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ARTICLES

HBCUs Propel African American Male Mathematics Majors

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Abstract While researchers have examined the educational experiences of African American male students at historically black colleges and universities (HBCUs), researchers have neglected to adequately hone in on the mathematics experiences of African American male students at these institutions. Studies reporting on their mathematics experiences usually call attention to African American male students' lack of mathematics preparation for collegiate mathematics and/or the difficulties these students experience in collegiate mathematics courses. This qualitative study, however, highlights the importance of HBCUs in producing successful African American male mathematics majors. Findings provide evidence that HBCUs provide supportive structures, mechanisms, and people, especially African American male mathematics professors, who contribute to the mathematical success of African American male mathematics majors.

Keywords HBCUs · African American male students · Mathematics · STEM

Introduction

Historically black colleges and universities (HBCUs) have played a significant role in educating African American students as well as other marginalized populations since their inception. Moreover, HBCUs have continued to be critical in the production of Science, Technology, Mathematics, and Engineering (STEM) majors, and a large number of these STEM graduates have gone on to obtain advanced degrees in these academic disciplines (Wenglinsky 1996; Wilson 2007). In addition, these institutions have provided support for African American male college students in multi-faceted ways. In this article, the experiences of four mathematically

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successful mathematics majors who matriculated through various HBCUs are highlighted.

First, a personal encounter is featured in the following paragraphs to infuse my subjective stance regarding this area of research. Then, a review of some of the research literature that aligns with this area of scholarship is brought to the forefront. Next, the methodology section calls attention to qualitative research, case study research, and the multiple case study approach, respectively. Following that, discussions are provided that accentuate the participants' collegiate experiences as African American male mathematics majors at their respective HBCUs. Finally, the conclusion is presented stressing the crucial role that HBCUs have had in these African American men's experiences and offering recommendations and suggestions for future research.

A few years ago, I was called upon by a university mentor (i.e., a mathematics teacher educator and researcher) to observe the facilitation of a workshop with secondary mathematics teachers in an urban school district. The group of teachers had already established camaraderie through their previous sessions and seemed enthusiastic about coming together to share experiences and ideas concerning the teaching and learning of mathematics in an urban context. Given that I was the newcomer, I wondered about "fitting in" with this mathematics community. At the time, I was collecting data for my dissertation research and was eager to learn more about the intricacies of becoming a mathematics teacher educator and researcher.

At the close of my brief introduction to the learning community, I gave credence to my alma mater, Tennessee State University. My statement concerning my HBCU elicited a response from the majority of the participants and caused them to "represent" their respective HBCUs. One would think that our allegiance to mathematics would be the common element to bind us together (and it did in some ways). It was our pride in and appreciation of our HBCUs, however, that provided a sense of community and belonging. Those participants who had not attended an HBCU witnessed the reaction from my fellow HBCU constituents and could sense the strong allegiance and pride we exhibited for our HBCUs. After leaving that workshop, the following questions permeated my thinking: What is it about HBCUs that foster a communal, familial atmosphere among its students and alumni? What can we learn from HBCUs as it pertains to producing African American mathematics graduates? And how might HBCUs be instrumental in the increasing demands to produce STEM graduates as well as mathematics and science role models and teachers of color?

Literature Review

The unique role that HBCUs have had in providing access to higher education for African Americans and producing African American college graduates is stressed in this section. I do not engage in the scrutiny that HBCUs have come under in recent years (Gasman 2007; Wenglinsky 1996). Neither am I constructing a dichotomy between HBCUs and predominantly white institutions (PWIs) regarding (mathematics) achievement rates, test scores, and the like, nor am I attempting to discuss the quality of education received at either type of institution (Allen 1992;

Kimbrough and Harper 2006; Wenglinsky 1996). Investigating these issues is beyond the scope of this research article. Rather, the role that HBCUs have played in propelling these African American male mathematics majors is explored.

HBCUs have provided access to higher education for several generations of African American college students who were not admitted to other universities based solely on race (Allen 1992; Copeland 2006). Since their inception in the late 1800 s and early 1900 s, HBCUs have not only provided an education for its alumni, but they have also opened up the doors to leadership opportunities as well as better living conditions for African Americans (Copeland 2006). Moreover, Williams and Ashley (2005) report, "When historically black colleges and universities were opened in the United States, they continued the tradition of scholarship and higher education begun in Africa" (p. 10). As such, HBCUs are also contributing to the historical legacy of educational excellence among Africana people. In the context of mathematics, this robust historical legacy dates back to ~2,650 B.C. (see, e.g., Hurry 1990).

