

In Their Own Voices: Factors That Influence African American Males' Decision to Major in STEM

Quality Education for Minorities Network
Workshop on the Recruitment and Retention of African American Male Students in STEM
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James L. Moore III, Ph.D.
Associate Professor, Counselor Education
Coordinator, School Counseling Program
Director, Todd Anthony Bell National Resource Center on the African American Male
The Ohio State University

My Research Agenda Four Distinct, Interrelated Strands

- Studying how educational professionals, such as school counselors, influence the educational/career aspirations and school experiences of students of color (particularly Black American males).
- Exploring socio-cultural, familial, school, and community factors that support, enhance, and impede academic outcomes for K-16 Black American students.
- Examining recruitment and retention issues of students of color in gifted education and college students in science, technology, engineering, and mathematics (STEM) majors.
- Exploring social, emotional, and psychological consequences of racial oppression for Black American males and other people of color in various social domains.

Education of African Americans Persistent Trends

- African American students:
 - In 1982, completed more academic courses than in 1998. In 1998, their academic credit totals remained lower than their White counterparts, but their vocational credit totals were higher.
 - In 1998, were less likely than their White counterparts to take advanced mathematics courses and some advanced science courses.
 - In 2000, took fewer Advanced Placement (AP) examinations in the 12th grade than both their White and Hispanic counterparts.

(NCES Status and trends in education of Blacks, 2003)

Education of African Americans Persistent Trends

- African American students:
 - are more likely than their White, Hispanic, and Asian/Pacific Islander students to receive special education services.
 - have higher retention and suspension/expulsion rates than do White and Hispanic students.
 - scored lower than all other racial groups and Hispanic subgroups on both the verbal and math sections of the Scholastic Assessment Test (SAT).

(NCES Status and trends in education of Blacks, 2003)

Education of African Americans: Persistent Trends

- African American students often underachieve or achieve at low levels in science and mathematics, and they are significantly underrepresented in STEM majors and careers (AAAS, 1998; Moore, 2000; Moore et al. 2004; Russell & Atwater, 2005).
- In 1998, African American females accounted for **9.7%** of the bachelor's degrees awarded to females in science and engineering.
- African American males earned **5.7%** of the bachelor's degrees in science and engineering awarded to males (Hill, 2001).

Education of African Americans Persistent Trends

- Studies examining differences in females' and males' academic achievement have proliferated in recent years. Taken as a whole, this literature has shown that gender influences educational outcomes (Flowers, Osterlind, Pascarella, & Pierson, 2001).
- National data show that there are differences between females and males in the number of students enrolled in STEM majors (National Science Foundation, 2008).
- At HBCUs, males constitute nearly 60% of all STEM majors, and females comprise 40% of all STEM majors. Interestingly, however, females earn larger numbers of degrees in STEM (National Science Foundation, 2008).
- African American males' perceptions of how educators' perceive them tend to have profound effects on their educational aspirations (Flowers, Milner, & Moore, 2002; Henfield, Moore, & Wood, 2008; Moore, 2006; Moore, Madison-Colmore, & Smith, 2003).

Context of the Problem

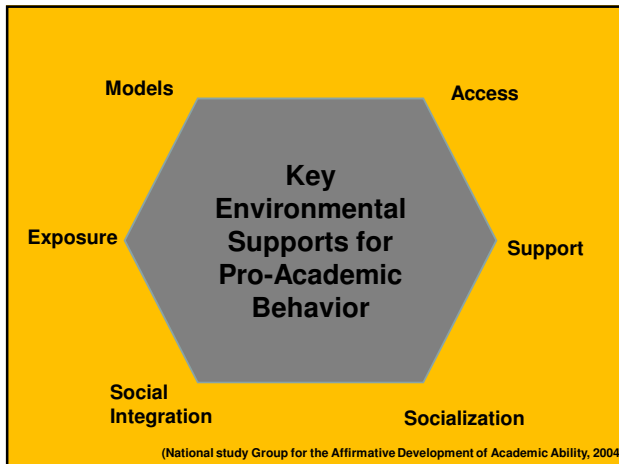
- Technological advancements, increasing globalization, and rapidly changing demographics are powerful forces that have spurred the need for more qualified students, ready to join a new-age workforce in need of talented employees (Achieve, 2005).
- To successfully transition from school to a more technologically advanced world of work, students need to be adequately prepared academically, particularly in math and science (Bush, 2006; Flowers & Moore, 2003; Maton, Hrabowski, & Schmitt, 2000).
- Many social scientists and economists have maintained that the U.S. desperately needs to attract nontraditional students, such as Black American males, into technical and advanced coursework (i.e., science, technology, engineering, and math) at all phases of their education in order to meet the need for a highly skilled workforce (Moore et al., 2004).

