Historically Black Colleges and Universities (HBCUs) and Academically Gifted Black Students in Science, Technology, Engineering, and Mathematics (STEM): Discovering the Alchemy for Success

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Historically Black Colleges and Universities (HBCUs) and Academically Gifted Black Students in Science, Technology, Engineering, and Mathematics (STEM): Discovering the Alchemy for Success

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Abstract: 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) currently being conducted by a research team comprised of faculty representing Prairie View A&M and Texas A&M Universities under the auspices of the National Science Foundation (NSF). As part of the Historically Black College and University Undergraduate Preparation (HBCU-UP) program Educational Research Project, this grant “provides awards to enhance the quality of undergraduate science, technology, engineering, and mathematics (STEM) education and research at Historically Black Colleges and Universities (HBCUs) as a means to broaden participation in the Nation’s STEM workforce” (NSF, 2007). The authors provide a brief overview of the extant literature, design and framework for the existing project investigation, as well as key preliminary findings from pilot study data collected at Prairie View A&M University. The authors conclude with several tentative recommendations for stakeholders internal and external to academe who are interested in promoting the success of African American students in STEM.

For more than three decades, both educational and scientific communities have focused resources on increasing the number of African-American students majoring in and subsequently pursuing careers in Science, Technology, Engineering, and Mathematics (STEM) disciplines. Despite these efforts there remains an on-going concern regarding the recruitment and retention of African American students in these disciplines, particularly engineering and technology. Notwithstanding an overall increase in baccalaureate degree production, the proportion of minority freshmen in engineering has steadily declined since 1995 (Chubin, May, & Babco, 2005). In 2003, the percentages of African Americans and Hispanics that earned bachelor degrees in engineering were 4.6% and 6.2%, respectively (Chubin, May, & Babco, 2005). Referencing the number of doctoral recipients in the STEM fields, an even more dire report was provided in Hamilton’s (2004) article:

In 2001, the last year for which figures are available, only two percent of doctorate holders in the sciences and engineering were African American, according to an analysis by the National Science Foundation. In some disciplines—such as computer and information sciences and math—the numbers were so small that they had to be suppressed lest they throw off the analysis. (p. 28)

Additionally, as minority populations continue to grow, increasing their participation in STEM fields will be critical to the health of our growing economy and our competitive edge in the world. Therefore, one of the most critical areas of focus should be on minority students who show extraordinary potential and promise in science and engineering related fields. According to Maton and Hrabowski (2004), “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).

Currently, an emerging body of literature has tended to focus on the psychosocial issues African American students confront during their matriculation at post-secondary institutions. For example, in a landmark study of factors influencing student persistence, Astin (1975) controlled for family social status, academic ability, and educational aspirations, in a national sample of college students and found African American students were significantly less likely to drop out of college if they were enrolled in a predominantly Black institution. Similarly, Wenglinsky (2006) found that African American
students performed better academically at predominantly Black institutions even when controlling for institutional selectivity, financial resources, size, and sponsorship. Hence, the research questions that will serve as a foundation to this emerging area becomes: 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?

This article focuses on research related to a National Science Foundation (NSF) funded project, An Empirical Investigation of the Success Factors Impacting Academically Gifted African American Students in Engineering and Technology at Historically Black Colleges and Universities (HBCUs), currently conducted by a research team comprised of faculty representing Prairie View A&M and Texas A&M Universities under the auspices of the National Science Foundation (NSF). As part of the Historically Black College and University Undergraduate Preparation (HBCU-UP) program Educational Research Project, this grant "provides awards to enhance the quality of undergraduate science, technology, engineering, and mathematics (STEM) education and research at Historically Black Colleges and Universities (HBCUs) as a means to broaden participation in the Nation's STEM workforce" (NSF, 2007). The authors provide a brief overview of the extant literature, design and framework for the existing project investigation, as well as key preliminary findings. The authors conclude with several tentative recommendations for stakeholders internal and external to academe who are interested in promoting the success of African American students in STEM.