Currently, HBCUs seek to continue to provide racial equality with regard to access to higher education. The goals and mission of HBCUs are unique and specifically designed to produce African American intellectuals who will hold leadership positions and provide service to the African American community (Roebuck and Murty 1993). According to R. Walters (as cited in Roebuck and Murty 1993), there are six goals for HBCUs. These goals include: (1) to continue the historical and cultural tradition of teaching and research about the black condition, (2) to serve the black community in various leadership roles, (3) to supply an economic function in the black community, (4) to provide black role models who examine social, political, and economic issues endemic to the black community, (5) to produce graduates who engage in tackling race-related issues in society, and (6) to produce black scholars who disseminate scholarly research and teaching to the black community.

In addition to these one-of-a-kind goals, HBCUs also have a founding mission, which is to uplift the race (Spence 2004). This uplifting of the race also impacts the black community. As a part of their mission, Copeland (2006) adds that all HBCUs stress

> the importance of developing the whole person, intellectually, morally, ethically, and spiritually. Emphasis has been and continues to be on developing the mind, heart, and soul and a strong work ethic, along with social and civic responsibility. An examination of some of these institutions' mission statements reveals that, in addition to developing the mind, they are concerned with cultural values, ethics, character development, civic responsibility, leadership, and service to the community. (p. 53)

In conjunction with developing scholars, HBCUs are also concerned with other cultural dimensions that develop the whole person. These dimensions include moral and ethical responsibilities to the black community as well as spiritual development (see, e.g., Jett 2010). Copeland also expressed: "The type of milieu in which students learn and develop can greatly influence retention and graduation rates" (p. 59). These supportive environments along with the goals and mission of HBCUs embody unique characteristics that aid in the successful production of African American collegians.

African Americans enrolled in HBCUs have access to other African American mentors. Both the formal and informal mentoring structures that have been established within HBCUs have been instrumental in their overall success (Palmer and Gasman 2008; Spence 2004). Faculty mentors and peer mentorship have proven to maintain, support, and propel several African American students at HBCUs, especially in the realm of mathematics. Given that mathematics is constructed as a discipline reserved for white men (Stinson 2010), HBCUs help to debunk this myth and provide positive portraits of mathematically competent students, instructors, and scholars. As such, HBCUs are vehicles of hope regarding equity and access for African American students in the realm of higher education in general (Brown and Davis 2001) and mathematics in particular. The ramifications of these relationships are immeasurable as described by the participants in this study and implicated by the data presented later in this article.

In a recent study, Palmer and Strayhorn (2008) examined academic achievement in the context of HBCUs for African American male students. These researchers employed the naturalistic inquiry methodological approach in their study with 11 academically underprepared African American men who enrolled in a public, urban HBCU. They found that these 11 men succeeded in spite of the fact that they were ill-prepared for collegiate coursework. While their results were tailored more specifically to the participants themselves as opposed to HBCUs (i.e., taking responsibility for their success, staying focused, managing their time, and sticking with a major), they have begun to conduct research in this relatively unexplored domain.

In the context of STEM majors, Perna et al. (2008) conducted a case study regarding the preparation of African American women for STEM careers at Spelman College. The participants in their study generally agreed that Spelman College provided them with the support that they needed to be successful in STEM professions such as peer support, faculty encouragement and involvement, academic support, and undergraduate research opportunities. It is also interesting to note that curricula materials were organized to ensure that these women could visualize themselves as competent STEM thinkers and that research opportunities were designed to yield financial support to those conducting STEM-related research.

In this literature review, an emphasis has been placed on the unique role that HBCUs have had on producing African American college graduates, especially in STEM disciplines. I am not suggesting that all African American students should attend HBCUs, nor am I suggesting that attending an HBCU will provide access to a better life for all African American students. What I am suggesting, however, is that because of the mission and goals of HBCUs, they have been successful, historically and currently, in promoting access to higher education and positively impacting (STEM) college graduation rates for African American students. Copeland (2006) emphasizes the point by arguing: “It is apparent that many black institutions provide a different milieu, an environment that promotes access and fosters retention and graduation” (p. 55). In the case of this study, all four African American men completed their undergraduate mathematics degrees in HBCU environments they described as conducive to promoting access to rigorous mathematics curricula and fostering academic success with a mathematics degree.

Notwithstanding that, there is a shortage of literature regarding the successful experiences of African American students at HBCUs in general. Although some studies focus on STEM majors, the literature dealing with African American male students and mathematics, specifically, at the college level is limited. Therefore, this study is needed to fill a gap in the existing literature, especially with regard to offering a deeper understanding of success in college mathematics among African American male HBCU graduates and providing insights to the mathematics education community about mathematically successful African American male students in higher education.