Context of the Problem

President George Bush (2006), in his State of the Union Address, stated:

...we need to encourage children to take more math and science, and to make sure those courses are rigorous enough to compete with other nations. I propose to train 70,000 high school teachers to lead advanced placement courses in math and science, bring 30,000 math and science professionals to teach in classrooms, and give early help to students who struggle with math so they have a better chance at good, high-wage jobs.

If we ensure that America's children succeed in life, they will ensure that America succeeds in the world. Preparing our nation to compete in the world is a goal that all of us can share.



Key Environmental Supports for Pro-Academic Behavior

- ACCESS -- Access to education-relevant capital
- SUPPORT -- Supportive family, community, and academic environments
- SOCIALIZATION -- Socialization to the attitudinal and behavioral demands of high academic achievement
- SOCIAL INTEGRATION -- Academic and social integration
- EXPOSURE -- Exposure to various forms of supplementary education
- MODELS -- Exposure to models of academic excellence and exemplars of scholarly practice

(National Study Group for the Affirmative Development of Academic Ability, 2004)

Individuals Indicated by Ohio 12th Grade Students as Most Influencing Their Career Choices

Trend Data for 2004

Ranking Order

- Parent
- Teacher
- Relative
- Friend
- Counselor
- Employer
- Business Person

Purpose of the Study

- To identify the factors that had the most influence on African American male students' decision to pursue a STEM field as an academic major and career choice.
- To provide individuals (e.g., teachers, school counselors, and parents) who interact with K-12 African American male students on an ongoing basis with valuable information to increase these students' interests in STEM fields.

Conceptual Framework

Social Capital Theory

- Social capital theory has been utilized as the conceptual framework for the current study.
- The accessibility of postsecondary education to Black American male participants is dependent on a number of factors, but a consistent theme throughout the research literature is the **necessity of strong social and academic support networks** for successful transition from high school to college (Adelman, 2006; Herndon, 2003; Martinez & Klopnett, 2005).

Conceptual Framework

Social Capital Theory

- Research has demonstrated that the social capital students receive from school programs, such as honor classes, gifted and talented programs, and AP coursework, has a great impact in moving students toward highly selective majors and universities (Gonzales, Stoner, & Jovel, 2003; Moore, 2000).
- Increased social capital gained from the school programs and personnel enhances the opportunities for students of color who participated in the aforementioned programs.

Methodological Approach

- Drawing on a larger study, this research investigation utilized the grounded theory approach (Glaser & Strauss, 1967; Strauss & Corbin, 1998).
- Social scientists refer to this qualitative procedure as the process of collecting and analyzing data simultaneously.
- The underlying premise of the grounded theory approach is to develop theoretical constructs that explain the researched phenomenon.

Participants

- Drawing on a larger study, a purposeful cross-selection of 42 Black American male engineering students was included in this investigation.
- The study was conducted at a large predominately White university, located in the southeastern part of the United States.
- Most of the Black American male participants were classified as juniors and seniors.

Participants

- The African American male participants ranged from 20 to 29 years of age, with a mean age of 23 years.
- The mean college grade point average (GPA) was 2.54, and the mean high school GPA was 3.54.
- Scholastic Aptitude Test (SAT) composite scores ranged from 900 to 1450, with a mean of 1082.

Data Collecting Protocols

Biographical Questionnaires

- The researcher administered these questionnaires to gather data on a range of relevant topics (e.g., academic interests and backgrounds, family socioeconomic situation and support, career aspirations, and childhood experiences).
- The questionnaires rendered descriptive data that complemented the overall intent of the study.

Individual and Focus Groups Interviews

- The two interview methods were the primary sources of inquiry. Both interview procedures comprised standardized, open-ended questions.

Data Collecting Protocols

Continued

Individual and Focus Groups Interviews

- The two interview methods allowed the researcher to examine the African American male participants' perceptions and experiences in their entirety to develop a complete perspective of these males.
- The two open-ended, interview protocols focused on topics similar to the questionnaires; however, for this study, emphasis was placed on the interview questions that examined participants' decisions to pursue a STEM field, as an academic major and career choice.