**Literature Review**

Literature highlighting the experiences of populations of color in STEM disciplines has vacillated between positive reports depicting the rapid gains that some members of these cohorts have made in various areas of endeavor to the more negative accounts of the low numbers that persist to graduation subsequent to their selection of a STEM major. According to information cited in the National Academies critical report, *Rising Above the Gathering Storm: Energizing and Employing America for a Brighter Economic Future*,

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).

Perhaps an even direr need to be addressed when considering viable ways to elevate the condition and status of the nation in regards to its future technological position is to recognize that STEM education and careers have to be more inclusive of populations that have historically been otherwise poorly represented. A mounting problem as complex as the statement depicted here requires a commitment by individuals representing the range of communities that are functioning and living in our collective national space. However, conditions related to full participation by many members within our national community continue to be problematic.
AFRICAN AMERICANS AND UNDERREPRESENTATION IN STEM

Notwithstanding the incremental improvements made by African Americans, particularly in their selection of STEM related college majors, myriad problems associated with underrepresentation continue to exist. According to the American Society for Engineering Education, 68% of all undergraduate engineering students in the U.S. are White, 14% are Asian American, and just over 5% each are Hispanic and African American. Still other research has revealed that the completion rates for African Americans and Hispanics in STEM disciplines is 20% less than that for White students (Anderson & Kim 2006). Roach (2004) found that the graduation rates for African Americans and Hispanics in the field of engineering has not changed in a decade—it is still a combined total of about 11%. Additionally, Chubin, May, and Babco (2005) reported that despite an overall increase in baccalaureate degree production, the proportion of minority freshmen in engineering has steadily declined since 1995. All of these statistics point to an ever-increasing problem—for the student of color in general and the African American student in particular, immediate and pointed interventions are in order to circumvent under representation.

Referencing the number of degree recipients in STEM fields, Chubin (2002) further problematizes and offers a candid view of the state of affairs for students of color,

In 2001, 20 percent of bachelor’s recipients in engineering were women, and less than 12 percent were minorities. In absolute numbers, 1,000 women and barely 200 minorities earned a Ph.D. in engineering last year. 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).

Again, the extant literature continues to reveal how the low populations of students of color who are missing in the STEM pipeline impact the resultant numbers of those who later pursue majors and subsequently gain employment in these disciplines. One approach to combating the problem of under representation has been the suggested focus on high achieving students; however, research has revealed that this population, much like their peers who are less academically astute, find that they too struggle in the academy. 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).

Thus, a potentially viable argument is that in order to identify variables that contribute to the success of African American students in STEM fields, perhaps looking beyond those factors that relate to academic and cognitive abilities would prove valuable (Bonner, 2001; Bonner, Jennings, Marbley, & Brown, 2008; Ford, Harris, Tyson, Frazier-Trotman, M., 2002; Sedlacek, 1993; Sedlacek & Tracey, 1985).

HBCUS AND AFRICAN AMERICANS IN STEM

One particular institutional type—the Historically Black College and University (HBCU)—has served as a major vehicle in providing access to higher education to African Americans in the nation (Jennings, Bonner, Lewis, Nave, 2007). HBCUs are Black academic institutions established prior to 1964 whose principle mission was and still is the education of Black Americans; this term is often used interchangeably with Black colleges (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). The Department of
Education recognizes 103 HBCUs operating in the 50 states and the District of Columbia, among which 89 are four-year institutions and 14 are two-year institutions (IES, 2007). Of particular significance is the Department Of Education statistics reporting HBCUs to enroll approximately 14% of all African American student in higher education, while constituting a mere 3% of the 4,084 institutions of higher education 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 are noted for providing access and a welcoming environment to populations of students, many who would otherwise not be afforded the opportunity to attend an institution of higher education. Benefits of attending an HBCU are often measured in terms of the individual as well as the collective benefit that these institutions provide. Although more than three decades old, Astin’s (1975) study continues to aptly depict the experiences of African American students in HBCU contexts. When Astin controlled for family social status, academic ability, and educational aspirations, in a national sample of college students, African American students were found to be significantly less likely to drop out of college if they were enrolled in a predominantly Black institution. Some 12 years later Pascarella, Smart, and Stoecker (1987) similarly discovered that African American students performed better academically at predominantly Black institutions even when controlling for institutional selectivity, financial resources, size, and sponsorship.

