maintain a positive outlook amid the difficulties in STEM courses, to talk through a problem by expressing their challenges with it clearly, and to be prepared to learn by attending these sessions with questions, the assignment, and the necessary textbooks and supplies. Seymour and Hewitt (1997) reported that students in STEM classes have negative perceptions of their teachers, making it challenging to speak up in class or seek faculty support. The PLTL teaches and encourages students to ask questions and engage with material in a more casual, and at times, accessible manner. Some students found it more effective to receive the information from their peers as opposed to the faculty, whose language can be too technical. When students enter Morehouse College, high expectations are placed on them because they are seen as inherently intelligent and capable to handling rigorous college work. The PLTL program is not about addressing a lack of intellect. It operates on the assumption that not every student has had the opportunity to gain fundamental (study) skills to improve their ability to learn and absorb the material in a way that will advance their current standing. The program certainly increases student engagement, both in- and outside the classroom (Gasiewski et al., 2012; Nelson Laird et al., 2007; Tinto, 1993), but the real value lies in the study skills students acquire from the conditions structured by the PLTL program and build upon to achieve greater success in the future.

Second, faculty members are more than just instructors. They are committed scholars and teachers, who mentor students in and outside the classroom. More focused attention from faculty can be motivating and offer students a more organized approach to their scholarly and professional interests because faculty members are a tangible example of success in STEM. Strong faculty–student mentorship and relationships are often discussed as an HBCU strong suit (Hall & Warner, 2009; Nelson Laird et al., 2007; Perna et al., 2009). Perna et al. (2009) discussed the role faculty played in preparing Black women for STEM fields at Spelman College.

The faculty–student relationship clarifies the expectations and brings to light the strategies to improve student learning in STEM. Our findings confirm that prior research establishing the positive influence of committed faculty on student achievement, but also brings to bear ideas not identified in the HBCU literature. First, Morehouse faculty "scaffolds interest [in science] through offering multiple standpoints" (Xu, Coats, & Davidson, 2012, p. 148) as minority educators and scientists. But aside from interest, Morehouse faculty, through their various perspectives, can improve students' retention *and* engagement in STEM (Gasiewski et al., 2012). Second, faculty members distribute "science-specific capital" to students (Archer et al., 2012) by providing students with an environment and the opportunities to approach and pursue STEM with a positive attitude. The findings from the current study show that Morehouse faculty, in many instances, can address this gap in capital found in their students. Through their enthusiasm, experiences, convictions, and professional role, faculties work with students—through long-term and meaningful relationships and research and publishing opportunities—to transform aspiration to accomplishment and to establish a favorable attitude toward earning a STEM degree. The risk of failure among Black males in STEM can be tempered with the presence and proximity of faculty abled to provide "science-specific capital" (Archer et al., 2012; Griffin, 2012; Xu, Coats & Davidson, 2012) and the "face time" (Eagan & Newman, 2010) to improve students' learning and chances of earning a STEM degree.

Third, we found that structured research programs through the MBRS-RISE program had a positive influence on student learning and student engagement and demystified the path toward earning a STEM degree. Students reported how research opportunities assisted them in learning many of the concepts lectured in class and how research managed to maintain their interest in STEM and helped them explore possible employment opportunities (Chang et al., 2008; Gary, 2013; Hurtado et al., 2000). More importantly, the orientation and structure of the MRBS-RISE program shape the way students identify. According to the director of the program, she wants her students to strongly identify as a RISE scholar and everything that is associated with it—giving way to a student that can see the possibility of being a scientist (Hurtado et al., 2009). The significance behind our findings further establishes the link between research opportunities and identifying strongly as a scientist, an attribute that can improve minority student retention in STEM (Chang et al., 2011). But more importantly they also demonstrate how it can transform the way students see themselves included in the domain of STEM (Seymour & Hewitt, 1997).

To optimize the success of these students, Morehouse begins to condition its students upon immediate matriculation. Although the bar is set high for all students in STEM, faculty are explicit with their expectations and they also ensure that students are provided with the proper guidance and experiences and tools to succeed. Students are not viewed through a deficit lens. Success is not an option, but a clearly communicated expectation. It is important to note that Morehouse College is one of the more selective HBCUs. Yet, it is possible that the nondeficit approach taken with students on Morehouse's campus is common across many HBCU campuses. In conclusion, through support from peers and faculty and experience gained from research, students are primed from the start that their achievement in a predominantly White field is indeed possible.

