

Mathematics Self-Efficacy and African American Male Students: An Examination of Models of Success

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The purpose of this study was to investigate the personal stories of African American men who excelled in mathematics to understand the impact of their self-efficacy beliefs on their motivation and subsequent academic achievement in mathematics at the postsecondary level. General analyses of autobiographies and interviews revealed that enactive attainment and vicarious experience were influential sources for these African American men's self-efficacy beliefs and were supported by family, friends, and peers. However, vicarious experience appeared to be more influential than enactive attainment for these participants. This finding may contradict Bandura's (1986; 1997) claim that enactive attainment has the most significant impact on self-efficacy; in contrast, it supports other claims, such as peers play a major role in the development of attitudes toward academics for African American men (Hrabowski & Maton, 1995; Hrabowski, Maton, & Greif, 1998; Kunjufu, 1986; Taylor, 1989).

In the book *Being a Black man: At the corner of progress and peril*, V. Dion Haynes (2007) describes two best friends, Jachin and Wayne, who were instrumental in transforming several of their football teammates' attitudes toward education. For example, during the young men's senior year, Advanced Placement (AP) literature had its highest enrollment of thirteen with six males, five from the football team. In AP calculus, for the first time there were fewer girls than boys, who were mostly football players. One player, who received mostly C's and D's prior to Jachin and Wayne attending the school, eventually worked his way to the honor roll by his senior year because of the friendship he developed with both peers and spending considerable amounts of time with Wayne. Furthermore, during graduation ceremonies, where only 39% of the entering freshman remained, eleven students, six of whom were boys, were inducted into the National Honor Society.

While some may view these as minor accomplishments, they were unrealistic goals at this school preceding the arrival of Jachin and Wayne. To illustrate some students' pessimistic beliefs, several of the football players said, after first being introduced to Jachin and Wayne, "They smart. We dumb. We can't get better" (Haynes, 2007, p. 54). However, Jachin responded, "That's crazy. Anybody can get good grades. Just go to class and do your work" (p. 54).

The sentiment expressed by the football players that they were dumb and could not get better is disturbing and could be categorized as academic disidentification (Cokley, 2002; Osbourne, 1997; Steele, 1997), oppositional identity (Ogbu, 1987), or, simply, Black boys being "active agents in their own failure" (Noguera, 2003, p. 437). Consequently, a commonly held belief is that the only viable options available that will modify their conditions are sports or entertainment. Whiting (2006) questions this frame of mind by asking, "Why do so many Black men attempt to find their identities on the athletic field and in the entertainment industry? Why do so few find their identities, their self-efficacy, and sources of pride in academic settings?" (pp. 223-224).

Focusing on the second of Whiting's questions, Bandura (1986; 1989a) suggests that a positive sense of personal perception of ability is a necessary condition for human achievement and constructive interests:

This is because ordinary social realities are strewn with difficulties. They are full of impediments, failures, adversities, setbacks, frustrations, and inequities. People must have a robust sense of personal efficacy to sustain the perseverant effort needed to succeed. ...because the acquisition of knowledge and competencies usually requires sustained effort in the face of difficulties and setbacks, it is resiliency of self-belief that counts (Bandura, 1989a, p. 1176).

The social realities of African American men are far from ordinary and difficulties are abundant. Consequently, their impediments, failures, adversities, setbacks, frustrations, and inequities are exaggerated when compared to women or men of another race or ethnicity. For a group that arguably faces the greatest challenges in education, research should be conducted, and made readily available, that offers practical and comprehensive solutions to defuse the negative perceptions of, what seems, a majority of this group's members.

Although there is an emergent body of research that explores success among African American boys in academic domains, it is small relative to the literature that focuses on deficit models. Consequently, some scholars (Berry, 2008; Stinson, 2006; Thompson & Lewis, 2005; Walker, 2006) have called for increased attention to certain aspects of this group's schooling experiences, with a particular need for research that highlights examples of success. For example, Stinson (2006) argues that we need more critical examinations of the motivation of successful Black male students, the influence of family and community on successful Black male students, the influence of teachers on successful Black male students, and the influence of high-achieving peer groups on successful Black male students. Additionally, Parson and Kritsonis (2006) argue that more research is necessary that encourages empowerment among this group of students. Thus, there has been a paradigm shift in the discourse, specifically as it pertains to African American male students' success in mathematics (Berry, 2008; Moore, Madison-Colmore, & Smith, 2003; Thompson & Lewis, 2005).

In the middle school arena, Berry (2008) used critical race theory (CRT) to convey the stories of eight middle school African American boys who were successful in mathematics. Based on data analysis from the boys, their families and teachers, five themes emerged that influenced these boys' academic success. They were 1) early educational experiences, 2) recognition of abilities and how it was achieved, 3) support systems, 4) positive mathematical and academic identity, and 5) alternative identities. As a result of these themes, Berry concluded that a) programs that specifically target the early schooling experiences for African American boys should be considered, b) educators should become more cognizant of their power to influence or deny access to academic opportunities for African American boys, and c) raising the consciousness of educators, parents, and the public about the performance of African American boys must become a significant priority.

In the high school arena, Thompson and Lewis (2005) used case study methodology to portray Malik, a student-athlete who, due to an inner drive that yearned for academic excellence within an inner-city public school in East Baltimore, requested that the administration develop a Pre-Calculus/Calculus course for students who wanted to take advanced level mathematics courses. From their analysis of data, Thompson and Lewis concluded that Malik was successful for the following reasons: 1) advanced mathematics course enrollment, 2) relationship between advanced course enrollment and career goals, 3) deep seated goals, and 4) role models. Malik was goal-oriented and pursued these advanced courses because of his desire to enter the best colleges and become a fighter pilot. As a result, Thompson and Lewis concluded that future research should: a) focus on the relationship between limited availability of advanced mathematics courses to African American students and advanced course enrollment, b) examine more closely the relationship between advanced mathematics enrollment and science-related career attainment, and c) investigate the relationship between role models and students' academic achievement.