In the STEM disciplines in particular, HBCUs play a significant role in the production of undergraduate degrees awarded to African Americans. Nationally, 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, p. 4-10). Additionally, African Americans who complete their undergraduate degrees at 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 shortage of a qualified workforce in STEM fields could potentially be addressed by these institutions. HBCUs appear to be ideally situated to offer viable solutions to combat the problem of underrepresentation, especially for African American students, in STEM. Perhaps the data cited in two separate HBCU-UP proposals prepared by both Kentucky State University and Southern University—New Orleans articulates this point best. According to these reports, HBCUs are unique in that they provide the country with some of the best resources to build

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<th>Institution</th>
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<td>Howard University</td>
<td>Washington DC</td>
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<td>North Carolina A&amp;T University</td>
<td>Greensboro, NC</td>
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<td>Alabama A&amp;M University</td>
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<td>Prairie View A&amp;M University</td>
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<td>Southern University-Baton Rouge</td>
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<td>Jackson State University</td>
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a technologically savvy workforce.

METHODOLOGY

The Research Question that guided this funded research project is stated: What are the factors that most significantly impact the success of academically gifted African American students in STEM disciplines that are enrolled in Historically Black Colleges and Universities (HBCUs)? The Study Population for this project included: Academically gifted African American students enrolled in STEM programs at four-year HBCUs. We also sought input from STEM faculty to capture their perspectives on the factors that impact success among academically gifted students in STEM disciplines.

The main construct that frames this study is academic giftedness. Academic giftedness, also defined as schoolhouse, test-taking and lesson-learning giftedness, is most easily measured by IQ or other cognitive ability tests, and for this reason it is also the type most often used for selecting students for entrance into special programs (Renzulli, 1986). Students were selected based on factors including college grade point average and faculty/staff recommendations. Additionally, students were targeted in the 3.00 to 4.00 grade point average range on a 4.0 scale with a particular emphasis on high academic achievement which is recognized as grade point averages in the range of 3.50 to 4.00 (Bonner, 1998).

This article reports on the findings collected from a pilot study conducted at one of the institutions identified for the first phase (Phase 1) of this project. Phase 1 includes a qualitative study (Focus Groups) focusing on factors related to the success of academically gifted African American students enrolled in one of the 12 four-year HBCU engineering programs in the nation that has been accredited by the Accreditation Board for Engineering and Technology (ABET). The list of institutions identified for this part of the grant project is listed in Table 1; Prairie View A&M University in Prairie View, Texas is the HBCU engineering program from which data for this article was extrapolated. Although slated for year three of this study and not included as part of the data reported in this article, Phase 2 of this project will utilize Phase 1 data to develop a quantitative instrument that will be subsequently administered to all academically gifted African American students who are enrolled in the array of STEM disciplines at each of the 89 four-year HBCUs in the nation. In essence, the data taken from Phase 1 which includes students enrolled in engineering disciplines will be used to construct an instrument that will tease out the factors found to contribute to the success of African American students in not only engineering but also the diversity of disciplines represented in the sciences, mathematics, and technology fields. The design for the project is depicted in Figure 1.