Data Collection Procedures

- The university's Office of Minority Affairs (OMA) was contacted for assistance in identifying and locating prospective African American male participants.
- The researcher initiated contact with prospective participants through synchronous and asynchronous communications (e.g., e-mails) and followed up with telephone calls and e-mails to arrange data collection.

Data Collection Procedures

Continued

- Individual interviews ranged from 30 to 60 minutes, and focus group interviews ranged from 2.5 to 3.5 hours.
- Both the individual and focus groups interviews were audio taped and transcribed.

Research Team

- After collecting the data (i.e., biographical questionnaires, individual interviews, and focus group interviews), the researcher assembled a research team to assist with data analysis.
- The team comprised the researcher, two advanced doctoral students, and one assistant professor in counselor education.
- All members of the research team (e.g., three males and one female) were African American, and all were experienced in conceptualizing, collecting, analyzing, and writing up qualitative research.

Data Analysis Procedures

- Based on the grounded theory approach, the transcripts were analyzed using the three-sequential coding process (i.e., coding, categorizing, and applying theoretical explanations).
- For example, the research team examined, compared, and asked questions until the data were able to be made in distinct categories and able to develop a clear illustration of the research phenomenon.

Data Analysis Procedures

Continued

- First, each research team member coded the data independently and later met as a research team to discuss the patterns or trends in the transcript data (Farber, 2006).
- Second, each research team member compared and discussed his or her interpretations of categories and subcategories with the group. This process continued until each research agreed on the identified categories and subcategories (Miles & Huberman, 1984, 1994).

Data Analysis Procedures

Continued

- **Third, after collapsing categories and subcategories, the researcher sent participants a final version of data analysis as a way of soliciting input and feedback about the study's findings.**
- **None of the participants had anything to add or change to the final version of data analysis; they all were satisfied with how the data had been interpreted by the researcher.**

Trustworthiness of Data

Trustworthiness Criteria in Qualitative Research

- **Credibility (Internal Validity):** It is the extent to which the researcher is able to accurately capture the views of those being researched (Lincoln & Guba, 1985). In this study, multiple data sources, peer debriefing, and member checking were utilized to ensure the credibility of the findings.
- **Transferability (External Validity):** It refers to the measures taken by the researcher to increase the ability of the findings to be generalized to other similar cases (Lincoln & Guba, 1985). As a technique of transferability, the researcher asked many questions related to the focus of the study. Additionally, a reflexive journal (Lincoln & Guba, 1985) was kept to record the beliefs, attitudes, and opinions, which provided a record of researcher introspection and understanding.

Trustworthiness of Data

Trustworthiness Criteria in Qualitative Research

- **Dependability (Reliability):** In order for a qualitative study to be deemed dependable, a logical, traceable, documented audit trail (Lincoln & Guba, 1985) must be established. For this study, the following were utilized in the creation of an audit trail: raw data (i.e., interviews and questionnaires), data reduction and analysis (i.e., summaries and working hypothesis), data reconstruction and synthesis (i.e., themes, relationships, etc.), process notes (i.e., methodological notes), etc.
- **Confirmability (Objectivity):** The researcher presented the data in an objective manner that was clear and discernable (Lincoln & Guba, 1985). To ensure objectivity, member checking and peer debriefing were utilized.

Results

The most salient factors pertaining to the participants' decision to pursue engineering as an academic major and career choice:

1. Strong interests in science, technology, engineering, and mathematics
- 2. Strong familial influence and encouragement**
3. Strong aptitudes in science and mathematics
- 4. Meaningful academic experiences and relationships with school personnel**
5. Meaningful enrichment programs, opportunities, and academic experiences

Strong Interest in Science, Technology, Engineering, and Mathematics

- Many of the participants made reference to interest and how these interest influenced their decision to pursue STEM as a college major and career choice.

Well, every since I was a kid, I always wanted to build spaceships.... I liked to take all my remote controlled cars and stuff apart... so I read up on it [engineering], it sounded like something that I wanted to do.

Just interest... I feel that I'm a smart guy, and I'm fascinated by any aspect of technology. I wish I could major in more than one engineering because mining mineral processing engineering isn't the only engineering I'm interested in...

Strong Familial Influence and Encouragement

- In this study, many of the participants illustrated the importance of family in their career path process (e.g., selecting engineering as an academic major). Below are example excerpts from different participants:

He [his father] was in Air Force, and he was an engineering technician. So math and science, he was really into it. I think he wanted me to be an engineer... I think that kind of had an effect on me.