In the collegiate arena, Moore, Madison-Colmore, and Smith (2003) used a grounded theory approach to explore persistence among African American male engineering majors at a predominantly white university. These young men dedicated themselves to doing well to avoid disappointing members of their support systems, who they viewed as people who sacrificed and struggled to open opportunities for them. In addition, they did well in an effort to disprove those who doubted the capabilities of African American men in engineering. Thus, the theory known as the prove-them-wrong syndrome was constructed to describe these young men's persistence in the face of psychological and sociological challenges. Accordingly, the authors concluded that more research was necessary in examining how unreceptive environments produce feelings of intellectual inferiority among some Black students and elicit the prove-them-wrong syndrome from some Black male students.

As one example, McGee and Martin (2011) featured the story of Rob who pursued his Ph.D. in mathematics. Due to a keen awareness of negative stereotypes of the intellectual capacity of Black students in mathematics, Rob employed proving-them-wrong to support his resilience, persistence, and identity in being a Black mathematics learner. Because of personal experiences suggesting that he was not as capable as his White peers, when in fact he excelled, Rob accepted the responsibility of demonstrating that Black intelligence in mathematics should not be devalued.

While these studies do not exhaust the extant research on success among African American male students, the pool of literature is still limited in scope (Jackson & Moore, 2006). This study adds to the literature by exploring the motivation of African American males who are

academically successful in mathematics at the collegiate level. This aim is addressed through the lens of self-efficacy. Although self-efficacy has been mentioned in previous studies (Berry, 2008), few scholars have made self-efficacy the primary focus of their work. In fact, few other studies have attempted to examine the self-efficacy of African American youth in general (Jonson-Reid, Davis, Saunders, Williams, & Williams, 2005) or African American male youth exclusively (Uwah, McMahon, & Furlow, 2008).

Jonson-Reid and colleagues (2005) stated that to increase academic self-efficacy, it was important to assist students in developing strategies that would build their belief in the importance of education. If these findings hold true for academic self-efficacy in general, can the same be said for mathematics self-efficacy? This study attempts to answer this question. Additionally, while examining the relationships between the perceptions of school belonging, educational aspirations, and academic self-efficacy, Uwah, McMahon, and Furlow (2008) concluded that academic self-efficacy was predicted by students' educational aspirations as well as their feeling encouraged to participate. While these findings support a broad examination of self-efficacy among African American youth, they also suggest that it may be warranted to take a more concentrated look at self-efficacy via academic achievement within a particular domain. In the case of mathematics, this exploration could potentially guide future research to better understand, for example, the peer relationships among successful African American male students.

Relevant Literature and Theoretical Underpinnings

Within the domain of academic achievement motivation, several motivational theories—self-efficacy (Bandura, 1986; Pajares, 1996); attribution theory (Weiner, 1985); and expectancy-value theory (Atkinson, 1964; Eccles, 1993)—exist that focus on facilitators of motivation (Gilman & Anderman, 2006). Of these facilitators, Bandura (1989b) claims that the mechanism of self-efficacy is the most influential, especially for people who want to stimulate change in self and situations on their own. Due to the concentration on self, the theoretical framework chosen for this study is Bandura's (1986) social cognitive theory, which asserts the following:

...people are neither driven by inner forces nor automatically shaped and controlled by external stimuli. Rather, human functioning is explained in terms of a model of triadic reciprocity in which behavior, cognitive and other personal factors, and environmental events all operate as interacting determinants of each other (p. 18).

Social cognitive theory outlines four sources of information on self-efficacy: enactive attainments, vicarious experience, verbal persuasion, and physiological state (Bandura, 1986, 1997). Enactive attainments refer to the effects of experiences on efficacy; accordingly, prior success can elevate efficacy while prior failure can lower efficacy. However, individuals must balance several factors—ability, non-ability, achievement success/failure, effort, task difficulty—before judging their self-efficacy. Another attribute that has an impact on one's self-efficacy is the manner in which the individuals monitor their own performances. If one selectively chooses, for example, to focus on good performances, then there exists the potential to increase perceptions of their self-efficacy and vice versa.

Vicarious experience, which may have profound influence(s) on an individual's performance, occurs when an individual believes in their ability to achieve certain results after observing other people, similar to them, who have engaged in the same activity and have acquired success (Bandura, 1986, 1997). Schunk, Pintrich, and Meece (2008) state, "Observing the successes, failures, rewards, and punishments of others creates expectations in observers that they are likely to experience similar outcomes for performing the same behaviors" (p. 157). Bandura (1997) has argued that social comparisons are a fundamental feature of vicarious experience and greatly affect the choice and proficiency of models. From these models, strategies, such as coping, are learned that help increase efficacy. Moreover, models are very useful when learning more complex skills.

Verbal persuasion is used to convince people that they possess the characteristics necessary to achieve a certain outcome (Bandura, 1986, 1997). This source influences and encourages the additional effort and persistence needed to achieve a desired goal. Those who provide the verbal persuasion have to be deemed competent enough, by the person who is receiving the persuasion, to evaluate the characteristics. In an examination of the self-efficacy of women who had entered mathematical, scientific, and technological careers, Zeldin and Pajares (2000) found that verbal persuasion was an essential source of their participants' self-efficacy beliefs. The women in this study received these cues from family, teachers, peers, and, supervisors. As a result of receiving encouraging words from others, who believed in them, the women's beliefs in their own competencies were positively reinforced.

The last of the four sources is a person's physiological state, which provides arousal cues that are used by a person to infer their ability to achieve a particular outcome (Bandura, 1986, 1997). In addition, the inference is based on that individual's judgment and also factors in things such as circumstances involved in the arousal, past experiences on the relationship between certain arousals and performance attainment, and evaluation of the arousal source. An example of arousal cues and their impact on performance is evident in stereotype threat (Steele & Aronson, 1995), which can impact the anxiety of underrepresented groups, such as women and minorities, in STEM fields (Marra, Rodgers, Shen, & Bogue, 2009). Keller (2007) has shown that the introduction of a stereotype can negatively influence the mathematics achievement of female students while Kiefer and Sekquaptewa (2007) have shown that reducing stereotype threat can elevate women's mathematics achievement. Furthermore, other researchers (Kellow & Jones, 2008; Ryan & Ryan, 2005) have observed similar findings as it relates to ethnic/racial groups.