This project followed a strengths-based approach, much like Maton and Hrabowski’s (2004) work with the Meyerhoff Scholarship Program at The University of Maryland Baltimore County. According to these researchers, they focus on the “existing strengths of talented Black youth that transform their academic and social environments” (p. 548). Additionally, the researchers found that the HBCU context was critical for this research investigation in that not only are more significant numbers of academically gifted African American students potentially available for participation but also unique environmental factors can be explored to determine their relative impact on student success.
DATA COLLECTION AND PRELIMINARY ANALYSIS AT FIRST RESEARCH SITE

Data collection consisted of face-to-face focus group interviews with seven students who were enrolled in Engineering, Computer Science, and/or Engineering Technology programs at Prairie View A&M University. These students were selected based on faculty recommendations as well as identification as gifted based on the criteria from the definition of academic giftedness described above. We also conducted face-to-face interviews with two faculty members from the College of Engineering. The faculty interviews lasted for approximately 90 minutes and the student focus group interviews lasted for approximately two hours. All interviews were tape recorded and transcribed verbatim. Preliminary analysis focused on participants’ views, experiences, and actions as they related to the factors that contributed to success among high achieving students in engineering. The data were analyzed using the constant comparative method (Strauss & Corbin 1990). We analyzed each data set (students and faculty) and then conducted a cross analysis of the themes to find commonalities between the views and experiences of the faculty and those of the students. Because of the page limitations of this paper, we will only present a brief summary of some of the findings.

FINDINGS

This paper presents the following two findings from faculty: (1) perceptions and definitions of academic giftedness and (2) perception of barriers to successful performance of African American students at that institution. For students, the following two findings are presented: (1) definition and characteristics of an academically gifted student and (2) factors that contribute to the academic success of gifted students in undergraduate engineering programs at an HBCU. Data collection consisted of face-to-face focus group interviews with seven students who were enrolled in Engineering, Computer Science, and/or Engineering Technology programs at Prairie View A&M University. These students were selected based on faculty recommendations as well as identification as gifted based on the criteria from the definition of academic giftedness described above. We also conducted face-to-face interviews with two faculty members from the College of Engineering. The faculty interviews lasted for approximately 90 minutes and the student focus group interviews lasted for approximately two hours. All interviews were tape recorded and transcribed verbatim. Preliminary analysis focused on participants’ views, experiences, and actions as they related to the factors that contributed to success among high achieving students in engineering. The data were analyzed using the constant comparative method (Strauss & Corbin 1990). We analyzed each data set (students and faculty).

DEFINITIONS AND CHARACTERISTICS OF ACADEMIC GIFTEDNESS

Faculty Perceptions

According to the faculty participants, academic giftedness is demonstrated through personal attributes which collectively influences an individual’s grade-point average. They hold the view that that grade-point averages and test scores, taken in isolation, are not predictors of academic success. The following characteristics were identified as predictors of academic giftedness (see Table 2).

As one faculty member noted, the interweaving of those characteristics propels an individual to have an appetite for knowledge. So when you have this appetite for knowledge, you’re going to want to learn and learn for the fun of it. You stop at some point competing with others and it’s about competing with yourself. Grades are still important because society places an impor-
Table 2. List of Predictors of Academic Giftedness Based on Faculty Perceptions

- Aptitude for learning the concepts in math and science and ability to demonstrate knowledge of these concepts
- Being resourceful, adaptive, and self-directed
- An appetite for knowledge
- Passion for what you do
- A vision for career and for living
- Having the persistence and the patience to stay the course
- Leadership potential
- Ability to work collaboratively with others
- A certain level of maturity
- Pride in education

The data suggest that academic giftedness is not defined primarily as a factor of grades, but by the personal characteristics that the individual brings to the educational context. Several faculty participants agreed that a small percentage of students fit the more traditional profile used to identify gifted students—many of these characteristics are cited in the above bulleted list. However, in speaking of the number of gifted students she has encountered, one faculty member noted,

It's few and far; in three and a half years, I have taught and interacted with certainly over 100, out of that, I would say 6 in my three and a half years.

