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Reversing the Tide in Science, Engineering, Technology and Mathematics (Stem): Academically Gifted African American Students in Historically Black Colleges & Universities

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Reversing the Tide in Science, Engineering, Technology and Mathematics (Stem): Academically Gifted African American Students in Historically Black Colleges & Universities

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REVERSING THE TIDE IN SCIENCE, ENGINEERING, TECHNOLOGY AND MATHEMATICS (STEM): ACADEMICALLY GIFTED AFRICAN AMERICAN STUDENTS IN HISTORICALLY BLACK COLLEGES & UNIVERSITIES

Delores Rice, Fred A. Bonner II, Chance W. Lewis, Mary Alfred, Felecia Nave and Sherri Frizell

Abstract

What started off as a national concern has escalated to the point of crisis (Bonner, Alfred, Lewis, Nave & Frizell, 2009; Chubin & Malcolm, 2008; Hrabowski, Summers & Hrabowski, 2006). The current state of affairs regarding African American participation in STEM disciplines has become one of the thorniest issues of contemporary focus. This article highlights data collected for a NSF Education Research grant. The focus of this HBCU-UP project was to uncover factors contributing to the success of academically gifted (high-achieving) African American students enrolled in engineering programs at the 12 ABET accredited four-year institutions in the U.S. Specifically, this research highlights qualitative case study data including key categories and themes identified as impacting the academic success of this high-achieving cohort across each of the 12 institutions included in this study. Based on the findings of this study, recommendations are provided to increase the success of African American gifted students in STEM fields at HBCUs.

Introduction

W.E.B. DuBois articulation in his 1903 treatise *The Souls of Black Folk* of what he perceived to be the quintessential problem of Twentieth century America as “The problem of the color line...” has become manifest twice over when we consider the contemporary state of affairs among African American populations in the Science, Technology, Engineering, and Mathematics (STEM) disciplines. What was a problem is now viewed as a crisis—a quiet crisis according to Shirley Ann Jackson, President of *Rensselaer Polytechnic Institute*. Attracting, maintaining, and graduating students in STEM fields is a difficult endeavor even when considering majority (White) populations; however, these difficulties become potential impossibilities when we look at the higher education landscape for African Americans in these fields.

Despite increases in overall enrollment and baccalaureate degree production in STEM, the proportion of minority freshmen in engineering has seen a steady decline since 1995 (Chubin, May, & Babco, 2005). These authors also assert, “While the national baccalaureate total swelled by 9.3% to 75,031, the fractions of this total awarded to African Americans, Latinos, and American Indians all declined. This continues a trend” (Chubin, May, & Babco, p. 74). A specific focus on African American women reveals an even deeper gulf in the number of STEM degrees, with Black women receiving less than 10% of all bachelor’s degrees awarded in engineering (NSF/Division of Science Resources Statistics, 2010).

In speaking to the current “gap” we see across STEM disciplines, perhaps we need to look to fruitful and underdeveloped grounds to create a more vivid STEM landscape. Namely, it is important to mount efforts to cultivate and harvest our populations of color, particularly African American cohorts who have not been provided the proper nutrients to support their growth and development. Drawing once again on President Shirley Jackson’s eye-opening report, *America’s Quiet Crisis*, she noted:

The need to make the nation safer from emerging terrorist threats that endanger the nation’s people, infrastructure, economy, health, and environment, makes this gap all the more critical and the need for action all the more urgent. We ignore this gap at our peril. Closing it will require a national commitment to develop more of the talent of all our citizens, especially the underrepresented majority—women, minorities, and persons with disabilities who comprise a disproportionately small part of the nation’s science, engineering, and technology workforce. (Jackson, 2010, ¶5-7)

One African American cohort that offers significant promise in addressing the STEM “gap” is the academically gifted. By focusing on these high-achievers not only is DuBois’ shibboleth extolling the progress of the race being undergirded by the *talented tenth* a truism, but is emblematic of how the tide of underachievement can be turned. However, before a sole-reliance on this group to address the *STEM problem* is undertaken, it is necessary to develop an understanding of some inherent pitfalls they experience; namely, Maton and Hrabowski (2004) reported, “Included among those who abandon science majors and underperform in science and quantitative courses are African American students with high scholastic aptitude tests (SAT) scores, impressive high school grade point averages (GPAs), and success in high school honors math and science courses” (p. 547).