Methods

Qualitative research methodology was employed during this empirical research study. With qualitative research, "the researcher's primary goal is to add to knowledge, not to pass judgment on a setting" (Bogdan and Biklen 2007, p. 38). As such, this study adds to the knowledge base concerning the successful mathematics collegiate experiences of African American men who matriculated at HBCUs.

Under the umbrella of qualitative research, a case study was conducted. Case study research "is an empirical inquiry that investigates a contemporary phenomenon within its real-life context, especially when the boundaries between phenomenon and context are not clearly evident" (Yin 2003, p. 13). Further, case study researchers investigate existing problems or cases for the purpose of explaining, understanding, and making the public aware about the cases (Hays 2004). Schram (2006) argues, "Its strategic value lies in its ability to draw attention to what can be learned from the single case" (p. 107). Additionally, case study research allowed me to investigate these four African American men's mathematics (educational) experiences by providing thick descriptions of each case (Merriam 1998).

Added to that, the multiple case study approach was employed. Multiple case studies are also referred to as multicase studies or collective case studies (Bogdan and Biklen 2007; Merriam 1998). A multiple case study is done when researchers carry out a case study in which more than one case is involved (Merriam 1998). Because four participants or cases were secured for this study, the multiple case study methodological approach was employed.

Participants for this study included African American men who met the following criteria: (1) self-identify as an African American man, (2) have majored in mathematics as an undergraduate student, and (3) be currently pursuing a graduate degree in mathematics or mathematics education. By selecting African American men who were pursuing advanced degrees in mathematics or mathematics education, I sought to select African American men who were continuing in the mathematics pipeline, thereby, strengthening my argument that they were successful in college mathematics. In addition, no participants were given the criterion that HBCU enrollment was a requirement for participation in this study.

The data collection methods included an introductory survey, three structured interviews, and artifacts. A survey was given to detail information pertaining to their demographics, family, education, and so on. Three interviews were conducted ranging between 35 min and 1 h. The interviews were audio-taped and transcribed

causing the participants to reflect and (re)construct their mathematics experiences in their own words. Additionally, artifacts were requested to serve as a catalyst for discussion for the second interview. These artifacts provided a sense of the unique tenets of each individual and also helped to solidify their connections to mathematics and their alma maters. For the purposes of this article, only data from the interviews are reported. Participants' names and institutions are pseudonyms to aid in the anonymity of each individual.

It is important to note that initial requests were sent to faculty members in mathematics and mathematics education departments, colleagues, graduate students, and secondary mathematics teachers concerning this research study to solicit research informants. Interestingly, countless electronic mail messages filled my inbox echoing the same message: they could not locate a single African American male graduate student in their program that fit the descriptors for my study. (Please note that African American male graduate students in mathematics or mathematics education majors were enrolled in my department, but I did not desire participants with whom I knew. Additionally, there was some ambiguity regarding the small number of graduate mathematics students in one HBCU's program.) After a tedious and rather exhaustive search (and much prayer), four African American men who met the study's criteria surfaced and agreed to participate in the research study. Although participants who attended an HBCU were not a criterion for selection, all four men who were recruited for this study had begun their higher educational mathematics careers at HBCUs. The four African American male participants for this study were Antonio, Rico, Dedrick, and Roger. Fortunately, all four men completed the study from the beginning of the study until its completion. The mathematics stories of these four men are presented in the next section.

Findings

Antonio, Rico, Dedrick, and Roger were the participants for this research study. Antonio is currently pursuing a Master's degree in mathematics education while Rico is pursuing a Master's in mathematics with a concentration in scientific computing. Dedrick is a doctoral student in mathematics education while Roger is a doctoral student in mathematics. It is interesting to point out that all four of these men are enrolled in graduate programs at PWIs or diverse research institutions. Borrowing from the (1998) analysis of multiple case study research by Merriam, first a snapshot of each participant's case is presented. Then, a cross-case analysis discussion is presented.

Antonio is working on his Master's degree in mathematics education and said that he knew that he would go to college since he was in the first grade. Because he had done so well in mathematics in school, he figured that he might as well pursue a degree in mathematics at Delmont College, an all-male HBCU. In his upper-level college mathematics classes, there were small groups of students, ranging from ten to fifteen students per class. He shared the following reflection about his mathematics experience:

> It's funny, uh, cause the classrooms were so small, everyone knew each other. And this is the class where it's pretty much 100% African American males. So

> it was very easy to relate to those guys. And then being at Delmont it was already dug into your head that this was a brotherhood. So you really feel…it's easy to ask questions to your neighbors next to you. (Interview 1)

Antonio indicated that everyone at his HBCU knew each other. Implicit in his statement is the idea that the students had established a sense of family or brotherhood so to speak and could relate to one another. He mentioned that this paradigm was shared among his fellow mathematics classmates. Because he could relate to his classmates, he felt comfortable asking his neighbors questions regarding mathematics.