Her comments speak to the small number of African American students who she identified as high achieving. She like many of her post-secondary peers use what could potentially be viewed as a deficit model in profiling the student populations they encounter; namely, the students in their engineering programs are viewed as fitting into the profile listed below. Ostensibly, these characteristics often serve as barriers to the students' academic success.

**Barriers to Academic Performance.**

The faculty participants identified both personal and institutional barriers that impacted students' academic performance. Personal barriers noted by participants are listed below in Table 3. One participant in discussing the under preparedness of African American secondary school

Table 3. Faculty Perception of Personal Barriers to Academic Success

- Under prepared academically upon admissions
- More focused on the money that results from an engineering degree and less prepared to commit to the academic work
- Preoccupied with materialism and activities to support a materialistic lifestyle
- Limited knowledge of the engineering professions
- Engagement with activities outside of school to include work and family
- Places little importance on the value of a good education
- Lack of time to take advantage of academic support programs and activities
graduates, attributed these observed deficiencies to the limited interactions these students had secondary institutions, our data also revealed evidence of these limited engagements occurring between faculty and students at the HBCUs included in this study. These limited engagements were attributed to the small number of African American professors at the institution. In speaking to the important role that African American faculty play in the lives of students, one participant stated,

> You are going to find, and even right here at our HBCU campus, less faculty of color educating our students of color. So then, you’ve got culture issues, you’ve got speaking barriers. We [African American faculty] are not gonna stop at five; we’re gonna be in your business til eight, nine at night or even on the weekend.” What we attributed this espoused value of going beyond the call of duty to educate African American students to was the period of segregation in which “Black teachers of Black children” saw as one of their primary roles the uplift of the race.

Among the institutional barriers that were noted included faculty who were not dedicated to the profession and to student success as well as ineffective leadership throughout the organizational hierarchy. Speaking of the lack of effective leadership and its influence on academic success, one participant noted,

> Leadership, lack of leadership throughout the entire chain of command; that’s the biggest one. Too often we have, and this is across the board, leaders of HBCUs who have lost sight of the importance of educating people of color.

Another faculty member interviewed agreed that leadership plays a significant role in student success, but he also argued that it is the classroom faculty member who plays a more significant role in creating a learning culture where
students are engaged with the learning environment. As he noted,

No matter what the administration does, it's still going to come down to that teacher teaching that student, and if they are good, bad, indifferent or what have you, that's what makes the difference.

The data seem to suggest that creating learning environments in which students are motivated to learn and are engaged in critical discourse with faculty members who are passionate about teaching are the elements necessary to promote academic excellence—particularly among those students and faculty influence on their academic success. For the purpose of this report, we will focus on two primary themes from the data set: Students’ perspectives of giftedness and factors that promote high performance in engineering disciplines.

Definitions and characteristics of academic giftedness.

Similar to the faculty participants, the students had difficulty defining the term “academic giftedness.” Some of their comments are summa-

Table 5: Student Perception of Factors That Contribute to Academic Success

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<td>Motivation to go beyond academic accomplishments of the family, especially where the family members had not graduated college</td>
<td>Commitment to follow the paths of college-educated parents and other family members</td>
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<td>Strong history and legacy of African Americans as teachers</td>
<td>Participating in communities of support—communities of fellow students in engineering, initiated and maintained by students for the purpose of academic and psychosocial support</td>
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<td>Encouragement from family and desire to keep the family pride as education is viewed as a source of pride in the African American family</td>
<td>STEM programs at the collegiate level and the supports activities that are built into the programs</td>
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<td>Encouragement from teachers</td>
<td>Vision of an engineering career beyond the collegiate experience</td>
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<tr>
<td>Participation in extra curricula activities to include athletics</td>
<td>Professional organizations on campus, for example, NSBE</td>
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<tr>
<td>An innate attraction to certain activities and disciplines at an early, for example model building and mathematics</td>
<td>Religion and spirituality</td>
</tr>
<tr>
<td>Challenging classes in high school and in college</td>
<td>Fear of failure</td>
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who were identified as academically gifted.