Additionally, a focus beyond population to underscore the importance of *place* (environment) is also critical in addressing this topic. Literature dating back over several decades has brought clarity to the discussion of the African American experience in higher education. A familiar and recapitulated refrain is the sense of “fit” and congruence that African American students tend to have in Black college settings. Dating back to 1975, Astin found that when controlling for family social status, academic ability, and educational aspirations among a national sample of college students, African American students were significantly less likely to drop out of college if they were enrolled in a predominantly Black institution. A similar study by Wenglinsky (2006) reported African American students to perform better academically in predominantly Black institutional contexts even when factors such as institutional selectivity, financial resources, size, and sponsorship are controlled. Also, Stewart, Wright, Perry, and Rankin (2008) state “Students that attend HBCUs benefit from increased levels of engagement with peers and faculty and faculty diversity. As a majority on the campus, students at HBCUs do not have to cope with assimilating in addition to other collegiate pressures” (p. 26).

This article focuses on research related to a National Science Foundation (NSF) funded project entitled *An Empirical Investigation of the Success Factors Impacting Academically Gifted African American Students in Engineering and Technology at Historically Black Colleges and Universities (HBCUs)*. As part of the Historically Black College and University Undergraduate Preparation (HBCU-UP) program, a research team of faculty investigators and graduate students representing Prairie View A&M and Texas A&M Universities conducted this study. Critical research questions that are considered in this article and that were subsequently treated in this grant investigation include: If efforts are focused to address the needs of African American STEM students who attend HBCUs, especially those who are academically gifted (high-achieving), would the data tell the same story? Are there institutional factors that can be

identified and manipulated in a way to ensure the success of academically gifted African American students in STEM disciplines? More specifically, do institutional climate, culture, and environment make a difference? The authors provide a brief overview of the extant literature, methods, findings, discussion and implications across the twelve institutions included in this project investigation. The authors conclude with several tentative recommendations for stakeholders internal and external to academe who are interested in closing the gap and reversing the tide of underachievement among African Americans in STEM.

Literature Review

The extant literature (Bonner, Alfred, Lewis, Nave, & Frizell, 2009; Chubin, May & Babco, 2005; Jackson, 2010; Summers & Hrabowski, 2006) documents the mounting problem that the nation is facing in terms of producing a viable STEM workforce. The National Academies landmark report *Rising Above the Gathering Storm: Energizing and Employing America for a Brighter Economic Future* asserts,

Having reviewed trends in the United States and abroad, the committee is deeply concerned that the scientific and technological building blocks critical to our economic leadership are eroding at a time when many other nations are gathering strength. We strongly believe that a worldwide strengthening will benefit the world's economy—particularly in the creation of jobs in countries that are far less well off than the United States. But we are worried about the future prosperity of the United States. Although many people assume that the United States will always be a world leader in science and technology, this may not continue to be the case inasmuch as great minds and ideas exist throughout the world. We fear the abruptness with which a lead in science and technology can be lost—and the difficulty of recovering a lead once lost, if indeed it can be regained at all. (National Academies Press, 2007, p. 3)

A conundrum as complex as the previous statement outlines defies a simple answer. What this problem begs is a multifaceted solution from the range of communities who can significantly contribute to the ongoing dialogue on this topic. However, what we continue to see is that certain conditions constrain the full participation of all members within our national communities to contribute to this dialogue.

African Americans and Underrepresentation in STEM

Despite the few strides that have been chronicled regarding African Americans in college, particularly in STEM related fields, a number of maladies associated with underrepresentation, continue to exist. The American Society for Engineering Education noted Yoder's (2014) report, *Engineering by the Numbers*, which revealed the following: 65.9% of all undergraduate engineering students in the U.S. are White, 13.1% are Asian American, 10% are Hispanic, and 3.5% are African American. Chubin, May, and Babco (2005) found the proportion of minority freshmen in engineering to be in a steady state of decline since 1995, this despite an overall increase in baccalaureate degree production. Roach (2004) lamented data indicating that graduation rates for African Americans and Hispanics in the field of engineering had not changed in a decade—a combined total of approximately 11%. Referencing the number of degree recipients in STEM fields, Jackson (2010) further problematizes and offers a candid view of the state of affairs:

...disproportion holds true for African Americans, Hispanics, Native Americans, and persons with disabilities who make up 24 percent of the population, but only 7 percent of the science and engineering workforce. Taken together, women and under-represented

groups make up a half to two-thirds of the population of the United States and comprise the nation's new majority. (p. 4)

These demographic data clearly point to the immediate need and pointed interventions to circumvent the tide of underrepresentation. According to Chubin (2002) "You only have to do the math to see how far engineering needs to go for minorities to reach parity in degree awards relative to their numbers in the general population. The time to act was the 1980s, a generation ago, when the future composition of the school-aged population became clear" (p. 72).

To combat the tide of underrepresentation of African Americans in STEM, one potential approach that warrants merit is the focus on high-achieving students. Yet as alluded to earlier in this article, much like their peers who are less high-achieving, these students too struggle to complete STEM majors (Bonner, Alfred, Lewis, Nave & Frizell, 2009; Summers & Hrabowski, 2006). According to Maton and Hrabowski (2004), "Many students who abandon science, mathematics, technology, and engineering majors and who under-perform in quantitative courses are students of color who possess high scholastic aptitude tests (SAT) scores, impressive high school grade point averages (GPAs), and success in high school honors math and science courses" (p. 547). In addition, Summers and Hrabowski (2006) reported that factors beyond academics must be responsible for the attrition and low performance within this cohort. What several researchers (Bonner, 2001; Bonner, Jennings, Marbley, & Brown, 2008; Ford, Harris, Tyson, Frazier-Trotman, M., 2002; Sedlacek, 1993; Sedlacek & Tracey, 1985) have suggested is that by looking beyond those factors that relate to academic and cognitive abilities, strategies to enhance success could potentially be identified.

HBCUs and African Americans in STEM

Historically Black College and Universities (HBCUs) have long-served as the primary conduit, providing access to higher education for African Americans in the nation (Jennings, Bonner, Lewis, & Nave, 2007). HBCUs are Black academic institutions whose principle mission were and continue to be the education of Black Americans (Roebuck & Murty, 1993). Brown (2002) asserts that HBCUs "have made their most important educational contribution through their profound commitment to and encouragement of African American (AA) students... The strength of the HBCU is its unique cultural context" (p. 275). According to Stewart, Wright, Perry, and Rankin (2008), there are approximately 105 HBCUs in the United States. Of particular significance concerning these institutions are the data reporting them to enroll 14% of all African American students in higher education, while only constituting 3% of the 4,084 institutions of higher education operating in the country. Additionally, in 2001, these institutions awarded 28.5% of all baccalaureate degrees earned by African Americans nationwide (Brown II, 2002).

In general, HBCUs not only promote access, but also offer a safe space for unfettered growth and development that could be potentially constrained in Predominantly White Institutions (PWIs). The benefits of attending an HBCU are frequently measured in terms of both individual and collective benefits. Again, it was Astin (1975) more than 35 years ago in researching the experiences of African American students in HBCU contexts who found that even when family social status, academic ability, and educational aspirations were controlled, African American students still tended to be significantly less likely to drop out of college if they were enrolled in a predominantly Black institution. Subsequent to this study, yet still almost three decades ago Pascarella, Smart, and Stoecker (1987) similarly posited that when controlling for institutional selectivity, financial resources, size, and sponsorship, African American students still performed better in Black institutional contexts. And, even today HBCUs register landmark

accomplishments: Nine of the top ten colleges graduating the largest number of African Americans who go on to earn PhDs are HBCUs, 50% of the nation's African American teachers and 70% of the African-American dentists earned their degrees at HBCUs (Stewart, Wright, Perry, & Rankin, 2008).

The STEM disciplines are especially supported by HBCUs in that they award a significant number of undergraduate degrees to African Americans. Data indicate that 30% of the undergraduate engineering degrees and 44% of the natural science undergraduate degrees were awarded to African American students who attended HBCUs (NSF, 2002). Additionally, African American undergraduates who matriculate and subsequently graduate from HBCUs are more likely to attend graduate school and complete a doctoral degree; for example, in the science and engineering fields, HBCUs account for 17% of Black graduate students (NSF, 2002, p. 30). Thus, the shortfall in the number of qualified individuals to contribute to the STEM workforce could be addressed by these institutions (Jackson, 2010). HBCUs appear to be ideally situated to offer viable solutions to reverse the tide of underrepresentation, especially for African American students, in STEM (Bonner, Alfred, Lewis, Nave & Frizell, 2009).

