AC 2011-2285: THE ROLE OF FACULTY IN THE RETENTION OF AFRICAN AMERICAN GIFTED STUDENTS IN STEM PROGRAMS IN HBCUS

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Dr. Bonner has been the recipient of the American Association for Higher Education Black Caucus Dissertation Award and the Educational Leadership, Counseling, and Foundation's Dissertation of the Year Award from the University of Arkansas College of Education. Dr. Bonner spent the 2005-2006 year as an American Council on Education (ACE) Fellow in the Office of the President at Old Dominion University in Norfolk, Virginia. Additionally, he has recently been awarded a $1 million National Science Foundation (NSF) grant that focuses on factors influencing the success of high achieving African American students in science, technology, engineering, and mathematics (STEM) disciplines in Historically Black Colleges and Universities (HBCUs).

This presentation highlights findings from a currently funded three-year research project with the National Science Foundation (NSF). Research for this investigation attempts to underscore the critical factors found to contribute to the success of gifted African American students enrolled in Historically Black College and Universities (HBCUs). The research for this project is contextualized within the broader spectrum of US higher education, in which reports of exponential student enrollment among majority (i.e. White) student populations has been documented while enrollment trends among populations of color—particularly African American college-age students remains relatively low. These enrollment disparities are especially apparent in specialized areas of study such as science and engineering; thus, it is important to identify key factors and strategies that can counter these apparent deficits. One such area of focus that has shown promise in this area is the role of faculty in the retention of students. This presentation will explicate the data and attempt to untangle some of the critical aspects regarding how faculty can help or restrain the academic success of African American students in science and engineering programs in the particular context of HBCUs.

Literature Review

Literature underscoring the experiences of populations of color in the science, technology, engineering, and mathematics (STEM) disciplines has been at best scant and at worst non-existent. Much of the emphasis on studying these populations, particularly African American cohorts, has tended to focus on the abysmally low numbers of those who select STEM-related fields[1,2,3,4,5].

Although African American populations have made some monumental strides in educational attainment in recent years, a severe lack of representation in a number of key areas continues to be experienced. Chubin and Babco[2] (2003) assert that, "Despite this overall progress in baccalaureate degree production, the proportion of women and minority freshmen in engineering has been declining since 1995 (p. 1). Further statistics indicate that by 1999 African Americans constituted a mere 8.5% of freshman engineering students in the United States, this a meager 13.2% increase since 1981. In speaking to the number of minority degree recipients in STEM fields, Chubin[2] (2002) adds that in 2001 minorities represented only 12% of the degree recipients in engineering and in absolute numbers only 200 of the Ph.D. recipients in engineering that same year. If African Americans are disaggregated from these numbers, the abysmal state of affairs that the country is in by way of education this population for careers in STEM become readily apparent.

Historically Black Colleges and Universities (HBCUs) continue to play a significant role in the education of African Americans across the postsecondary landscape. From the reports chronicling the numbers of African American graduates at the baccalaureate level to the graduation rates of those who obtain doctoral degrees in STEM, these institutions continue to produce the most significant numbers of African American STEM graduates in the nation[1,6,7].

According to the current Secretary of Education, Ernie Duncan, "Forty percent or more of all African Americans who receive degrees today in physics, chemistry, mathematics, biology, and environmental sciences graduate from HBCUs…HBCUs cannot simply survive. They have to thrive…" (pp. 1-2). On a national level, 30% of the undergraduate engineering degrees and 44%

of the natural science baccalaureate degrees were awarded to African American students who attended HBCUs[8]. Data also reveals that HBCUs produced approximately one-third of the Black graduates who went on to earn doctorates in agricultural sciences, biological sciences, engineering, mathematics, and physical sciences[9]. Thus, it is imperative that HBCUs given their positioning in contributing to the numbers of African American STEM professionals in the country are allowed to "sit at the table" when critical decisions are being made about the country's scientific and technological development[10].

Methodology

This project was divided into two phases regarding data collection and analysis. The first phase of the project was completed during the first two years of the grant funding. The second phase of the program will be completed during the final year of the project. Phase 1 of the study utilized qualitative methods to gather data from nine engineering programs at Historically Black Colleges and Universities (HBCU) that have been accredited by the Accreditation Board for Engineering and Technology (ABET). The data obtained from phase 1 of the project will subsequently be used for the development of a quantitative instrument targeted for all of the Department of Education registered HBCUs in the nation with Science, Technology, Engineering, and Math (STEM) programs. The guiding research question for the study was: *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)?* This section describes the methodology used for Phase 1 of the research study.

Participants

In Phase 1 of the research study, 12 HBCUs were identified for participation in the study and 9 HBCUs agreed to participate. The engineering department, beginning with the Dean, was contacted to negotiate entry into the schools. Faculty members and academically gifted African American students were identified and interviewed at each of the institutions. Faculty interviews occurred individually and students were interviewed in focus groups ranging from 2--12 participants per group. The research team used a semi-structured interview protocol to ensure equivalent data were captured in each session. The faculty interviews ranged from 60 to 90 minutes and the student focus group interviews ranged from 60 to 120 minutes.