Morehouse's practices and programs can be tailored and replicated to meet the needs of other institutions, especially in their efforts to empower and support African American men and perhaps men of color more generally. This study corroborates the importance of hiring underrepresented racial minority faculty and the recruitment of minority students. The compositional dominance of White students on any given campus can be extremely daunting for minorities in terms of realizing academic interests and talents. Institutions need to give every student a fighting chance for these interests and talents to develop equitably (Colbeck, Cabrera, & Terenzini, 2001). In addition to creating a more racially diverse campus, the development of programs that target minority student success should be underway but also sensitive in that these programs do no warrant an unnecessary stigma for those very students. It is not only important for the students to be educated, but for them to be empowered.

References

Allen, W. R. (1992). The color of success: African-American college student outcomes at predominantly White and historically Black public colleges and universities. *Harvard Educational Review, 62,* 26–45. http://dx.doi.org/10.17763/haer.62.1.wv5627665007v701

Archer, L., DeWitt, J., Osborne, J., Dillon, J., Willis, B., & Wong, B. (2012). Science aspirations, capital, and family habitus: How families shape children's engagement and identification with science. *American Educational Research Journal, 49,* 881–908. http://dx.doi.org/10.3102/0002831211433290

Becker, M. C., & Zirpoli, F. (2008). Applying organizational routines in analyzing the behavior of organizations. *Journal of Economic Behavior & Organization, 66,* 128–148. http://dx.doi.org/10.1016/j.jebo.2007.04.002

Bogdan, R. C., & Biklen, S. K. (2007). *Research for education: An introduction to theories and methods*. New York, NY: Pearson.

Center on Education and the Workforce. (2011). *STEM*. Washington, DC: Georgetown University.

Chang, M. J., Cerna, O., Han, J., & Saenz, V. (2008). The contradictory roles of institutional status in retaining underrepresented minorities in biomedical and behavioral science majors. *Review of Higher Education: Journal of the Association for the Study of Higher Education, 31,* 433–464. http://dx.doi.org/10.1353/rhe.0.0011

Chang, M. J., Eagan, M. K., Lin, M. H., & Hurtado, S. (2011). Considering the impact of racial stigmas and science identity: Persistence among biomedical and behavioral science aspirants. *The Journal of Higher Education, 82,* 564–596. http://dx.doi.org/10.1353/jhe.2011.0030

Charmaz, K. (2006). *Constructing grounded theory: A practical guide through qualitative research*. London, United Kingdom. Sage Publications.

Colbeck, C. L., Cabrera, A. F., & Terenzini, P. T. (2001). Learning professional confidence: Linking teaching practices, students' self-perceptions, and gender. *Review of Higher Education: Journal of the Association for the Study of Higher Education, 24,* 173–191. http://dx.doi.org/10.1353/rhe.2000.0028

Cole, M. (1996). *Cultural psychology: a once and future discipline*. Cambridge, MA: Belknap Press of Harvard University Press.

Condron, D. J., & Roseigno, V. J. (2003). Disparities within: Unequal spending and achievement in an urban school district. *Sociology of Education, 76,* 18–36. http://dx.doi.org/10.2307/3090259

Conrad, C., Millar, S. B., & Haworth, J. G. (1993). *A silent success*. Baltimore, MD: Johns Hopkins University Press.

Creswell, J. W. (2012). *Educational research: Planning, conducting, and evaluating quantitative and qualitative research*. Boston, MA: Pearson Education.

Davis, T. M., & Murrell, P. H. (1993). A structural model of perceived academic, personal, and vocational gains related to college student responsibility. *Research in Higher Education, 34,* 267–289. http://dx.doi.org/10.1007/BF00991846

Deil-Amen, R., & Tevis, T. L. (2010). Circumscribed agency: The relevance of standardized college entrance exams for low SES high school students. *Review of Higher Education: Journal of the Association for the Study of Higher Education, 33,* 141–175. http://dx.doi.org/10.1353/rhe.0.0125

Eagan, M. K., Garcia, G. A., Hurtado, S., & Gasiewski, J. A. (2012). *Passing through the gates: Identifying and developing talent in introductory STEM courses*. Manuscript in preparation.