Self-efficacy has been used within the field of educational research to explore relationships that exist between it and motivation, academic performance, and achievement (Betz & Hackett, 1983; O'Brian, Martinez-Pons, & Kopala, 1999). Pajares and Graham (1999) found that self-efficacy independently contributed to the prediction of math performance. In addition, Schunk and Pajares (2002) have shown that self-efficacy influences the types of tasks chosen, perseverance with tasks, and expenditure of effort on tasks. These findings support Bandura's (1986) claim that perceived self-efficacy can operate as a principal contributor to students' academic progress because, as Bandura (1989a) further asserts, people assume an active role in their motivation and a major influencing factor to motivation is an individual's perceived self-efficacy.

Research specifically designed for African American populations is still developing; as a result, findings are tentative. Although Post, Stewart, and Smith (1991) generated support for the claim that the self-efficacy of African American male undergraduates is higher than that of African American female undergraduates, the sources of African Americans' self-efficacy is still

unclear and other studies have only been able to suggest directions in which this research should proceed. For example, using descriptive statistics and correlational matrix analysis, Attaway and Bry (2004) examined the association between parenting style and academic achievement. The researchers could only infer that complete parent control with minimal child input may lead to reduction in self-efficacy. This relationship leads to low engagement, and, in turn, low academic achievement. Conversely, they were unsure of the direction of causality for the relationship between parental belief in control and low achievement. Furthermore, fathers were excluded from the study, thereby creating a void in the study, its findings and conclusions. Although Graham (1994) has called for more research studies on self-efficacy's effects on motivational factors in regard to race, little has been done.

In an effort to uncover some motivational characteristics that contributed to the academic success of African American male students in mathematics at the postsecondary level, this study posed the following research question, "*What is the influence of self-efficacy on the motivation of African American males and how does this influence affect their academic achievement in mathematics at the collegiate level?*" Using, as a guide, the work of researchers (Bandura, 1997; Hackett & Betz, 1989; Pajares, 1996; Zeldin & Pajares, 2000), who have gathered valuable information by examining the self-efficacy of women, an underrepresented group in mathematics-related fields, this study examines the influence of self-efficacy on the motivation of another underrepresented group, African American men. Primarily, this model was used to determine how the participants' self-efficacy affected their choice of interests, perseverance, and effort as it specifically pertains to collegiate mathematics. Through a qualitative process, this study attempted to provide evidence that supported or rejected the claims of this theoretical framework.

Methodology

Culturally approach research methods were employed in this qualitative study. These methods were selected for several reasons. First, Tillman (2002) asserts that these methods make use of both the cultural knowledge and experiences of the researcher and those of the subjects in all facets of the research design including data collection and analysis. Second, these important features not only account for the complexity and inter-relatedness of African Americans (Boykin, 1994), but can also be used to generate recommendations to enhance the educational conditions of Black communities (Kershaw, 1990).

One of the principal assumptions of culturally appropriate research methods is that there exists a shared and collective knowledge among African Americans (Tillman, 2002). In order to uncover that knowledge, Tillman suggests that culturally appropriate research methods are characterized by five attributes:

- 1) culturally congruent research methods—qualitative, but can be quantitative, research that includes interviews and participant observations as a means to gain a holistic representation of the African American experience,
- 2) resistance to theoretical dominance—goal is to reveal, understand, and respond to unequal power structures,
- 3) culturally sensitive data interpretations—legitimize the knowledge and experiences of the both the researcher and the researched,
- 4) informed theory and practice—promote new theories and practices that are specific to

the African American experience, and
5) culturally specific knowledge—use of self-defined experiences of African Americans.

There are several reasons that culturally appropriate research methods were suitable for this study. First, most of the literature relevant to this work uses qualitative methods to capture the experiences of their subjects. Second, I recognize the importance of exposing the variety of experiences that exist among this group. Third, the data supported my assumption that academic success is abundant among this group and reaffirmed the participants' beliefs in their abilities knowing that someone was interested in their stories. Fourth, this strategy attempted to overlay an alternative theory, self-efficacy, onto the African American academic experience. Last, it was important to understand the stories of the participants of this study to construct a framework by which other African American men can assess, comprehend, and fulfill their own educational potential.

Because there have been few works that specifically address the self-efficacy of African American men, it is important to determine some characteristics of this group's self-efficacy before attempting to measure it. Qualitative methods were used to collect this information by posing semi-structured questions that foster the emergence of detailed descriptions (Zeldin & Pajares, 2000) and the production of deeper insights (Pajares, 1996). Second, the experiences of African American men are complex and cannot be partitioned into discrete variables (Glesne, 1999). As a result, it seemed imperative to concentrate on each man's awareness of his academic world and how that awareness affected how each situated themselves inside their academic worlds. Finally, any strategies designed for African American men in education must be informed by some contributions of African American men (Noguera, 2003) who possess valuable knowledge concerning their feelings toward and approaches to education. Thus, the study was designed so that participants could define, discuss, and reflect on their beliefs in their mathematics abilities, the sources of their beliefs, and the impact of their beliefs on their motivation and academic achievement in mathematics.

Context

All participants in this study attended a Historically Black College and University (HBCU). The first school, Opportunity University, is a privately-endowed, non-profit, non-sectarian, and co-educational institution. Located in one of the South Atlantic states, it offered a wide range of technical, liberal arts, pre-professional, professional, and graduate degree programs. The school enrolled over 5,700 students. At the time of the study, approximately 700 of the undergraduate population were enrolled as science majors and 56 students were enrolled as math majors.

The second school, Chance University, is a comprehensive institution that offered bachelor's degrees in more than 100 fields and awarded graduate degrees in an estimated 40 disciplines. Also located in a South Atlantic state, the school enrolled nearly 9,000 students. The school had programs in science, technology, and mathematics.

Participants

Participants were purposefully selected from college and university students who were male, identified as African American, and between the ages of 18-23. With the direction and support of faculty members and individuals familiar with this work, students were identified who fit the

aforementioned criterion. Of the nine students who were initially recruited and verbally agreed to participate in the research study, only six completed all of the data collection instruments. Also, of the original nine recruits, one attended a predominantly White institution (PWI) while the remaining eight all attended two different HBCUs. However, the primary research question was not intended to address any differences between the schools.

Each participant was asked to provide a copy of their transcript to ensure that they met the following standards—1) students were not required to be mathematics majors, but must be in a degree granting program that required mathematics beyond Calculus I and 2) students must have received a cumulative average of B or higher in the mathematics courses taken since enrolling in their respective universities. For a brief profile of each participant, see Table 1 below. See Appendix A for detailed profiles.