Data Analysis

Data were analyzed using content analysis[11] and the constant comparative method[12].The data obtained from faculty interviews and student focus groups were treated as independent groups. Therefore, for each institution, the faculty interviews were analyzed as one unit and the student focus groups were analyzed as a separate unit of data.

The research team met as a group to analyze the data from the first two institutions. The team followed this procedure to identify strong categories for the initial themes and to utilize peer debriefing concurrently. The interviews for these particular institutions were transcribed and individual units of data were placed on note cards. The note cards, particularly for the small

group analysis, provided visual manageability for the emergent categories and promoted group participation for each unit of data. After the initial categories were established, the research team utilized Atlas.ti software (version 5.0) for subsequent data analysis.

Data analysis for subsequent sites included the same process of transcribing data however the transcriptions were unitized in Microsoft Word. The unitized documents were then uploaded and analyzed in Atlas.ti. There were at least two members of the research team engaged in the data analysis at all times. In Atlas.ti, units of data were coded using the initial categories created by the research team. In cases where an initial category was not applicable, then a new category was created within the software program. After all data were analyzed in Atlas.ti (the first two institutions were uploaded into the software system) the team reviewed each category to ensure the accuracy and appropriateness of each assignment. Categories were merged and renamed to ensure the final grouping of sound and cohesive units.

At the end of the grouping, the categories for the faculty and student data were thoroughly reviewed to determine commonality. The overlapping categories were selected as key findings which will be presented in the next section. In addition to shared categories, each group's data (faculty and student) was reviewed to identify the categories which included a substantial number of data. These categories were considered to be strong themes and are also included in the key findings.

Findings

From the data analysis of this study emerged findings related to the role faculty plays in the retention of STEM students at HBCUs. The first finding pertains to the relationships that students develop with faculty and the support students perceive from their professors; the second finding conveys to the impact of teaching in the student experiences.

Faculty Support and Faculty-Student Relationships

The first finding is congruent with literature that states that one characteristic that has remained constant through the institutions' history is the personal academic relationships that faculty at HBCUs establish with their students and the role these relationships play in the retention of African American students at HBCUs[13]. Participants in this study recognize the value of the relationships they have established with their professors and stated for instance,

> Student E-1 [**as a strategy that you use for your success?**] Student E: Well just like student F was saying before being able to talk to my teachers; the communication with my teachers and also my teachers push me because I have such a close relationship with them, I don't like to let them down. I mean I don't really like to let my mother down but really my teachers are people I see on a regular basis so if I do bad they looking at me like, "what are you doing?" You know they're really disappointed in me and I don't like to disappoint my teachers. So at least I just make sure that they know that I'm trying and so I guess…it's my teachers pushing me.

Similarly, students recognize the role HBCU characteristics, such as class size, play in fostering

faculty-student personal relationships. Participants share,

> Student A-2 : The faculty; here at HBCU campuses you have the opportunity to work one-on-one with the faculty, talk one-on-one with the faculty and share information one-on-one.
>
> Student B-2: Along with what participant number 1 said, the class size not being as large we have close contact with our professors

Furthermore, when participants talk about their relationships with professors in their majors, the results present two dimensions. On the one hand, and congruent with the previous findings, participants in this study stress the importance of establishing relationships with professors in their STEM major, as student A portrayed

> Student A-1: I think an important factor would be networking, getting to know different people and the most important thing is I would say your teachers, getting to know your teachers. Establishing a relationship with them is very important, especially in the engineering building establishing a relationship with your advisor and just getting to know all your teachers so they know you on a first-name basis and not just as another student in the class, so I think that's very important in high-achieving students.

On the other hand, students also described the lack of black faculty among the STEM disciplines, and the cultural barriers they found when trying to relate to professors. Student C illustrates this situation,

> Student C-1: One of the challenges is and it kind of alludes to the fact that there aren't a lot of black engineers and we're trying to increase that number, but our teachers more than likely aren't African American or black. So that barrier of culture to relate to our teachers better is not there. Even when we have a white teacher them being American kind of helps a little bit, but we're talking about a different culture; a different way of thinking, that barrier there sometimes can be a factor.

Moreover, the faculty in STEM programs at HBCUs includes many international professors. Students describe their struggle to establish personal relationships with international professors, as participants describe,

> **[about international professors** Student E-1: …] But sometimes it creates a very difficult barrier; a communication barrier. I know in one of my classes that I have right now it's very difficult to understand not just what he's saying, not just how he speaks but, him trying to communicate with us on a level we can understand. So I don't think its all foreign professors but in some cases it makes it a lot more difficult. And like I said not just the way they talk or how they speak but how they relate to us.
>
> Student A-2: With other students I can kind of agree with what they're saying but you really have to listen. Cause some students be talking in class or doing this or doing that and if you have a class where the professor is foreign or their English isn't that great;

zone in on him or her. It's usually him, but there's some things you actually need to do and it might be a little harder in class. I think one-on-one time is time to understand.