I had a few cousins graduated from Howard [University], and they were my role models... I looked up to them. They were successful, they had money, they were where I wanted to be. I thought that it [engineering] was definitely the route I needed to take, being I liked math and science in high school.

Strong Aptitude in Science and Mathematics

- Strong science and mathematic aptitude was instrumental in developing both the educational and career interests of the participants.

I was sectioned off in the high math classes and that's when I began to know... so, those classes let me know 'hey, this might be a good area to study in.

Early childhood years, I would say... probably the latter part of elementary school that I started really loving math and sciences. I don't think it was more that I loved it... I think that it was more because I could do it better than other students in the class, and they made me feel better to do something better than they could because when it came to reading and English, I was struggling on that scale. So, I intended to push that aside and focus more on math and science.

Meaningful Academic Experiences and Relationships with School Personnel

- Quality school experiences and interactions with school personnel (e.g., teachers and school counselors) positively influenced the participants' educational interests and career aspirations for engineering.

I would say the first time I got interested in math was when my fifth grade teacher thought I was very good in math, so she would give me lots of personal help. While the rest of the class was working on something, she would give me worksheets that were harder.

As I was taking the technical drawing class in high school, I like 'yeah, I like this,' and that confirmed my decision.

Meaningful Enrichment Programs, Opportunities, and Academic Experiences

- Many participants illustrated the importance of advanced curricula and special programs in their career decision-making process.

In like fourth and fifth grade, I was involved in the Young Astronauts program, where we met these astronauts, and they were aerospace engineers... so I was like 'oh, I want to be an aerospace engineer,' and since then engineering has been on my mind.

I did go to some of the PCI (precollege initiatives) programs that they had here, and they helped too. They kind of gave you an inside view of engineering.

Discussion

- The **five themes** discussed were found to be the primary factors that influenced the African American male participants' decisions to pursue engineering as an academic major and career choice.

• Therefore, it is reasonable to conclude that African American males who were more likely to pursue STEM as an academic major and career choice possessed strong interest in STEM; received support and encouragement from family to explore the different possibilities in STEM; possessed high aptitudes in science and mathematics; received strong school support and encouragement from teachers and school counselors; and participated in STEM enrichment opportunities K-12.

Implications

- Because teachers play a critical role in the educational process for African American males, it is important that they use and develop pedagogical strategies that increase educational and career aspirations (Flowers, Milner, & Moore, 2003; Ford & Moore, 2004; Ford, Moore, & Milner, 2005b).

• Equally as important, it is essential that teachers cover content in their courses that is expected of college students in general and STEM majors in particular. The more students are exposed to the rigors of science and mathematics, the more likely they will become interested in STEM as a major (Hrabowski et al., 1998; Moore et al., 2004).

Implications

Continued

- It is also important that teachers understand how teacher-student interactions affect school outcomes and career aspirations for African American male students and other students of color (Ford, Moore, & Harmon, 2005; Moore, Ford, & Milner, 2005a). **Therefore, teachers need to work diligently to build relationships with African American male students, based on caring, trust, and positive regard.**

• Enrichment programs and courses are excellent ways to expose African American males to science, technology, engineering, and mathematics. **Therefore, it is essential that educators, such as teachers and school counselors, monitor the academic progress of students and proactively approach and communicate with them about their academic ability and career options.**

Implications

Continued

- Enrichment programs and courses are excellent ways to expose African American males to science, technology, engineering, and mathematics. **Therefore, it is essential that educators, such as teachers and school counselors, monitor the academic progress of students and proactively approach them about different enrichment programs and courses.**
- Educators in both K-12 and higher education settings should connect African American male students with individuals in STEM fields to increase their interests and aspirations for STEM. Such individuals could serve as excellent role models.
- Because parents play a significant role in African American male students' career aspirations, **it is essential that parents/guardians demonstrate their love through active involvement in their child's education.** Equally as important, they need to provide ongoing support and encouragement so their African American male students will have a strong belief in himself.
- Higher education institutions should establish partnerships with their local school districts to establish STEM pre-college programs, where African American males could obtain "hands on" experiences with STEM applications. Such partnerships are excellent ways to increase African American males' interest and exposure to the different career paths in STEM. Also, these initiatives are excellent ways to supplement students K-12 educational experiences.

Implications

Continued

- Because science, technology, engineering, and mathematics are seen as rigorous academic majors, **it is essential that African American male students are encouraged to take advanced courses, especially in science and mathematics.**
- Prevention and early intervention are essential. No time is too early to expose students to STEM areas, via



Questions and Answers