Eagan, M. K., & Newman, C. B. (2010). *Investing in human capital: Underrepresented racial minorities' intentions to attend graduate school in STEM fields*. Los Angeles, CA: UCLA Higher Education Research Institute. Available: Newman-Investing in Human Capital-AERA.

Eagan, M. K., Jr., Sharkness, J., Hurtado, S., Mosqueda, C. M., & Chang, M. J. (2011). Engaging undergraduates in science research: Not just about faculty willingness. *Research in Higher Education, 52,* 151–177. http://dx.doi.org/10.1007/s11162-010-9189-9

Feldman, M. S., & Pentland, B. T. (2003). Reconceptualizing organizational routines as a source of flexibility and change. *Administrative Science Quarterly, 48,* 94–118. http://dx.doi.org/10.2307/3556620

Gary, S. (2013). Supporting the dream: The role of faculty members at Historically Black Colleges and Universities in promoting STEM PhD education. In R. T. Palmer, D. C. Maramba, & M. Gasman (Eds.), *Fostering success of ethnic and racial minorities in STEM: The role of minority serving institutions* (86–101). New York, NY: Routledge.

Gasiewski, J. A., Eagan, M. K., Garcia, G. A., Hurtado, S., & Chang, M. J. (2012). From gatekeeping to engagement: A multicontextual, mixed method study of student academic engagement in introductory STEM courses. *Research in Higher Education, 53,* 229–261. http://dx.doi.org/10.1007/s11162-011-9247-y

Gasman, M., Baez, B., & Sotello Viernes, C. (2007). *Understanding minority serving institutions*. Albany, NY: SUNY Press.

Gee, J. P. (2004). *Situated language and learning: A critique of traditional schooling*. New York, NY: Routledge.

Gee, J. P. (2005). Semiotic social spaces and affinity spaces. In D. Barton & K. Tusting (Eds.), *Beyond communities of practice: language, power and social context* (pp. 214–232). Cambridge, UK: Cambridge University Press. http://dx.doi.org/10.1017/CBO9780511610554.012

Gee, J. P. (2008). A sociocultural perspective on opportunity to learn. In P. Moss, D. C. Pullin, J. P. Gee, E. H. Haertel, & L. J. Young (Eds.), *Assessment, equity, and opportunity to learn* (pp. 76–108). Cambridge, UK: Cambridge University Press. http://dx.doi.org/10.1017/CBO9780511802157.006

Glesne, C., & Peshkin, A. (1999). Finding your story: Data analysis. In *becoming qualitative researchers* (pp. 127–149). Boston, MA: Addison Wesley.

Griffin, K. (2012). Black professors managing mentorship: Implications of applying social exchange to analyses of student interactions and their influence on scholarly productivity. *Teachers College Record, 114,* 1–37.

Hall, C., & Warner, S. (2009). Faculty–student interaction at a southern HBCU. *Multicultural Learning and Teaching, 4*.

Hanson, S. L. (2004). African American women in science: Experiences from high school through the Post-secondary years and beyond. *NWSA Journal, 16,* 96–115. http://dx.doi.org/10.2979/NWS.2004.16.1.96

Harper, S. R. (2006). Peer support for African American male college achievement: Beyond internalized racism and the burden of "acting White." *The Journal of Men's Studies, 14,* 337–358. http://dx.doi.org/10.3149/jms.1403.337

Harper, S. R., Carini, R., Bridges, B., & Hayek, J. (2004). Gender differences in student engagement among African American undergraduates at Historically Black Colleges and Universities. *Journal of College Student Development, 45,* 271–284. http://dx.doi.org/10.1353/csd.2004.0035

Hurtado, S., Cabrera, N. L., Lin, M. H., Arellano, L., & Espinosa, L. L. (2009). Diversifying science: Underrepresented student experiences in structured research programs. *Research in Higher Education, 50,* 189–214. http://dx.doi.org/10.1007/s11162-008-9114-7

Hurtado, S., Eagan, M. K., Tran, M. C., Newman, C. B., Chang, M. J., & Velasco, P. (2011). "We do science here": Underrepresented students' interactions with faculty in different college contexts. *Journal of Social Issues, 67,* 553–579. http://dx.doi.org/10.1111/j.1540-4560.2011.01714.x

Jackson, C. K. (2009). Student demographics, teacher sorting, and teacher quality: Evidence from the end of school desegregation. *Journal of Labor Economics, 27,* 213–256. http://dx.doi.org/10.1086/599334