Students’ Perspectives on Academic Giftedness

We sought student perspectives regarding a definition of academic giftedness, factors that contributed to their success, personal and institutional challenges encountered, the role that race and gender plays in their academic experience, summarized here in Table 4.

In defining academic giftedness, Student F eloquently explained,

The more standard answer would be good grades, good GPA, high test scores, and standardized tests and what not, but I think it goes a little bit beyond that in the sense that an academically gifted student, if that's what we're defining, is someone who can pick up concepts and topics
quickly, somebody who doesn’t need the teacher to explain to them twenty times before they get it; or they might understand the concept a little sooner than the rest of their peers in that class; so I think this kind of adds to the definition of academically gifted.

Student E defines an academically-gifted student as one who is well rounded and participates in both academic and other extra curricular activities. Student A disagrees, noting that:

If we’re going off on academically gifted, we are talking about academics, not your outside life.

On the other hand, Student C sees academic giftedness as going beyond grades and test scores. The student noted,

I don’t think academically gifted means you make good grades. I just think that . . . everybody has to make an “A” to be gifted in something, but it’s . . . how to go and get what you need to solve whatever problems that there is.

These findings suggest that there is not an agreed-upon definition of the term or its conceptualization. Overall, faculty and students view the academically gifted individual as one who demonstrates high cognitive abilities as well as particular desirable personal characteristics.

Contributors to Academic Success

While faculty focused on barriers to academic success, the students discussed the factors that have contributed to their high academic performance and, hence, their success in their engineering program. Table 5 lists some of their assertions:

One of the major findings is the role of peer collaboration and participation in study groups which serve as sources of support for students in engineering programs. One creative approach these students used was to build communities of support in the form of study groups. In so doing, they learned to rely primarily on each other for academic support rather than rely on the teacher. All of the participants in the preliminary study reported on the value of study groups and the role they play in their academic performance. For some, engagement in extracurricular activities prepared them to function effectively as team members of collaborative groups. As Student B articulated,

I have been playing sports all my life . . . so I’m used to working in a lot of team environments and dealing with a lot of different personalities. So I think that helps me a lot cause like most people, I study in small study groups; and so sports helped me out with that I think.

As a result of the challenges of the engineering program, students developed a sense of self-directedness and found ways to manage the rigors of the program.

Speaking of the value of community to survival, Student C noted,

That’s the only way to survive in engineering; there’s never an ‘I’; there’s never an ‘I’ in anything we do once we form [the study group]. It means that if somebody else captured something in class, and since that person has captured another concept, maybe that person can teach it better than the teacher cause all professors can’t teach in a way that they can relate to the student.

The students, overall, found much more value in the self-initiated team approach to learning rather than the teacher-initiated classroom instructions.

The student participants overwhelmingly spoke of family as a major contributor to their academic accomplishments. Historically, education has been viewed as a pathway for upward mobility for African Americans. Therefore, family members passed on the legacy of education and the pride associated with being an educated African American citizen. Student F articulated the family history and tradition that motivated her to strive for high academic success. As the student shared,

I grew up and both my parents went to college; they were teachers. So they instilled in me at an early age that I have to go to be educated; so I had to go to college. I had to go to high school and make good grades and things of that nature.

Similarly, Student D agreed,

I would like to say ‘family.’ Just the motivation
that you get and just people constantly telling you ... you have to go on; it's gonna be hard, but you can get through it, and just knowing and just knowing that ... you kind of want to do better than your parents.

It was clear that the legacy of obtaining a good education as a demonstration of ethnic pride and career success propel many of these students to persevere.