In college, Antonio's mathematics professors were described as exceptional. They were willing to help, even though he might not have been enrolled in their classes during the given semester(s). Several of his mathematics professors were African American men, and most of them were alumni of Delmont. As a matter of fact, he said that he knew firsthand that a few of them attended his alma mater, which he cited as helping to instill pride in his HBCU and his mathematical abilities.

Moreover, while in college, he cited mentoring and tutoring as his two areas of expertise, which he still exercises today. His college professor told him about a community service project they were doing and invited Antonio to join them in the work. He explained:

> It's where, uh, we took students out of the university area…. We went out into the community around the university, and we mentored kids. And so I was in charge of the math SAT prep. And so I would basically work out problems with them and teach them little tricks and what not. And uh, also, I used to tutor algebra on the side, for a small fee. (We both laughed.) (Interview 1)

Because of his successful experiences with mathematics and his SAT mathematics preparatory course, Antonio shared that he took the leadership role for the SAT mathematics tutoring. In addition, he tutored algebra to provide him with supplementary income while in college. As such, Antonio's professor who sought out Antonio to engage in the mathematics community initiative has several implications for the mathematics community as well as HBCUs who are striving to develop initiatives to attract marginalized students to STEM fields.

Rico is pursuing his Master's degree as a full-time graduate student in mathematics and attended the same all-male HBCU (i.e., Delmont) that Antonio attended. Although mathematics was Rico's passion, he also studied computer science in college because he was attracted to the monetary rewards that computer scientists are expected to earn. Because of his expertise in both areas, Rico tutored fellow college students in mathematics and in computer programming while he was enrolled at Delmont. In college, Rico attended several research symposia offered by his HBCU's mathematics department. Even though he confessed that all of the seminars did not relate to his mathematical and personal interests, he did cite them as being beneficial. They were beneficial in that they provided him with the outlet of conducting research in mathematics and witnessing how mathematics researchers present their work in a comprehensive manner. In other words, he came to realize that mathematicians can do more than teach mathematics at higher education institutions. He also mentioned being fascinated by some of the mathematical

theories and ideas that were being discovered and reported by the real world mathematicians.

Rico made exceptional grades in college mathematics courses during his college matriculation. Rico's practice of making up his own problems and implementing different strategies to solve them was a methodological approach that he first began during his high school mathematics career. In addition to his own studying technique, Rico attributed other things such as his mathematics professors and his undergraduate mathematics courses to his success in college mathematics. He described the usefulness of his undergraduate mathematics courses:

> Well, I used those skills that I learned to apply them in high school, when I was teaching high school. And I use those skills today in my classes now in DE and partial DE. And especially in the lab, 'cause I work in the Math Lab, the tutorial lab, so when I'm explaining problems to them, I use those skills. So I'm grateful for the professors I had in undergrad. (Interview 1)

As indicated, Rico believed his undergraduate mathematics courses were useful. He believed they assisted him during his stint as a secondary mathematics teacher by providing him with a solid knowledge base concerning mathematics. Further, he believed his undergraduate mathematics courses helped prepare him for rigorous graduate mathematics courses such as Differential Equations (DE) and Partial DE. It is interesting to note that he also paid homage to his mathematics professors, many of whom were graduates of his HBCU, for assisting in his mathematical development.

Overall, Rico's mathematics professors were willing to help with mathematics work and provide advice about seeking admission into various graduate mathematics programs. Rico had two African American male mathematics professors, and he recalled instances of professors (African American as well as other professors) recommending their graduate institutions for him to attend. He cited one of his African American male mathematics professors as serving as a father figure to him. Describing this professor, Rico articulated:

> Rico: Because he would chew us out when he would hear some type of bad news go on on campus about a student acting up or being foolish or broke into a car. And he would crack down on us like you shouldn't do things like this; I don't know why ya'll don't do this, this, and this. At the same time, he would work out a problem for us and help us along the way. So at the same time, he was like a counselor/teacher in the classroom. And I appreciate him for that.
>
> Res.: Uh-hum.
>
> Rico: Even though we lost class time during his lectures, we lost class time because he wanted to talk about certain things like that, but it was okay. I learned at the same time still. I did well in his class, which I was very appreciative of because I learned in his class at the same time along with the little inspirational talks. (Interview 2)

At Delmont, Rico benefited from the motivational speeches that were given by his African American male mathematics professor. Although he realized the inspirational talks took away from mathematics instructional time, he considered them valuable and relevant to his overall educational progress and success. The fact

that Rico referred to his African American male mathematics professor as a father figure speaks volumes regarding the importance of providing African American male scholars as role models in the mathematics classroom and STEM professions in general and how HBCUs have been at the forefront of this vision.