Table 1
Background of Participants

Name	Classification	Major	Institution
Alfred	Senior	Economics	Opportunity University
Barry	Senior	Chemical Engineering	Opportunity University
Corey	Sophomore	Mathematics	Chance University
Dexter	Junior	Mathematics	Chance University
Elijah	Senior	Mathematics	Chance University
Frank	Junior	Mathematics	Chance University

Data Collection

After receiving the names of potential candidates, each was contacted via phone and the purpose of the study was explained. Consent forms were mailed to those students who verbally agreed to participate in the study. Data collection began with the mathematics autobiography, which was distributed after consent forms were collected. A mathematics autobiography is a detailed account of each student’s personal experiences with mathematics, in-and-out of academic settings. Each participant had approximately one week to complete the autobiography. After receiving and reading a participant’s autobiography, each was contacted within a week to schedule the second round of data collection, the individual interview.

Participants were given the option of choosing where the interview was conducted for their convenience and comfort. These interviews were performed to expose and/or clarify factors that explain the individual’s experiences as academically successful African American men in collegiate mathematics. These interviews addressed responses from the math autobiography and were used to discuss the interplay between self-efficacy, motivation, and academic achievement (specifically choice of interest, perseverance, and effort). The interviews, which ranged in length from 30 minutes to an hour, were audio taped and transcribed at the completion of each interview. The participants were assured that their responses were confidential.

Data Analysis

In keeping with most qualitative studies, data analysis continued throughout the research process—while collecting data, organizing and reorganizing findings, and writing results. It also continued beyond this initial effort. To ensure reliability, I documented the procedures of the study and attempted to document as many of the steps of the procedures as possible (Yin, 2003). I also used Gibbs' (2007) reliability procedures of checking transcripts for obvious mistakes and constantly comparing data with the codes and memo writing. Through the use of this process, themes were developed that provided a different view of African American men in collegiate mathematics and that identified facets of these individual's experiences that were overlooked or underestimated.

Responses to the mathematics autobiographies and the individual interviews were coded. The mathematics autobiographies were used to develop background portfolios of each individual, while the one-on-one interviews were used to develop more current portrayals of each individual. Both were used to blend fragmented data and provide opportunities for other ideas to surface, all the while looking to develop meanings among the participating individuals.

Transcript based analysis (Krueger & Casey, 2000) was used to develop a coding frame (with key analytic constructs compiled in a codebook) from the transcripts. The coding frame included broad easily identified themes and more abstract, complex themes. I then used a codebook to review the transcripts a second time to refine the coding categories of the first reading. After the coding was complete, I created graphical models of the data to assist in data transformation using strategies described by Glesne (1999) and Wolcott (1994).

To resolve the issue of quality (Guba & Lincoln, 1994) and ensure the validity of the findings (Creswell, 2009), the following strategies, suggested by Creswell (2009), were incorporated: triangulation; member checking; rich, thick description; bias; discrepant information; and peer debriefing. In triangulating the data, I examined several sources of information, such as student transcripts, mathematics autobiographies, and interviews, to build a rational justification for established themes, which converged from the data sources. With respect to member checking, I provided each participant, at the end of data collection and transcription of the audio-taped interview, an opportunity to review their interview to verify that I had accurately captured their responses.

In rich, thick descriptions, I attempted to provide, where appropriate, multiple and robust perspectives about a theme. I periodically clarified my bias as a means of being self-reflective and honest. With discrepant information, I included participants' responses that ran counter to the themes. Finally, in peer debriefing, I had a colleague (fellow academician) review and ask questions about the study so that it would resonate with others.

Findings

Models of Success

Through the mathematics autobiography and interviews, the participants defined their beliefs about their mathematics abilities and identified the sources of their beliefs. This offered insight into the impact of these beliefs on their motivation and subsequent academic achievement. Based on the participants' responses, vicarious experience and enactive attainment were the sources of self-efficacy that seemingly had the most significant impact on their academic

experiences. Because the young men spoke at greater length and in more detail with respect to vicarious experience, it appears that this source may have an important influence on the African American male experience in mathematics.

Enactive Attainment. To gain insight on the experiences that helped develop these young men's perceptions of their abilities, one of the questions asked in the mathematics autobiography was, "When did you first realize you were good at math?" In these explanations, the young men's perceptions were framed in the context of the grades that they made in school, the courses that they took, or the relative ease with which they learned the subject. In some cases, responses were similar; however, there were some variations in the stories. In the case of Alfred and Dexter, both saw their positive perceptions emerge in elementary school. Alfred recalled in his autobiography:

I first realized that I was "better at math" when I was in elementary school and we had to take the EOG testing to pass from one grade to the next. I believe the testing started in second grade. Every year that I took the test, I always scored a perfect score in the math section while my verbal/reading scores usually tended to fluctuate between the perfect and a point less. I took this as a sign that I was a pretty good mathematician in my younger years. As the years progressed I took these scores plus my many A's that I got in my math classes as something to be proud of. I especially liked the way that in many of my classes where I was one of only a few minority students I still was able to come in the top percentile of my class, especially as one of only a few Black students. I felt like this was a great accomplishment because it showed that anyone, no matter their race or background, could be successful. I finally realized that I was "good at math" when I was in high school and I was a year or two ahead of many of my peers.... Unlike many other students, I very rarely needed extra help with my homework or with learning how to do something mathematically. Whenever I couldn't exactly understand something, I would just look at how my teacher or my book performed the steps and then I would analyze it to see how to go from one step to the next. I always enjoyed doing math and considered it as a fun activity.

While Alfred's realization seemed to naturally occur, Dexter's evolved with assistance. He specifically discussed a teacher who helped influence his perceptions of his abilities:

I first began to realize I was good at math when I was in second grade. They began to put me in academically gifted classes, which meant I left my class and was taught math with other advanced students by a different teacher. This made me feel smart, but I did not think it was a big deal like my parents did. My A.G. teacher Ms. A was probably the most influential in helping me to realize I was good at math because after we would do problems, she would tell us that we weren't supposed to learn that until fourth grade. And being in the second grade meant that was a big deal.