For some students, there was an expressed need to go beyond what other family members had accomplished, particularly those family members who had obtained some measure of academic success. This phenomenon was particularly significant for those students who were identified as first generation college graduates or who had not experienced many college graduates in their family networks. Although only one of the seven students fell into that category, her story is worth noting. According to this student, Student C,

I wanted to do something that my family did not do; a lot of people in my family did not go to college or a lot of people when I say the word ‘engineering,’ they could not give me an answer what engineering was. ... So that was one of my main motives on going to do something to make me ... somebody, that somebody my family has not been.

Going beyond the academic accomplishments of the family was articulated as one of her primary motivating factors to achieve. At the time of the interview, she was scheduled to graduate in a few months and had multiple lucrative job offers from large well-known corporations. As she had set out to do, she had achieved academic success beyond that of her immediate family members.

Another factor that students identified as contributors to their success was the deep sense of spirituality and belief in a supreme being that influenced their educational sojourn. As Student C shared,

I just think like all of my success ties back into what I get down on my knees and pray for, the person who, I believe, gives me strength to go on day to day. It wasn't because of him I don't know where I would be.

African Americans have maintained a rich history of religious traditions that have guided them from slavery to contemporary society. The value of religion and spirituality that Student C evokes to help manage the challenges of the academic rigor represents a rich legacy passed on by generations of Black families.

Having a vision of a better life beyond what is observed among low-income African American families is another motivating factor among those students who have been identified as being academically gifted. Again Student C was very eloquent in her articulation of how the visions of present and future propels her to shape her life’s destiny. She shared,

I kind of look at the long picture. ... I know at the end when I graduate, there's a lot of money, and I can be successful. ... I don't want to live paycheck to paycheck cause I saw people do it, and so I look at it and say, hey, you can do this if you stay in school with the end picture in mind. Yes, school might be really, really hard, the teachers might get on your nerves, you might not have any friends, but at the end of the day when you go to sleep, in four years where you going to be?

The vision of successful career in engineering as a symbol of economic mobility motivates students to persist in their academic endeavors.

In summary, there is a general agreement among both the faculty and students who participated in the study that academic giftedness is characterized not only by good grades and high test scores but by other personal requisites to include resourcefulness, self-directedness, leadership potential, aptitude and passion for learning, a certain degree of maturity, and pride in education. Faculty had difficulty identifying academically-gifted students they had encountered. Instead of focusing on attributes that were positively associated with giftedness, many chose to instead highlight the barriers that impeded the successful performance of African American students enrolled in engineering disciplines. In essence, it was as if these faculty
members chose to define giftedness by revealing the negative attributes that it did not embody—
attributes that they often associated with the
students they encountered. Perhaps the most
pervasive negative attribute identified by fac-
ulty, which we coded as a barrier, was a lack of
motivation to learn that faculty perceived stu-
dents held. The students, on the other hand,
provided data to suggest that they embodied a
high level of motivation and that they were re-
sourceful in implementing strategies to manage
the academic expectations placed on them by
the academy. In essence, the portrait that fac-
ulty painted of the students was quite in con-
trast to the portrait the students painted of
themselves.

CONCLUSION

So, what can be made of the findings of this
study? First, faculty interviewed noted that the
definitions and characteristics of academically
gifted students were as follows: (a) an aptitude
for learning the concepts in math and science
and ability to demonstrate knowledge of these
concepts; (b) being resourceful, adaptive and
self-motivated; (c) an appetite for knowledge;
(d) passion for what you do; (e) a vision for ca-
reer and for living; (f) having the persistence
and the patience to stay the course; (g) leader-
ship potential; (h) ability to work collaboratively
with others; (i) a certain level of maturity and (j)
p pride in education. When reflecting on the skill
sets of their African American students in engi-
neering, faculty participants agreed that a small
percentage of their students fit the aforemen-
tioned characteristics.