In these quotes, the students describe the difficulties they have to establish relationships with foreign professors, not only because of the language barrier, but also because of cultural differences perceived in the way foreign professors relate to students. Contrastingly, some participants are able to establish good relationships with foreign faculty, as exemplified in the following conversation,

> Student H-2: On the other end in regards to the internationals if they've been here for a while the interaction is great. In that case they tend to care for your development more than the ones that are here. Like I know in aerospace most of ours are international and have been here for like 15 years something like that so it's like from your freshmen year to when you graduate they really are passionate about getting to know you and understanding your strengths. They pick up on it quicker than most of the other ones. The only problem is some of the same ones who are domestic or have been here for a while seem like they could care less.
> **Interviewer: Really? So there's a period of acculturation that has to go on for one to be comfortable in the space?**
> Student H: When they do become comfortable they become very great at it.

In addition to faculty support through good relationships and some of the barriers that students find in establishing these relationships, in the following paragraphs the students describe the impact that teaching has in their academic success.

Teaching

The second finding that emerged from this study relates to instruction. Teaching was the most frequently cited skill mentioned throughout the students' interviews. Good experiences with teaching involve hands-on and good examples that relate to "real practice" in industry. Some students describe how professors' teaching has helped them succeed in their programs. The following statements illustrate these experiences,

> Student B-1: Yeah you gotta pretty much create it for yourself, cause some of the professors are purely academia. You probably have one professor who actually worked in an industry. So I would say I learn the most from him and it's probably because he actually had experience in the industry and it wasn't just he went to school his life and just starting teaching. So he would pretty much give us examples of how it actually works in the aerospace industry, you know how what we are learning is applied to what actually goes on in real life.

> Student B-3: The faculty and professors play the role of providing you with the materials, the examples, different and various types of ways to solve the problem. They don't give you just one method, they give you about three different methods and they give you examples and explain it to you the best way they can and they're there in their office hours for more understanding.

However, congruent with the literature, most of the students clearly identify teaching as an important barrier for their academic success. Among the challenges the students face are the lack of teaching ability and the disconnect between theory and practice. Students illustrate these challenges, for instance,

> Student B-3: I think one of the issues that we have a lot of times here would be, one teacher will teach the lecture class and another teacher teaches the lab. And it's kind of difficult because they don't move at the same pace or someone might focus more on one thing and not the other and we get in the lab and we're expected to know something, but we don't. And so…or some labs are just…follow along with the teacher and you're not really doing it yourself and learning or making those things.

> Student D-3: And then I also notice that…I don't know if this is just nationwide…but there is such a disconnect with people with Ph.D.s and the rest of the world. So when they try to transfer the information it's on another level. Not saying that it's just saying that I could read this out the text book.

Finally, the students perceive a barrier in the teaching methods taken by some international professors. Students describe a number of areas they believed faculty needed to improve upon such as the modality in which teaching occurs as well as properly conveying information to students such that they are able to comprehend the material. Students discuss these challenges below,

> Student A-4: I know most times if I'm just in class and the teacher is just up there writing up on the board sometimes our teachers don't even talk.
> Dr. Alfred: Talk to us about that…
> Student A: Okay they would just go to the board and just write notes on the board without even talking to us or….
> Interviewer 1: So no real interaction?
> Student A-4: Right, it's like no interaction and I find myself being quite bored with that. I still learn from it, like I try to teach myself but that's one difficulty that I find. But if I'm often involved with something that I'm learning then I can apply it and use it a lot better.

> Student C-4: As for the professors I think they're so focused and concentrated. You know when you go to grad school you're going to specialize in one thing. Just doing that it gets so complicated that they forget how to relate it in simple terms.
> Interviewer 2: I see, I see. They know the content but being able to teach it so that you grasp it is sometimes a challenge.
> Student C-4: Right. So like they teaching us like they teaching other professors.
> Student D-5 : I would say teachers…teachers could make the most interesting class in the world be the most boring class. The most not interesting, make you not want to take it up anymore, make you change your major; and you can try to tell them change up your…not change up your style but you know I don't understand can you help me?

How can I find out more about this subject and some don't listen. Some think you're stupid because you don't understand and then they're just really not personable, it just makes it really hard I would say for me to stay interested in the class and get through it.

Student B-6: It's almost like …sometimes when you ask questions, like I've noticed lately we'll ask questions in class and they'll kind of put it off on another professor. So they'll be like "oh you didn't learn this in such and such class?" And we'll just

Conclusions

Faculty, congruent to the literature, can help or restrain the academic success of higher education students in STEM disciplines. However, HBCUs are able to foster an environment where students can establish good relationships with faculty and overcome the barriers that teaching posed to the students participating in this study. The results of this study highlight the importance of faculty/student relationships as a key factor that contributes to the success of gifted students enrolled in STEM programs. Even when faced with difficult challenges such as teaching methods and cultural differences, having a relationship with faculty provides an arena to receive guidance, encouragement, support, and open communication such that the relationships are able to combat to some degree the challenges that students likely face. Much can be learned from the experiences of the students within this study. From this data we can see what works for promoting success and what areas need to be the focus of improvement.

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