Whereas Alfred and Dexter noticed early their penchant for mathematics, Barry and Corey first noticed the emergence of their beliefs in middle school. Corey's autobiography revealed:

Math wasn't a subject that always got me excited, but I always excelled in the area. The first time I realized that I was drawn to mathematics was in the 6th grade. This year was my first year of middle school, and I was recruited to participate with the math club due to my performance in class. As we competed against other schools, I stood out and began to form a real love for the subject. From that point forward I grew fonder of the subject. It was the only subject that I didn't fall asleep through in school, and it pleased me that I could actually take a problem and solve it with a given method. Math has always challenged me, and this is what keeps me drawn to it.

Like Corey, Barry also stated that he was not very fond of mathematics early on. It was never a subject that stood out to him in elementary school. However, he could remember doing problems, such as "learning time tables, and working on long division," that became problematic to his peers, but not to him. He enjoyed them and because he enjoyed them, he never viewed mathematics as being the "stereotypically hard subject." Then in eighth grade, Barry realized that he could grasp mathematics without any worries because of his exposure to a good teacher whose teaching style he enjoyed. His perceptions were reinforced by his ability to catch on to the subject rather quickly in addition to receiving the highest marks on tests and quizzes.

A common theme among several of the participants was their response to grades and the influence that these grades had on their beliefs. Reactions to the grades are an example of what Bandura (1986) calls response outcomes, which serve several functions: provide feedback on the structuring of behavior to achieve a desired outcome, provide encouragement for certain behaviors and automatically strengthen responses. For example, Frank stated in his interview that he "expected to make A's and nothing less." Barry, in his autobiography, also mentioned grades and their impact on his self-efficacy beliefs:

During my junior year of high school, I took pre-calculus... and during most of the class I maintained above a 95 average. This boosted my confidence in math tremendously. Since attending Opportunity University, I have made A's in all of the math courses I have taken. My most meaningful math class was Calculus II. I took the class as a first semester freshman with mostly upperclassmen. I worked really hard with practice problems and asking the teacher for help when needed. I did exceptionally well in the class compared to my peers. Next, I took differential equations, which was great because I made an A+. I felt at this point that math was something that I could tackle. By developing confidence in math, I never felt the need to be scared of my major, chemical engineering.

Thus, we see Barry structure his behavior with respect to his major as a result of his confidence in mathematics. Another interesting feature of Barry's story is that although his autobiography suggests that his self-efficacy emerged around middle school ("I took Algebra I in the eighth grade. This is where I noticed that I could handle math and not have anything to worry about"), it was not until college, after receiving the A+ in differential equations, that Barry fully came to trust his abilities.

Once the foundation for their mathematics self-efficacy was established, four of the six participants used their mathematics beliefs as a guide for course selection and career paths. As

examples, in high school, Alfred enrolled in more advanced mathematics subjects, such as geometry, Algebra II, pre-calculus, and AP Calculus. Alfred asserted that he always attempted more challenging courses because of his past performance. He firmly believed that if he had a good teacher, if he studied and did the work, then he would be successful in the course. The fact that Alfred took these courses seems to imply that he was comfortable with being successful academically. Moreover, because he freely chose these difficult classes is an indication that Alfred was motivated (Schunk, Pintrich, & Meece, 2008).

Elijah was also motivated to take challenging courses and took pride in setting himself apart from the rest of his peers because of this choice. In his interview, he communicated:

I've taken more math courses than I've actually had to, which is something I didn't mind doing because you have to take a certain amount of hours to be full time and you have to have certain electives. So I've taken some of the more difficult classes as electives, some of the classes that people generally try to stay away from. And then also, as a math major, we have three different tracks you can pursue. So I've taken classes from each track, and the track that I've taken is the one where people try to steer away from because some of the required courses, like abstract algebra, are pretty difficult for a lot of people.

Enrolling in these demanding courses combined with meeting the expectations of those courses can have profound effects. For instance, Barry who entered an International Baccalaureate program encountered some difficulty with geometry "because of the demanding level of the program." However, this experience helped his transition into college, where he took Calculus II as a freshman with mostly upperclassmen and "did exceptionally well in the class." Accordingly, his confidence in his abilities was strengthened.

Vicarious Experiences. Individuals can convince themselves that if others are capable of being successful, then they can also. The participants in this study identified several vicarious experiences that helped to structure their mathematics self-efficacy. Those experiences included teachers, peers, and family.

Without hesitation, the participants mentioned in their autobiographies how receptive they were to the vicarious experiences offered by their favorite teacher(s). Participants spoke of these teachers in the highest regard and three of the favorite teachers were male, which had a significant impact on those individuals. Reasons for selecting a favorite teacher fluctuated; nonetheless, from the participants' descriptions, these teachers possessed several key characteristics, such as passion for teaching, caring, motivating, and knowledgeable. For instance, Barry expressed that his pre-calculus teacher during junior year of high school was very motivating, which helped him maintain a very high average for that class, and Alfred spoke openly about Dr. B, his AP Calculus teacher:

I believe what made him such a great teacher was that he was very charismatic and truly cared about making every student a math success. Whenever there was a tough question that he nor the students couldn't easily find the answer to, he would always go home and work on it before returning the next day with a logical explanation. His class was always full of discussions of math and life which made it easy for the students to relate to him and his teachings.

Dr. B had many qualities that influenced my classmates and my thoughts about him. One of my favorite qualities was that he was able to simplify some of the most complicated math problems and made them comprehensible to even the most anti-math student. He wouldn't go onto the next problem until the issue was resolved and everyone in the class understood it. He was very knowledgeable about math and he always had something new and interesting to tell us about. He was also able to push everyone to go further even when there was a large wall blocking our thinking.

This teacher helped me to better accept my ability to do math. My other math teachers were very effective in teaching the math classes that I was in, but not until Dr. B was a teacher so concerned with the success of his class. He really invested time and effort into us and everyone individually most importantly. He would come around the class and answer any questions we had about the homework and assignments or on whatever he was teaching. He also would allow us to ask questions about our tests and would take the time with us after class to help us understand what to do. He helped me to reach my true mathematical ability at that time, which helped me to achieve a great score on my advanced placement test and on my SATs. As a result, I was able to obtain a major scholarship to college. Through his in-depth instruction and assistance I was able to see that I wasn't an average student, but that I had a gift that many people didn't have.