Methodology

Given the current status of the extant literature surrounding African American students in STEM disciplines, the primary research question that provided the foundation for understanding this cutting-edge project funded by the National Science Foundation was: What are the factors that most significantly impact the success of academically gifted African American students in Science, Technology, Engineering and Mathematics (STEM) disciplines that are enrolled in Historically Black Colleges and Universities (HBCUs)? More importantly, the primary research population was academically gifted African American students enrolled in STEM academic majors at HBCUs.

Academic giftedness was the main construct that provided a framework for this study. According to Renzulli (1986), academic giftedness, also defined as schoolhouse, test-taking and lesson-learning giftedness is easily measured by IQ or other cognitive ability tests and for this reason it is also the type most often used in selecting students for entry into special programs. As a result, African American undergraduate students included for this study were based on factors including college GPA and faculty/staff recommendations. In addition, African American students in STEM fields were targeted in the 3.0 to 4.0 GPA range on a 4.0 scale with a particular focus on high academic achievement which is recognized as grade point averages of 3.5 to 4.0 (Bonner, 1998).

This article reports on the findings of the first phase (Phase 1) of this project. Phase 1 included a qualitative study, interpretive inquiry, using focus groups centered on factors related to the success of academically gifted African American students enrolled across the twelve (12) four-year HBCU engineering programs in the nation accredited by the Accreditation Board for Engineering and Technology (ABET). The list of institutions identified for this phase (Phase 1) of this grant project can be found in Table 1. Phase 1 data will be used to develop a quantitative survey instrument for Phase 2 that will be administered to all academically gifted African American students who are enrolled in a plethora of STEM disciplines at each of the eight-nine (89) four-year HBCUs in the nation.

Table 1: ABET Accredited Engineering Programs at HBCUs

<i>Institution</i>	<i>Location</i>
Howard University	Washington, DC

North Carolina A&T University	Greensboro, NC
Alabama A&M University	Normal, AL
Prairie View A&M University	Prairie View, TX
Southern University – Baton Rouge	Baton Rouge, LA
Tennessee State University	Nashville, TN
Morgan State University	Baltimore, MD
Florida A&M University	Tallahassee, FL
Hampton University	Hampton, VA
Tuskegee University	Tuskegee, AL
Norfolk State University	Norfolk, VA
Jackson State University	Jackson, MS

Data Collection and Analysis

Data collection consisted of face-to-face focus group interviews with African American academically gifted undergraduate students enrolled in STEM programs at the 12 ABET accredited HBCUs (see Table 1). Students selected for these focus groups at each institution were based on faculty recommendations from each of the areas of Science, Technology, Engineering and Mathematics. To be included students had to have had a GPA of 3.0 or higher, a criterion for academic giftedness identified by Bonner (1998). Students self-reported that they were admitted to their university with a high grade point average and many reported being among the top of their graduating class. All students included in this research study were either in their junior or senior year of study in their respective STEM fields and had been in their respective majors upon arrival at their respective universities.

We conducted three to five focus groups at each institution with 6-8 students per group. Each group interview lasted 90-120 minutes and the data were digitally audio recorded and later transcribed. In analyzing the data, we followed Creswell's (2005) six steps to data analysis, with much focus on the coding of the data and generating categories and themes. For that part of the analytical process, we used Straus and Corbin's (1998) two levels of coding, namely open coding and axial coding. In open coding, we read through each transcript and highlighted key words and phrases that captured what was going on with that piece of data and provided a label for the phenomenon. We completed this process for each group interview within an institution. We used Atlas.Ti software to assist in coding the data. For the second level of coding, axial coding, we looked for patterns in the data within and across institutions through cross-case analyses and developed categories from the labels identified in the first step. We then looked for relationships among the categories and collapsed them into common themes across the data sets, focusing on institutional factors that contribute to the success of African American students in STEM fields at HBCUs.