Kao, G., & Thompson, J. S. (2003). Racial and ethnic stratification in educational achievement and attainment. *Annual Review of Sociology, 29,* 417–442. http://dx.doi.org/10.1146/annurev.soc.29.010202.100019

Kim, M. M., & Conrad, C. F. (2006). The impact of historically black colleges and universities on the academic success of African-American students. *Research in Higher Education, 47,* 399–427. http://dx.doi.org/10.1007/s11162-005-9001-4

Klopfenstein, K. (2004). Advanced placement: Do minorities have equal opportunity? *Economics of Education Review, 23,* 115–131. http://dx.doi.org/10.1016/S0272-7757(03)00076-1

Kuh, G. D., Kinzie, J., Buckley, J. A., Bridges, B. K., & Hayek, J. C. (2007). *Piecing together the student success puzzle: Research, propositions, and recommendations. ASHE Higher Education Report, Vol. 32, Number 5* (No. 1551–6970; pp. 1–182). ASHE Higher Education Report. Retrieved from http://ezproxy.library.wisc.edu/login?url=http://search.ebscohost.com/lon.aspx?direct=true&db=eric&AN=EJ791634&login.asp&site=ehost-live

Kuntz, A. M., & Berger, J. B. (2011). *Faculty work practices in material environments: A case study.* Columbus, OH: Ohio State University Press. Retrieved from http://search.ebscohost.com/login.aspx?direct=true&AuthType=ip,uid&dbehh&AN=60461983&site=ehost-live&scope=site

Kyburg, R. M., Hertberg-Davis, H., & Callahan, C. M. (2007). Advanced Placement and International Baccalaureate programs: Optimal learning environments for talented minorities? *Journal of Advanced Academics, 18,* 172–215.

Ladson-Billings, G., & Tate, W. F., IV. (1995). Toward a critical race theory of education. *Teachers College Record, 97,* 47–68.

Lave, J. (1993). The practice of learning. In J. Lave & S. Chaiklin (Eds.), *Understanding practice: Perspectives on activity and context. Cambridge,* UK: Cambridge University Press. http://dx.doi.org/10.1017/CBO9780511625510.002

Lave, J., & Wenger, E. (1991). *Situated learning: Legitimate peripheral participation*. Cambridge, UK: Cambridge University Press. http://dx.doi.org/10.1017/CBO9780511815355

Maton, K. I., & Hrabowski, F. A., III. (2004). Increasing the number of African American PhDs in the sciences and engineering: A strengths-based approach. *American Psychologist, 59,* 547–556. http://dx.doi.org/10.1037/0003-066X.59.6.547

Maton, K. I., Hrabowski, F. A., III, & Schmitt, C. L. (2000). African American college students excelling in the sciences: College and post college outcomes in the Meyerhoff scholars program. *Journal of Research in Science Teaching, 37,* 629–654. http://dx.doi.org/10.1002/1098-2736(200009)37:7<629::AID-TEA2>3.0.CO;2-8

McGee, E. O., & Martin, D. B. (2011). "You would not believe what I have to go through to prove my intellectual value!" Stereotype management among academically successful black mathematics and engineering students. *American Educational Research Journal, 48,* 1347–1389. http://dx.doi.org/10.3102/0002831211423972

Muller, P. A., Stage, F. K., & Kinzie, J. (2001). Science achievement growth trajectories: Understanding factors related to gender and racial-ethnic differences in precollege science achievement. *American Educational Research Journal, 38,* 981–1012. http://dx.doi.org/10.3102/00028312038004981

Murphy, T. E., Gaughan, M., Hume, R., & Moore, S. G., Jr. (2010). College graduation rates for minority students in a selective technical university: Will participation in a summer bridge program contribute to success? *Educational Evaluation and Policy Analysis, 32,* 70–83. http://dx.doi.org/10.3102/0162373709360064

National Science Foundation. (2006). *America's pressing challenge: Building a stronger foundation, a companion to science and engineering indicators*. Arlington, VA: Author.

National Science Foundation. (2011). *Women, minorities, and persons with disabilities in the science and engineering*. Arlington, VA: National Science Foundation (NSF 11–309).

National Science Foundation. (2012). *An analysis of STEM education funding of the NSF: Trends and policy discussion*. Washington, DC: Congressional Research Service.