Dexter, on the other hand, identified not one, but two teachers as his favorites and both were female. He expressed that they were very similar in their approach to the teaching and learning of mathematics. These ladies tried to make mathematics fun by doing a lot of group work or in-class competitions, but the thing that Dexter liked the most was their passion for the subject and the way they transferred this passion to the class:

There were hardly any days where either one of them was not smiling throughout the whole class period. You could also tell they wanted every single person in the class to succeed. They also made me specifically feel as though I was great at math and they loved to teach me.

Although Barry, Alfred, and Dexter identified high school teachers as their favorites, Corey identified Dr. K, a college professor. Dr. K was very easygoing, knowledgeable about the information, and, in lectures, "extremely good at articulating it to the class in a manner we can all understand." But what distinguished Dr. K from the rest, at least for Corey, was his willingness to help students and accommodate questions; in addition, he provided students with experiences in a research lab by allowing them to work with him. To Corey, "Dr. K has always been a boost to my spirit and ability in math classes."

Five of the six participants were also receptive to the vicarious experiences offered by their peers. This is not surprising given the abundance of literature (Hrabowski III & Maton, 1995; Hrabowski III et al., 1998; Kunjufu, 1986) suggesting the influential power peers have on African American men. This discussion arose during the interviews and responses revealed that the influence for these participants was most evident in the types of peers they chose to associate

with, their willingness to pattern their behaviors after those types of peers, and also in their willingness to assist others who may not perform as well in mathematics. For example, Alfred mentioned that, "...when I have friends who I know are good at math, then a lot of times we'll work together. And so they help me learn more and become better." Consequently, Alfred stated that he would put more effort into his mathematics courses.

Corey used others doing well around him as a motivational tool to enhance his abilities. He admitted that he tried to surround himself with "people that perform on my level or higher." However, Corey also stated that working with people who were better than him was sometimes problematic because of his previous background. "Where I come from, I was one of the best... So, when I see people perform better than me, it hurts me...." Despite this feeling, Corey viewed these experiences as inspiration "to do better and continue to give chase and strive to be the best."

Dexter also discussed how he was the best in high school and that seeing others perform better than him was unusual.

I've never really felt like somebody that's in the same class as me is smarter than me. I've never really felt that way. So, when they succeed, I feel like that shows me that I could have succeeded if I didn't succeed. I realize that I should have set the bar higher.

While Corey took others performing better than him to mean that he should study with those individuals and learn from them, Dexter was more of a loner and was certain that he could improve by putting in the extra work on his own. Despite choosing to work in isolation, it was apparent that Dexter did use his peers to gauge his progress with the greatest source of influence coming from his roommates who were all "trying real hard to keep their grades up." As a result, Dexter admitted the following:

I definitely spend most of my time in my room, if I'm not playing basketball. I spend most of my time in my room because that core around me allows me to see and say..., they're in their room working on their homework, I need to work on mine too.

Elijah used a similar rationale when discussing his friends' performance in relation to his. Many of Elijah's friends were computer science or mathematics majors who were very proficient at mathematics. Therefore, Elijah had an additional incentive when he approached his studies because, as he stated, "You don't wanna be the friend who fails the test."

Finally, the participants mentioned how receptive they were to the vicarious experiences offered by their family. Again, this should come as no surprise due to the literature (Berry, 2008; Hrabowski et al., 1998; Martin, 2000; Walker, 2006) stating how influential family members are for African American students' academic success. For these participants, there were similar findings. Corey, for instance, was influenced by his older brother, father, and mother.

In his autobiography and interview, Corey mentioned his brother often and compared their accomplishments. As a result, I asked Corey, during his interview, to describe the influence of his brother's academic performance on his academic success. He responded that his brother had a significant influence because he felt that he had to perform at his brother's level and keep the

ball rolling; however, as he spoke, it was clear that there were other reasons in addition to his brother. Corey divulged the following concerning his father:

I never wanted to be noticed as that child that didn't succeed because my father actually came from a great background, performed very well in school, got his degree..., but doesn't really do anything with himself.... He's absent in my life right now. He's pretty much recognized as that child that didn't succeed. So, I've always looked at that, and said my brother's doing well, there's no excuse for me not to do well because if he can do it, then I can do it too. That's how I look at everything. There's somebody that has done it before. So, it is possible.

Corey's mother also had a significant influence on his academic success. She was very active in his life and ensured that he put the necessary work into his academics. Corey remembered how his mother made him sit down every day at the kitchen table and do homework, which she checked. He also remembered how "she would get on me so bad for careless mistakes." Furthermore, he recounted the following concerning his mother:

...she was pretty strong with math when she was in school.... So, she really pushed me a lot. She pushed me real hard, with school period, but especially with math. It was kind of like you have no excuse to not do this.

In addition to the parental influence that he received, Elijah was also influenced by an aunt who was an instructor at a university in his hometown. Collectively, his family placed tremendous emphasis on school, and Elijah was beginning to see the benefits. For example, although he did not enjoy being on the debate team, which his mother forced him to do when he was younger, he noticed that his communication skills placed him at an advantage over other candidates on job interviews.

Barry's "academic role models" were an aunt and cousin, who were both successful in school and graduated with honors. Thus, Barry wanted to follow in their footsteps and make his family proud by matching or exceeding their performance. While the previous examples looked to an older family member, Dexter's family influence extended to younger members also:

I've got an older brother and a younger brother. My older brother didn't do quite as well in college, but in high school he did really well. And so that motivates me. And my little brother is in middle school now making all A's. So, that definitely motivates me to want to keep doing well.

Based on these responses, teachers, peers, and family were instrumental in supporting these participants' beliefs in their mathematics abilities. From teachers, the participants were encouraged via passionate instruction, motivation, and genuine concern. From peers, the participants were inspired to do well academically. Finally from family, the participants saw models who demonstrated that being academically successful in mathematics was well within their reach.

Discussion

The purpose of this study was to investigate the personal stories of African American men who excelled in mathematics in an effort to understand the impact of their self-efficacy beliefs on their motivation and subsequent academic achievement in mathematics at the postsecondary level. Results indicate that it would be beneficial to continue exploring the self-efficacy of African American men and also raise several issues for consideration.

The first area deals with teacher expectations. For African American male students, low expectations occur frequently and regardless of the ethnicity of the teacher (Garibaldi, 1992). This study provides evidence that higher expectations could have a positive impact on African American male students. Consider Corey's story of being asked by his teacher to join the math club and compete, "When I began to think, I realized that math is something I love and that as a direct result I was very gifted in the area." This moment led Corey to realize, "I felt like I had finally found my purpose and calling in life. I liked the fact that I could be rewarded and compete with others doing something school related." Also, recall the statements made by Alfred, whose "teacher helped me to better accept my ability to do math" and was concerned with the success of the entire class. Unfortunately, not enough African American male students have these experiences.