In addition to probing his mathematics professors in their offices concerning mathematics problems, he also drew on the knowledge base of some of his peers whom he described as having higher order thinking skills. Rico said: "I picked the individual's brain so I could understand how they were understanding the concept" (Interview 1). He described mathematics study sessions where he would pick the brains of his classmates to understand how they arrived at different complex mathematical processes. Moreover, he stressed the importance of the support network that he received from individuals around him as being instrumental with his success in collegiate mathematics.

Dedrick is pursuing his doctorate in mathematics education. When asked why he chose to attend an HBCU, Dedrick cited the television show, *A Different World*, as being the chief mechanism for exposing him to the HBCU culture and for his desire to seek admission into these institutions. He attended two HBCUs during his undergraduate matriculation. Dedrick shared:

> I had probably one of the best times of my life at that university. I was in the band; I was an engineering major. And a lot of people were like how do you do it, knowing that the band practices all night and go to every game, home games as well as away games. But I think I was pretty good with time management. And you know, I was taught study skills early on. … Out-of-state tuition was kicking butt, and financial aid just wasn't cutting it, and after a while I realized that I'm going to be bored in corporate America as an engineer. And I said I can't do it. So I transferred. Became a regular math major, and I thought I was going to go back and pick it (engineering) up. That's why my degree is mathematics pre-engineering because I could have done those last years in engineering and got a dual degree. (Interview 1)

At his first HBCU, he expressed he had an exceptional time. Being in the band and studying engineering were two demanding tasks, and he implied that he balanced the two time-consuming tasks with relative ease. He reported that he had good study skills and time management skills, which contributed to his success with managing both of these tasks. He also indicated that the out-of-state tuition costs were becoming insurmountable. This financial difficulty coupled with his lack of interest in engineering led him to transfer and change his major to mathematics.

When he transferred to another HBCU, the university required that all students take a prescribed set of core courses. Included in this set of courses was College Algebra and Pre-Calculus. Because Dedrick had taken the Calculus sequence at his previous HBCU, he figured that he would not be required to take the College Algebra and Pre-Calculus courses. Surprisingly, the university officials required him to take the lower-level mathematics classes as part of the university's requirements. Dedrick expressed his disdain with the policy:

> I was pissed. I was mad as hell. I was like, you know, I've taken Calculus I, II, III, and IV. You all don't even offer Calculus IV, and they made me go back and

> to take College Algebra and Pre-Cal. So what I do? … I remember going to my final in College Algebra in my pajamas. The final was from 8 to 10. I got there about 8:45. At 9:30, I was back in bed. To this day, that professor was like how did you do it, and I didn't tell him 'til the end, and he was like why did they even make you take that class. (Interview 1)

Dedrick's frustration with this university requirement is understandable. He had taken mathematics courses that were more rigorous than the mathematics courses required at his new HBCU. It seemed logical that he would be able to substitute those mathematics courses or test out of them, to no avail. What are the implications of such policies that are inadvertently used to impede African American college students from reaching their educational goals? In spite of this obstacle, he still persisted in mathematics.

Nevertheless, Dedrick's upper-level mathematics classes at his second HBCU were small in number, ranging from six to approximately fifteen students in each mathematics class. He spoke of a strong bond that the mathematics majors created among themselves as well as the one-on-one attention given to him by his mathematics professors. His situation is unique in that his male cousin was pursuing mathematics as a major who enrolled in several classes with him and that a member of the mathematics faculty was also his fraternity brother.

Similar to Antonio and Rico, Dedrick went to his professor's office to seek help with his mathematics problems. He also expressed that he was vocal in class when the mathematics material did not register with him. Dedrick communicated that he could relate to his African American male mathematics professors. Dedrick declared:

> The black professors that I had in math, they were strong, sharp individuals. And you know, for one thing, I could relate to them, and I respected them. Because I was like hey, I have a black man in front of me teaching this class versus a foreign professor where people are like I can't understand him or like I don't know what he's writing; I don't know what he's saying, so from that aspect, that was a great connection for me. (Interview 3)

Dedrick emphasized the importance of the positive cultural image of an African American male mathematics professor leading the class. He experienced a greater connection with an African American male mathematics professor as opposed to a mathematics professor of another ethnicity. With this cultural connection, it is not surprising that Dedrick is someone who is knowledgeable regarding the legacy of African Americans in mathematics as well as STEM fields. As a matter of fact, he has his high school students complete assignments that highlight the contributions of people of African descent to mathematics. Dedrick drew attention to the fact that African Americans were (and still are) clever and creative in their inventions. He makes it a point to stress this idea to his high school mathematics students, which are primarily African American students.