Findings

Four major findings characterized the perspectives of academically gifted African American students at HBCUs related to the institutional success factors that have contributed to their positive matriculation in their respective STEM fields. These themes included: faculty support, financial support, smaller class sizes, and student organizations at HBCUs. In addition, based on these themes, a series of consistent issues for improving the successful matriculation of African Americans in STEM fields at HBCUs emerged. These consistent issues were collapsed into the four emergent themes presented in this paper for improving the successful matriculation

of African American gifted students in STEM fields. Below, the four themes are developed, and then, following the discussion of the findings, the ideas for improving the successful matriculation of African American gifted undergraduate students at HBCUs in STEM fields are presented. Finally, several conclusions are drawn in the last section.

Faculty Support

The most powerful theme that characterized the student's perspective on the institutional factors that impacted their successful matriculation in STEM fields at HBCUs for students in this study was the sense that their relationship to STEM faculty were especially important. This was the most common and most welcomed support across all groups and institutions and students spoke of its impact with great passion. For the students in this study, their university provided an atmosphere that encouraged positive relationships with faculty. Students described this positive relationship as most influential to their success in their academic programs. Surprisingly, no students interviewed across the 12 ABET-accredited HBCUs indicated that they did not have some form of faculty support. Many of the students noted that they came to the HBCU with an understanding that it was a supportive environment for undergraduate students due to their faculty members in the STEM disciplines even though the academic coursework was quite rigorous.

The students' comments underscored the many feelings of faculty support received on their respective HBCU campuses. Below are some examples of the nature of faculty support found in STEM disciplines at some of these institutions:

- “Our professors are always there... I guess being in a smaller university they have more one-on-one interaction with us and most of them [professors], their door is always open if you need help. Some of them give us their cell phone number... we can call them at home. We don't go that far, we just wait until their office hours, but if we needed to they were available... e-mail, if you want to come in early, do you need little extra time on your homework? They're just willing to help us. So I guess, because they are passionate about helping us, we are passionate about learning.”
- “I think our professors really reach out. They'll pretty much reach out to those students who are really active in class, like if those students are asking a lot of questions or they're very attentive to what they're saying... they really look at those students. And if they are achieving academically in their classes, they also reach out to those students because they feel like... I guess they have a real impact on them. So I feel like professors really reached out to me because I guess they see potential in me, so I think that helped build up the relationship because once they learn your name and they already know you... like “how you know my name?” That's when the relationship starts.”
- “Yeah, I think they [faculty] do play a large role – significant role in your degree, your field of study. They are almost like a mentor and just try to be like that and for that you learn from that a lot academically and experience and you can use them for networking purposes.”
- “I have instructors who really motivate us to be the best and make sure we understand our work. It feels so good to have instructors who care and set goals. This is especially important because I am a non-traditional student who is 40 years old and can still get attention.”

- “They [faculty] play a significant role, because you want to be acknowledged for what you have done and if you see that a faculty member cares and they want you to do well...also knowing that someone besides your family cares about your success. So, I think they have a nice role or significant role in my success.”
- “They [faculty] play a significant role in my success too, because playing football I have to miss class sometimes and they’re willing to work with you and get you to make up work and tests and that’s real significant and it helps me out in my academics too.”

Clearly, African American gifted students in STEM fields in this study experienced strong relationships with faculty members in their respective areas of study. Many students felt that the faculty had their best interest at heart and they did not want to let down the faculty members because of the feeling that they cared so much about them. For all of these students, their matriculation in their respective STEM fields would have been much different if they did not have positive relationships with faculty members. This theme of “Faculty Support” was most significant for students in this study.

Financial Support

Along with strong feelings of faculty support from the respective institutions, the students in this study were keenly aware that financial support provided by the institution was also a key factor in their academic success. Many of them did not come from a wealthy background and the financial support they received provided the necessary resources for each to be able to survive (financially) while pursuing their respective academic degrees. One student explained ‘scholarships’ were an essential component that allowed him to even attend college. But more importantly, the students felt that this financial support illustrated an institutional commitment to their success in pursuing their degrees in their respective STEM fields. While these colleges/universities could not provide all students with the same level of financial support, students in this study noted that whatever they received definitely made a difference in them matriculating this far on their academic journeys. One student succinctly summed up this view by saying “financial aid helps me along.” This student explained that his institution “has scholarships for students who have a 3.0 GPA and higher.” Other students noted:

- “...I would say financial aid and scholarships so that you don’t have to work as much while you’re in school. Because engineering is a major where you don’t need to be working...not full time. You’re not going to do as well as you need too. To not work at all is actually excellent because the semesters I didn’t work; I did the best!”
- “The number one factor that’s allowed me to be academically successful, meaning having a decent GPA is the fact that I’m on scholarship and have adequate finances to buy books...I would be in a different situation if I had a lot of loans and there was no money and there was no food, there might not be a place for me to sleep tonight.”
- “I have a lot of extra activities going on [because of funding]. I do research; I’m really doing two types of research right now. I won the Eisenhower fellowship this semester and I also do research in the GIS lab for NASA. So that requires about 8 hours per week of research, but the money that I get from doing that is very nice. I don’t have to work as much as I needed to before.”

It was obvious to all of these African American gifted students that the institutional factor that was a big part of their success was financial support. The financial support allowed them more of an opportunity to focus on their coursework and less time focused on a job to support themselves. The financial support these students received appear to have been a major contributor to their success in their respective STEM fields.

Smaller Class Sizes

The majority of the students previously noted that financial support from their institutions played a significant role; however, another theme that emerged was the fact that the smaller class sizes at HBCUs were a key factor as to why this population has been successful in STEM fields. Students recognized early in their selections of HBCUs as a choice to pursue their academic careers that each of them as individuals saw advantages of having these smaller class sizes. Many of these students saw smaller class sizes as a way to have more one-on-one attention from their professors. Also, students noted that smaller class sizes would allow them to meet other potential study partners who were serious about their academic coursework. Interestingly, students viewed smaller class sizes as an institutional commitment at HBCUs that were orchestrated to have African American students succeed in their respective fields. For some of the students in this study, this unique institutional culture was the reason they chose to attend an HBCU over a predominately White institution (PWI). Note these comments:

- “One of the reasons I came to [university name] was the small classes and the ability to be one-on-one with my professors.”
- “...I knew from early on that I was a one-on-one learner. Even when I was in high school I knew that regardless of what you sit and tell me here in front of the class, I’m still going to come to you after class. So that was one of my major things when picking my colleges; was a smaller college because of that.”
- “One of the things my parents told me which is why they wanted me to go to an HBCU is that they typically have smaller classrooms and that the professors care more about you succeeding.”
- “I guess being in a smaller university they have more one-on-one interaction with us [students] and most of them [faculty], their door is always open if you need help.”

As noted in the comments above, smaller classes to African American gifted students in this study made a difference for students. Students saw smaller class sizes as an opportunity to get one-on-one attention from their professors and to develop close relationships with the professors. The students identified the small as a unique part of the HBCU and there was a general agreement that if they had attended a PWI they would be lost in large classes and faculty would not be as attentive particularly to African American students in STEM disciplines.

Student Organizations at HBCUs

The study participants highlighted the importance of getting involved in various student organizations at the HBCU. African American gifted students were involved in student organizations that were within their respective STEM fields and a few outside of these areas as well. They discussed how these organizations put them in an environment

with other students who may not be in their classes but whom they felt were “going somewhere.” This ‘going somewhere’ viewpoint represented a student who would have a good career upon finishing college because they were serious about their academic major. Certainly, student organizations at the HBCU, along with other allowed students to build a network of support. One student noted, “I’ve got a connection [via student organizations] with so many other people and my success is not just based on how well I do in my STEM department or classes...it has allowed me to network with other people outside of my field of study.” Other students discussed their experiences with student organizations on their campuses and how it assisted them in successfully matriculating through their STEM fields. Note their comments below:

- “...I would say my involvement with the National Society of Black Engineers. I have really become a leader by being a great follower, which is one of the characteristics of being a great leader. I also say that coming up in the ranks of NSBE, I’ve learned how to manage a budget of probably like \$60,000 to \$100,000. I’ve learned how to think on a corporate level before I actually dive in the corporate level or corporation ranks.”
- “I feel the things that have prepared me the most even to cope with the academic side of things and to get me ready for what I am going to do professionally all have come from outside the classroom...everything I have done from student organizations to the opportunities to go abroad to intern have given me an opportunity to practice what I’m learning. It has allowed me to see if the say I think can really drive solutions and hold weight in the professional arena.”
- “I’m involved with some student organizations focusing on undergraduate recruitment and things of that nature. There are some organizations on campus that require a certain GPA. That provides me with the encouragement to get on top of my books in order to be involved in activities that are student-based with student life.”
- “I’m involved with the ACM program in my department...it’s still a group of friends that’s inside some of the same courses. This organization gives us time to relax, but we’re still learning about the real world and just what’s expected. There’s a lot of stuff in the whole field but it’s relaxed...it gives us time to chill [relax] and just laugh.”