The second area deals with the social construction of these young men's identities. These men appropriately selected and used information from multiple sources, primarily peers, to construct and maintain their identities as academically successful African American male mathematics learners. These participants' efficacy information appears to have been enhanced via social comparisons to similar models (Bandura, 1986). Bandura (1986) and Schunk (1995) have both argued that model similarity provides a valuable source of information to observers. If the observer and the models are more alike, then chances are higher that an observer's patterned actions will produce results comparable to that of the model. Bandura (1986) makes the following claim:

Seeing others eventually succeed provides incentives for individuals to undertake difficult tasks. Moreover, showing that success is possible through perseverance helps to sustain effort in the face of setbacks. Without the benefit of observed accomplishments, initial personal failures—which inevitably occur in difficult endeavors—more readily create discouragement and resignation (p. 302).

Thus, there needs to be an aggressive effort to immediately provide more models of success to African American male youth so that they will have accessible mechanisms to help counter the many perceptions that exist with regard to their academic achievement capabilities.

Third, African American men who strive to be academically successful should possess certain skills including the capacity to effectively navigate multiple worlds, which could be difficult without a proper foundation. To determine whether this was the case with these young men, I asked whether they experienced managing multiple worlds and the unanimous response was "yes." Several of the participants mentioned being in advanced courses that were populated by mostly White students, which impacted with whom they spent their time. According to Frank, "I spent a lot more time with the White kids because they were the only ones in those upper level classes," but he also had relationships with some of the Black students and stated, in comparing the groups, "You don't always act the same around each one of them." Some of the

other participants expressed similar feelings, but also indicated that they had different or additional balancing acts to perform.

As an example, Alfred felt as though he had to be careful when talking about his success. Being the highest performing Black male student made him the target of criticism from other Black male students who thought he was trying to be better than them; however, Alfred was adamant that he did not play down his intelligence. On the other hand, Corey did feel a need to “dumb down a little bit when I do get around some of my friends.” Corey identified three worlds that he navigated. There was his one circle of Black male friends who Corey felt he could not relate to on an academic level; as a result, this was the group for which he would ‘dumb down’. However, he fit in socially with this group. There was his second circle of Black male friends who he took classes with and who he could relate to on an academic level. Finally, there was his summer program circle of peers who were not Black. Around this group, Corey felt he had to be more reserved socially.

Dexter also managed multiple worlds—one between academics and athletics and the other between academics and friends, which occurred during his high school years and when he played basketball for the university. However, the dormitory in which he lived, which also housed other academically gifted students, relieved, but did not eliminate some of those pressures. For Dexter, it was important to strike a balance. He admitted that if he hung out with his basketball friends too much, then he might begin to adopt some of their attitudes about academics, like, “I’ll take this C on this homework or assignment. It’s okay because we’re gonna go out and play ball today.” To offset this mentality, Dexter knew that he had to find equilibrium to maintain his high academic achievement.

The only participant who did not feel as though he had to balance dual worlds was Barry. In high school, Barry admitted to limiting his relationships to only the people who were in the program in which he was involved. With these peers, Barry developed a competitive, but friendly relationship. For the few friends that he had outside of this program, there were no discussions about academics. Then once Barry made it to college, the people he associated with were either on scholarship with him or were individuals who wanted to do well in school. Consequently, Barry felt that pressures to not work as hard or someone thinking that he was a nerd were removed “because we’re all pretty much there for the same goal, and I try to surround myself with those types of people.”

Lastly, the participants were asked to share their thoughts on why so few African American men do not pursue mathematics. Responses included lack of role models, not understanding the importance of math, the perceived difficulty of mathematics, being afraid of challenges that mathematics presents, reluctance to expend the required effort, lack of quality teachers, and lack of teachers to whom students could relate. The young men in this study were very candid in their explanations because many had previously considered the answer(s) to this question. For instance, Barry mentioned that he had recently discussed this very question with his mother and concluded that most people think mathematics is hard; as a result, most are scared off before they even get started.

Dexter, Corey, and Frank all agreed, in their interviews, that it is imperative to develop a firm foundation at an early age in mathematics, not being afraid of putting in the work, which could be a significant amount, and overcoming prior negative experiences. Dexter discussed the consequences, such as getting a particular attitude towards mathematics, if a person is not willing to put in the work. He frequently hears, and was sure I did too, people say “I hate math, I hate math.” But if this is the mindset that is established at a young age, then, as Frank concluded,

“The further you go along the worse it gets.” Thus, by the time many of these African American men get to their mathematics courses later, Frank summarized that they “get into this mode where it’s like, I just can’t do it and I’d rather not. I’m not good at this. Why keep on doing this when I know I’m not good at it?” This pessimistic stance is why, according to these participants, we do not see larger numbers of African American men pursuing mathematics.

Limitations of the Study

In the data collection phase of this study, there were three limitations. First, the interpretation of the questions by each participant may have been different; consequently, their responses may have been filtered. Second, I was unable to conduct each interview face-to-face, which was the original design of the study. Consequently, some information may have been lost due to not observing the participants in the field. Third, for the participants whom I did interview face-to-face, my presence may have contributed to some bias in the responses.

Another limitation of this study is the sample size. The proposed number of participants was eight; however, only six were retained for this study. Although generalizations are not the intent of qualitative research, at a minimum, the results here will serve as a basis for future inquiry.

Conclusion

The participants in this study had a variety of experiences, but all shared a common goal, which was to achieve academic success because they knew they were capable. A fundamental feature that these participants used to judge their beliefs in their mathematics abilities were vicarious experiences. These participants appeared to have developed relatively reasonable mechanisms by which to assess their efficacy judgments and were able to rely on these attributes in later stages of their academic career. Due to the results of this study, I offer the following recommendations.