Instinctively, Dedrick has continued his mathematical cultivation beyond an undergraduate degree program. He explained why he did not study Pure Mathematics in graduate school. He said:

> For one, I wanted to keep math, and I didn't want to do Pure Math. I didn't want to do Pure Math because I was like I want a life, and I don't want to fry my brain. (Interview 2)

He joked about Pure Mathematics frying his brain to indicate that he sought something more than proving theorems over and over again. Besides, it worked in his favor to seek a Master's degree in mathematics education given that he had landed a job teaching high school mathematics. Because his Master's work was enjoyable, he decided to pursue his Ph.D. in mathematics education. Although he initially sought to complete his doctoral studies at an HBCU, he applied to various research universities due to the fact that he did not find any doctoral programs in mathematics education at HBCUs at that time suitable to his needs.

Roger is working on his doctoral degree in mathematics. (For an account of Roger's case study, please see Jett 2011) Roger credits his HBCU with producing the most African American mathematics majors, even more than all of the well-known research universities in the state. He credits this production of African American mathematics majors to a strong mathematics department along with strong faculty and a strong department chair. He used the word strong to refer to their sternness with regard to mathematics content and their ability to help him and other African American students prepare for graduate level mathematics.

Roger also played on the football team while pursuing a mathematics degree. Although he was involved with football, he cited several instances of working with other mathematics majors on various assignments. Additionally, he did several mathematics presentations in college, which he credits with helping him strengthen his teaching skills. He joked: "I'm teaching, so I give presentations everyday" (Interview 2), stressing the importance of those mathematics presentations at his HBCU to his current occupation as an assistant professor of mathematics. In addition, he kept the majority of his lecture notes from his college mathematics courses and draws upon those lecture notes to prepare mathematics lessons for his students.

When questioned about his most difficult mathematics course in college, he identified Calculus as the course that posed the most problems for him. This might seem ironic given that the calculus sequence is the most prominent and (usually) favorite course sequence for mathematics majors. Recounting his time in Calculus, he noted:

> Uh, basically, I wasn't putting enough time into it. And basically as a young person, it was kind of overwhelming the material and stuff. But after the, basically I had to understand that if I don't know these rules, then I'm not going to get it. I didn't really; it wasn't just clicking that I need to know these rules. I was just, basically, pictured calculus as being intimidating. And after you're intimidated, that's it. I believe I fell in that bracket for a little bit. (Interview 2)

Surprisingly, Roger claimed that he was intimidated by Calculus. Later on in the interview, he mentioned that he had to take Calculus again in summer school because he failed to master it the first time he took it. He failed Calculus because he did not invest a sufficient amount of time needed to be a success in the course not because of a lack of mathematical ability. After mastering Calculus, however, Roger found that his remaining mathematics courses built off of the Calculus foundational knowledge.

As a result, he experienced much success with the remainder of his mathematics courses as a mathematics major. Interestingly, Roger has been an A student in

mathematics since that experience. In college, he was bestowed respect from his peers because of his intellectual capabilities to pursue mathematics as a major:

> I mean that's the major to pursue because after you tell them you're a math major, you're looked at different. And people ask you questions like how'd you do it, so basically, the bottom line is I believe we carry the most weight than anything that you can do. (Interview 2)

Roger believes people see mathematics majors in a different light than other majors. In his experience, people regarded him as being intelligent because he was pursuing a mathematics degree. This paradigm may have caused him to excel further in mathematics. During his graduate school years in mathematics and engineering and in his doctoral work in mathematics, Roger says that he has not had a challenging mathematics course because he obtained the mathematics training at his HBCU to achieve advanced theoretical mathematics graduate courses.

At his HBCU, Roger affirmed there were approximately five African American male mathematics professors. In describing them, he said:

> They knew their subject matter. They knew their material. They were good. They weren't good; they were excellent. And basically they tried to pour that into you. (Interview 2)

When asked about the importance of having those five African American male mathematics professors and what he took away from that experience, Roger responded:

> Uh, basically so I can do the same thing they did for me. Help other African American young men that's coming along, so then they can help other African American males that's coming along. (Interview 2)

As such, Roger's allegiance to continue the mathematical legacy established at his HBCU among other African Americans infiltrates his current teaching and advising practices with African American students.

Discussions

A common element among Antonio, Rico, Dedrick, and Roger was that they all attended HBCUs during their collegiate mathematics studies. More specifically, they all attended HBCUs in the southern part of the USA for their undergraduate studies. The African American male participants in this study expressed that their respective HBCUs served as institutions that provided positive racial environments. Their statements closely aligned with scholarship that purports that HBCUs provide a different milieu with regard to racial features for African American students (see, e.g., Copeland 2006; Roebuck and Murty 1993).