More importantly, the faculty in this study,
noted that their students faced a plethora of bar-
riers to academic success such as: (a) being un-
der prepared academically upon admissions; (b)
preoccupation with materialism and activities to
support a materialistic lifestyle; (c) engagement
with activities outside of school to include work
and family; (d) lack of time to take advantage of
academic support programs and activities; (e)
more focused on the money that results from an
engineering degree and less prepared to commit
to the academic work; (f) limited knowledge of
the engineering professions; and (g) little impor-
tance placed on the value of a good education.
As a result, faculty noted that many African
American students are under prepared for the
rigors of this academic major.

Second, when examining the student percep-
tions of how they defined the concept of ‘aca-
demic giftedness’ they differed from the faculty.
These students noted ‘academic giftedness’ as:
(a) good grades, good GPA, high scores on stan-
dardized tests...; (b) someone who can pick up
concepts and topics quickly; (c) being well bal-
anced in a multitude of other things you do; (d)
one who is resourceful and has the ability to tap
into different resources to get the job done; and
(e) being self-directed. Given these definitions,
there is a slightly different view of the concept
of ‘academic giftedness’ between faculty and
students. As an example, faculty perception fo-
cused on a broader definition of academic gift-
edness that placed a greater emphasis on the
internal drive and zeal for learning whereas
students tended to offer a more classic definition
which relies on traditional measures such as
grade point averages and cognitive ability tests.

Third, since the notion of faculty/student in-
teraction became an issue, students discussed the
importance of study groups in facilitating their
success in the field of engineering. This is an
important finding given that the common per-
ception of American-born students, particularly
African American students, is that they study in
isolation with minimal interaction with their
peers (Bonner & Evans, 2004). As previously
noted, one student documented the importance
of study groups, “That’s the only way to survive
in engineering; there’s never an ‘I’; there’s never
a ‘I’ in anything we do we do for the [study
group].

Finally, the African American students in this
study discussed the importance of family as a key characteristic of survival in the field of engineering. While many of their family members have never had the experience of venturing into a high-demanding academic field like engineering, they planted a love for learning and a motivation to beat the odds to matriculate through their academic programs. Also, many of the students used their family backgrounds as a motivation to take their lives to the next level via their educational pursuits. Given the examples presented in this study, African American students in engineering must overcome a plethora of variables; however, they still have the academic ability to be successful.

RECOMMENDATIONS

As a result of this pilot study, several recommendations are warranted for both internal and external stakeholders. Internal Stakeholders (HBCU Faculty, Staff and Administrators)

- The HBCU must understand that the millennial African American student that currently matriculates in engineering programs do not have the same definition of what a student should be as the faculty who participated in this study. More specifically, many of the students feel they are in situations where they have to work to be able to survive financially while they are in school. As a result, to fit the clientele of the students in the academic program, a different approach should be considered to facilitate the success of this population.

- African American students in this study indicated that they have minimal interaction with their faculty instructors and more interaction with their peers in study groups. As a result, professional development should be provided to HBCU faculty to promote greater interaction between the students and faculty.

- The HBCU should take the necessary steps to ensure they continue to promote the use of study groups for African American students in engineering. African American students in this study noted that this was critically important for their academic success.

EXTERNAL STAKEHOLDERS (ENGINEERING COMPANIES, HR OFFICIALS, ETC)

Engineering employers who seek to employ and retain African American students must recognize and understand their need for strong peer interactions as identified by the study. Companies should integrate within their organizational structural programs that promote socialization and networking among their African American employees in order to avoid feelings of isolation and “not belonging.” This is particularly important when:

African American students participate in internship and co-op programs, where the students’ perceptions of engineering careers are first formed.

Students identified having a successful career in engineering and economic mobility as a motivator. Companies should work to more clearly outline paths to upward mobility within their organization. They should empower their human resource department to develop mentoring programs to cultivate African American students for management positions and thus further increase the financial stability, professional growth and longevity in the engineering profession.

Engineering Companies should invest more resources (financial and human resources) and partner with engineering programs at HBCUs to identify avenues to present a portrait of the environment they are expected to perform and excel. These programs should be initiated as early as the freshman year.

REFERENCES