These students suggested they were affiliated with a student organization, which made them better students in their academic major. Additionally, they shared the perspective that participating in student organizations made them better well rounded than other students. Also, students looked to these student organizations as a time of relaxation given the fact that their academic majors were so rigorous. Most importantly, it is an avenue for building social capital and networking with others in and out of their academic discipline.

Discussion

The purpose of this study was to examine the factors that most significantly impact the success of academically gifted African American students in STEM. The data revealed that the following four factors—faculty support, financial support, small class sizes, and student organizations—considerably impact African American student success in STEM at HBCUs.

Kim and Conrad (2006) emphasized that HBCUs are noted for “providing a more collegial and supportive learning environment for students and faculty” (p. 401). Our data support their assertion, highlighting the significance of a positive learning environment in

student academic success. Faculty, indeed, impact the learning environment, a factor in student success in any learning institution. Moreover, oftentimes students of color are not connected to the faculty. However, the students who participated in the study developed strong bonds with faculty who motivated them to continue in engineering, graduate, and be successful. Similarly, Pascarella and Terenzini (1978) stress the importance of student interaction with faculty as a major factor that contributes to student success. Allen (1992) agrees, noting that academic success, particularly for African American students, is tied to faculty support and interaction.

Financial support provided students with an opportunity to focus on the curriculum, learning, and development. The importance of securing financial resources for students is a common thread in the literature addressing student persistence and success in higher education (e.g. Palmer, Davis, & Hilton, 2009; Perna, 2006; Titus, 2006). Shireman (2009) highlighted,

The purpose of financial aid is not merely to make it possible for a student to pay tuition and buy books and supplies; it is to get more students to *and through* college. It's not worth covering the tuition and books unless the student also has the *time* to be a student. That means the student needs to have, one way or another, a place to live and study and food to eat without having to take on excessive outside work (p. 56).

The financial support gave students a sense of mattering; they felt valued by the institution with the HBCU having a vested interest in their academic success.

The environment at HBCUs affords the offering of small class sizes, which was a key component relative to the success of African American students in engineering. The smaller class sizes helped to foster community with the professors and other students in the class and felt more supportive to the student participants. The class dynamic and interaction as a result of smaller class sizes were a key component for some students to attend an HBCU.

Student organizations provided an additional support network for student success. Being in an organization with other likeminded students who were committed to succeeding in engineering and serious about their academic journey, provided the additional community, which supported student success. In addition to providing support academically, the professional student organizations provided the additional mechanism to develop professional and career skills for the next step on the students' journey. Foundational theorists on student involvement, for example Astin (1984) and Tinto (1998) note the importance of students getting connected with the institution, which can be facilitated by formal and informal social connections with peers. For many students, participating in student organizations provided the social bond and familial relationship needed for support, which contributes to retention and success.

Overall, the data suggest that the HBCU environment provides a solid support system to recruit and retain Black academically gifted students. Allen's (1992) research on Black students at HBCUs and at PWIs presents the same outcome. According to Allen, "On historically Black campuses, Black students emphasize feelings of engagement, connection, acceptance, and extensive support and encouragement" (p. 39). He added,

The supportive environments of historically Black colleges communicate to Black students that it is safe to take the risks associated with intellectual growth and development. Such environments also have more people who provide Black students with positive feedback, support, and understanding, and who communicate that they care about the students' welfare. (pp. 39-40)

Allen (1992) stated that there are two primary factors which contribute to student success. The first factor is largely dependent on the students' individual characteristics and aptitude. The second is due to external factors such as "the quality of life at the institution, the level of academic competition, university rules/procedures/resources, racial relations on the campus,

relationships with faculty and friends, and the extent of social support networks on campus” (p. 40). For students who already have the internal motivation, the leadership at the HBCUs in the study appeared to pay attention to the external factors that influence success among students at their institutions.

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