Cooper (2000) also asserts: "Many black students find the most comfort and can relax, not fearing condescension or disrespect, in the company of other black students" (p. 185). As such, a unique feature concerning HBCUs is their potential for social and academic collaboration among a large pool of African American college students (Cooper 2000; Kimbrough and Harper 2006). Furthermore, "a key

consideration for these students is being connected to peers who will provide them with critical feedback related not only to their academic progress, but also to their nonacademic progress" (Bonner and Bailey 2006, p. 26). As mentioned previously, the participants' clustering with other African American students contributed to their peer academic support in college mathematics and with other facets of the African American experience as African American men.

With regard to HBCUs providing this feature of providing a large number of African American college students, this phenomenon rang true for Dedrick especially. Because Dedrick had witnessed many African American college students enjoying college life on the television show, *A Different World*, he cited that show for being the chief reason why he decided to attend an HBCU. He expressed that he perceived the campus environments of HBCUs to provide supportive environments for African American college students. All four of my participants declared they chose HBCUs for the supportive environment, especially the positive racial support they believed they needed as African American men.

As expressed in the literature review, HBCUs provide access to higher education for African American students in a society permeated with racism (Brown and Davis 2001). In the case of the four participants in this study, HBCUs served as a vehicle to higher education as well as mathematics. In addition to providing my participants access to higher education and to mathematics, the data revealed that these four mathematically successful African American were also granted access to African American male mathematics professors at their respective HBCUs, which is consistent with other research findings (see, e.g., Palmer and Gasman 2008).

Also, HBCUs train their students to provide service to the African American community (Roebuck and Murty 1993). Because most HBCUs are located within predominantly African American communities, these institutions provide a unique service to K-12 African American students in the community who seek to enter college (Kimbrough and Harper 2006). One participant, Antonio, worked with a program in which he taught mathematics SAT preparatory courses for community students while he was enrolled at his HBCU. Rico also did some mathematics tutoring in his college community. With his fraternal organization, Dedrick participated in community service projects. Although the projects were not mathematical in nature per se, he mentioned that the community initiatives promoted education for African American students and provided students with positive African American collegiate role models.

All four of the participants, especially Rico and Roger, stressed that their mathematics departments at their HBCUs were instrumental in preparing them for graduate studies in mathematics. It is interesting to note that these two participants are also the individuals who are pursuing graduate work in Pure Mathematics. Antonio emphasized how graduate representatives from various universities came to his HBCU to recruit African American male mathematics students for their graduate programs in Mathematics and Statistics. This practice of preparing undergraduate mathematics students for graduate school work is consistent with the finding by Tucker (1996) that effective undergraduate mathematics programs prepare students for advanced mathematics study. Although Tucker's study included case studies of mathematics departments from HBCUs and PWIs, the HBCUs possessed "especially nurturing atmospheres for students" (p. 1358). While these mathematical practices

may occur at all higher education institutions, they were particularly meaningful for the participants in this study at their HBCUs because they expressed that this preparation came from someone of their own African American culture.

One goal of HBCUs is to provide African American role models who examine issues relevant to the African American community (Roebuck and Murty 1993). While completing their undergraduate studies in mathematics at HBCUs, all four of the African American men in this study cited an African American male mathematics professor as being an influential role model with regard to their mathematics education. (For another account of the importance of having mentors, please see Warde 2008.) The participants expressed that they were able to gain access and obtain success in college mathematics as a result of these interactions. Please note that I am not suggesting, however, that placing African American male students with African American male mathematics professors will ensure college mathematics success. What I am implying, however, is that African American male professors might have an effect on African American male students as it pertains to seeing themselves as doers of mathematics (Clark et al. 2009).

Consequently, what I found in the data were resounding messages of these African American male mathematics professors being instrumental in the participants' HBCU experiences. Similarly, the African American male high school mathematics students in the study by McGlamery and Mitchell (2000) were able to relate and connect to the professional African American mathematicians because the mathematicians "embodied their culture and attitudes" (p. 81). With regard to my study, the participants acknowledged they were able to make the cultural connection to an African American male mathematics professor at their respective HBCUs and that this contributed to their academic success.