Nelson Laird, T. F., Bridges, B. K., Morelon-Quainoo, C. L., Williams, J. M., & Holmes, M. S. (2007). African American and Hispanic student engagement at minority serving and predominantly White institutions. *Journal of College Student Development, 48,* 39–56. http://dx.doi.org/10.1353/csd.2007.0005

Oakes, J. (1990). Opportunities, achievement, and choice: Women and minority students in science and mathematics. *Review of Educational Research, 16,* 153–222.

Palmer, R. T., & Gasman, M. (2008). "It takes a village to raise a child": The role of social capital in promoting academic success for African American men at a Black college. *Journal of College Student Development, 49,* 52–70. http://dx.doi.org/10.1353/csd.2008.0002

Pascarella, E. T., & Terenzini, P. T. (2005). *How college affects students: A third decade of research*. San Francisco, CA: Jossey-Bass.

Pentland, B. T., & Feldman, M. S. (2005). Organizational routines as a unit of analysis. *Industrial and Corporate Change, 14,* 793–815. http://dx.doi.org/10.1093/icc/dth070

Perna, L. W. (2001). The contribution of historically black colleges and universities to the preparation of African Americans for faculty careers. *Research in Higher Education, 42,* 267–294. http://dx.doi.org/10.1023/A:1018869922415

Perna, L., Lundy-Wagner, V., Drezner, N. D., Gasman, M., Yoon, S., Bose, E., & Gary, S. (2009). The contribution of HBCUs to the preparation of African American women for Stem careers: A case study. *Research in Higher Education, 50,* 1–23.

Saunders, M., & Serna, I. (2004). Making college happen: The college experiences of first-generation Latino students. *Journal of Hispanic Higher Education, 3,* 146–163. http://dx.doi.org/10.1177/1538192703262515

Scribner, S., & Cole, M. (1981). *The psychology of literacy*. Cambridge, MA: Harvard University Press. http://dx.doi.org/10.4159/harvard.9780674433014

Seymour, E., & Hewitt, N. M. (1997). *Talking about leaving: Why undergraduates leave the sciences*. Boulder, CO: Westview press.

Stake, R. E. (1995). *The art of case study research*. Sage Publications.

Stassun, K. G., Sturm, S., Holly-Bockelmann, K., Burger, A., & Ernst, D. J. (2011). The Fisk-Vanderbilt Master's-to-Ph.D. Bridge Program: Recognizing, enlisting, and cultivating unrealized or unrecognized potential in underrepresented minority students.

Steele, C. M. (1997). A threat in the air. How stereotypes shape intellectual identity and performance. *American Psychologist, 52,* 613–629. http://dx.doi.org/10.1037/0003-066X.52.6.613

Steele, C. (2011). *Whistling Vivaldi: How stereotypes affect us and what we can do*. New York, NY: Norton, Inc.

Steele, C. M., & Aronson, J. (1995). Stereotype threat and the intellectual test performance of African Americans. *Journal of Personality and Social Psychology, 69,* 797–811. http://dx.doi.org/10.1037/0022-3514.69.5.797

Tinto, V. (1993). Building Community. *Liberal Education, 79,* 16–21.

Topping, K. J. (2005). Trends in Peer Learning. *Educational Psychology, 25,* 631–645. http://dx.doi.org/10.1080/01443410500345172

United States Census Bureau. (2010). The Black population: 2010. Washington, DC: Author. Retrieved from http://www.census.gov/prod/cen2010/briefs/c2010br-06.pdf

United States Census Bureau. (2011). *The Black alone population in the United States: 2011*. Washington, DC: Author. Retrieved from http://www.census.gov/population/race/data/ppl-ba11.html

Wang, X. (2013). Why students choose STEM majors: Motivation, high school learning, and postsecondary context of support. *American Educational Research Journal, 50,* 1081–1121. http://dx.doi.org/10.3102/0002831213488622

Wenglinsky, H. (1997). *Students at historically Black colleges and universities: Their aspirations and accomplishments*. Princeton, NJ: Education Testing Services.

Xu, J., Coats, L. T., & Davidson, M. L. (2012). Promoting student interest in science: The perspectives of exemplary African American teachers. *American Educational Research Journal, 49,* 124–154. http://dx.doi.org/10.3102/0002831211426200

Yin, R. (1994). *Case study research: Design and methods*. Beverly Hills, CA: Sage.

Yin, R. K. (2012). *Applications of case study research*. Thousand Oaks, CA: Sage.

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