In the case of Antonio, he sought the help of an African American male mathematics professor even when he was not enrolled in the professor's course. Antonio also mentioned that he was able to relate to the African American male mathematics professors who had decided to come back and teach at his alma mater. Moreover, Rico cited an influential African American male mathematics professor who served as a father figure to him. Rico discussed the personal advice concerning life as an African American male in this society that was provided to him by his African American mathematics professor. In like manner, Dedrick mentioned his fraternity brother who was also a mathematics professor at his HBCU. Dedrick told of how his mathematics professor was a positive influence with regard to mathematics and his work with the fraternity in the African American community. In addition, Roger was taken under his African American male mathematics professor's wings (so to speak) to understand the fundamental theorems and rules of mathematics. Roger cited his African American male mathematics professor as showing him "the ins and outs" (Interview 1) of mathematics and encouraging him to pursue a major in mathematics.

In summary, HBCUs provided these men with a positive racial climate that was conducive for success in mathematics. This atmosphere was also inclusive of likeminded African American peers who sought to be successful in their academic questions in their various intellectual traditions. Further, these HBCUs provided community service opportunities and provided them with access to high quality mathematics, which was needed to propel them for graduate studies in mathematics.

The fact remains that these four African American men were influenced to persist in mathematics in college because of the efforts of an African American male mathematics professor. Although African American male professors can exist at any university, the culture at HBCUs lends itself to a more nuanced professional relationship as expressed by the participants in this study.

Conclusion

First and foremost, researchers should (continue to) tap into the academic networks and intellectual communities established at HBCUs. Researchers should examine the role and impact of HBCUs in producing African American mathematicians and mathematics educators. This examination should also be inclusive of those individuals seeking to enter STEM fields. Because HBCUs abound in producing African American college graduates, the successful established (mathematics) practices at these institutions should be researched and brought to the forefront if we are serious about sustaining our African American mathematical communities, ensuring that African Americans continue to enter the mathematics pipeline, and producing more mathematics and science teachers of color (Allen 1992; Kimbrough and Harper 2006).

Further, researchers should (continue to) initiate conversations with those (STEM) scholars at HBCUs who have a legacy of producing African American mathematicians, especially African American male mathematicians. Also, researchers investigating these complex issues regarding the participation of African American men in mathematics should employ theoretical perspectives such as critical race theory to bring issues of race and/or racism to the forefront given that race seems to be a recurring impediment to those seeking to pursue STEM degrees and careers. More specifically, the experiences of African American male mathematics HBCU alumni should be examined as they enter in graduate programs and industry work to ascertain the ways in which HBCUs mobilized them for such work.

Notably, the success of HBCUs in attracting African American (male) students and assisting with their development as scholars within an African context cannot be ignored (Copeland 2006). HBCUs and their role as vehicles of access have produced a significant number of African American college graduates, especially in the field of mathematics. Brown and Davis (2001) argue that "HBCUs provide a unique educational function that cannot be replaced" (p. 47). I concur with these scholars that HBCUs serve a special purpose of attracting African American students to the higher educational landscape that cannot be duplicated. As I mentioned in the introduction to this article, HBCUs provided a catalyst for a group of African American mathematics educators to solidify their professional, mathematical relationships.

Because HBCUs are a vehicle in which many African American male students are provided access to higher education with high retention rates, HBCUs should be presented as a viable option for African American male students to pursue their college education, especially given that spaces are created at these institutions where students succeed regardless of academic preparation, socioeconomic status, and the

like (Allen 1992; Copeland 2006; Kimbrough and Harper 2006; Palmer and Gasman 2008). With regard to HBCUs, Kimbrough and Harper (2006) posit:

> Given that most HBCUs are nestled in the heart of black neighborhoods or in close geographic proximity to large concentrations of African Americans, they are in a unique position to reinforce college-going messages to young boys and teenage males. After-school, summer, and special outreach programs should be created to nurture pools of prospective African American male college-goers. (p. 205)

Kimbrough and Harper's recommendation should (continue to) be implemented given that several HBCUs are embedded within African American communities. This suggestion might serve powerful to young African American K-12 students as well as the African American college students who might assist with such efforts as evidenced by the participants in this study.

All things considered, HBCUs serve a unique, significant role in the production of African American male and mathematics college graduates and STEM professionals in general. Given the many calls to ensure the success of African American male college students and the desire to make mathematics a more welcoming space for students of color, it seems prudent that researchers and educational leaders would work to create policies and environments where these students can achieve in mathematics at the highest levels. Since HBCUs have been at the forefront of this command for several years, they must be used as an influential resource to sustain our Africana mathematical communities and change the faces of mathematics (Strutchens et al. 2000). An essential point from this study is that HBCUs and the presence of African American male mathematics professors propelled these four participants to continue in the mathematics pipeline. Therefore, the accomplishments of HBCUs in providing access to higher education in general and mathematics in particular and producing African American college graduates should be valued, appreciated, and acknowledged in the academic realm. In addition, HBCUs should continue to be used to propel African American (male) students in STEM-related fields in general and in mathematics in particular.

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