First, teachers should encourage African American male students to persevere in mathematics at an early age, provide a stimulating curriculum that encourages more to participate in advanced mathematics courses, and provide greater access to the opportunities that exist within mathematics-related fields. Teachers should also become more aware of any cultural differences that exist between them and their male students (Irvine, 1990; Obidah & Teel, 2001) so that the teachers do not fall prey to existing misperceptions of African American men. A final implication for future teachers and teacher education programs is a call for more African American male teachers. Each young man in this study expressed that having an African American male teacher might be beneficial to African American male students. Responses suggested that male African American teachers would be more attentive to the needs of African American male students and more passionate about helping them. A common theme in this discussion was the importance of a presence to which they, as African American men, could relate. While the presence of an African American male teacher could possibly produce more meaningful and lasting relationships with African American male students, there are a number of issues to consider for initiatives that seek to fill this void including 1) recruitment and retention of competent individuals, 2) funding to support these initiatives, and 3) research that documents the progress and success of these initiatives.

Second, African American male students should be more receptive of the experiences provided by teachers, peers, and family that promote and nourish one’s beliefs in their

mathematics abilities. Another implication for other African American male students is to establish a set of peers whose mathematics performance is equal to or better. Thus, more care should be exercised in peer selection because, according to Bandura and Walters (1963) as well as Bullock and Merrill (1980), selective peer relationships will enhance self-efficacy.

In response to Whiting's (2006) conceptual model of Scholar Identity in Black Males, one of the questions generated by this research is, "By what stage (or at what age) do we see the emergence of African American male self-efficacy?" Based on the responses of participants in this study, we see self-efficacy emerging as early as second grade, in the cases of Alfred and Dexter, but as late as eighth grade, in the case of Barry. Does that span of years provide the most opportune moment to answer questions concerning the mathematics achievement and self-efficacy of African American male students? Once past eighth grade, is it too late to develop the mathematics self-efficacy of African American male students?

Lastly, future research should consider examining this timeframe because we know for certain that African American students leave the pipeline to higher education as early as elementary school (Oakes, 1990) and are academically 'off track' by high school. Specifically, research is needed that examines the early development of self-efficacy among African American male students, as well as how their self-efficacy evolves over time. These efforts are necessary to produce a more comprehensive review of the self-efficacy of African American men. From the perspective of those who want to see different perceptions of and outcomes for members of this group, a wider lens is necessary to make the reversal of such trends a reality.

Appendix A **Student profiles**

Alfred is a senior economics major who attends Opportunity University. Since early elementary school, mathematics has been his favorite subject because he "really enjoyed the fun of finding the answer to a problem, especially really complicated and long problems because it allowed me to feel that I had done something that others couldn't." In middle school, Alfred began noticing that he was one of only a few Black students in most of his classes, including math. As a senior in high school, he took AP Calculus and received college credit. Also, during high school, Alfred took the SAT three times because he was unsatisfied with his mathematics scores. He eventually achieved his goal of 700 (his final score was 710). At the time of this study, Alfred had only taken one college mathematics course, Calculus II, in which he received an A+. As a result of his performance in the course, Alfred was encouraged by his professor to switch to mathematics as a major. With expectations of going to graduate school, Alfred also took the Graduate Record Exam (GRE) and, on his first attempt, scored 750 out of 800 on the mathematics section.

Barry is a senior chemical engineering major at Opportunity University. By his own admission, mathematics has not always been one of his favorite subjects; however, it is a subject for which he has developed an appreciation. During his middle school years, Barry was not always willing to exert the required effort in mathematics, was satisfied with B's on most of his assignments, and therefore was not a standout student. Barry also expressed that he had an issue with one of his middle school teachers who, by his account, had a domineering personality that stressed him out. In high school, Barry took calculus; however, he felt that he did not learn the concepts to the best of his ability. Consequently, he took the course again at a local college before entering Opportunity U. At the time of this study, Barry had made A's in all of his

college math courses and was preparing to take Probability and Statistics as well as Advanced Ordinary Differential Equations his last semester in college.

Corey is a sophomore mathematics major at Chance University. He is also a member of his university's baseball team. Although mathematics was not a subject that always excited him, Corey always excelled in the subject. In middle school, he joined the math club after being asked by his math teacher. Because of this experience, Corey realized that he loved mathematics and that he enjoyed competing with others. Despite being gifted academically, Corey had his heart set on obtaining an athletic scholarship to attend college. Because he had not received any scholarship offers by his junior year, like his older brother who attended a Division I institution on an athletic scholarship and who was also academically gifted, Corey expressed that this caused a great deal of tension between them. In fact, he shared "I was almost like forget college. If I can't compete with my brother and do what he did, then I don't want to do it at all. I'll just give up." However, after talking matters over with his brother, they resolved the conflict. Corey eventually received his athletic scholarship, and, as he stated, "things turned out fine."

Dexter, who was recommended for the study by Corey, is a junior mathematics major at Chance University. Dexter is a former athlete who, at one time, was a member of his university's basketball team. Both of Dexter's parents majored in mathematics and also were graduates of Chance. In elementary school, as a result of completing sheets of multiplications problems very quickly, Dexter discovered he had an affinity for mathematics and practiced often. He took advanced mathematics courses in middle school and had taken high school courses by 7th and 8th grades. Consequently, upon entering high school, Dexter usually found himself in mathematics courses where he was one or two years younger than the other students. He completed calculus by his junior year of high school and received college credit for both Calculus I and II, once again placing him in mathematics classes with students who were older than him once he entered Chance. When the other students discovered how skilled he was, he began receiving a lot of requests for tutoring services.

Elijah is a senior mathematics major at Chance University. His father taught him mathematics at an early age, and he has taken advanced mathematics courses since elementary school. The predominantly Black elementary school that he attended provided him the opportunity of being situated within walking distance of four HBCUs, one of which offered a program that required him to attend another school for gifted students once a week where he was given work that was middle school level. Because of this exposure, he made an easy transition into an integrated middle school where the majority of the students in the advanced mathematics courses were White. These students became his "academic" friends, but he also held on to his relationships with his Black friends who were, as he put it, "non-academic." By the time Elijah reached high school and was able to take AP courses, he became the only Black student in the class, but never felt singled out by any of his peers. Consequently, he never felt the "stigma" of being gifted academically.

Frank is a junior mathematics major at Chance University. Corey, mentioned previously, and Frank are roommates. Frank enjoys taking the harder courses because he felt that in taking easier courses, "there's really nothing to gain from taking those classes." Frank committed to education at an early age because of his mother, who was not a high school graduate. In his interview, Frank stated the following,

My mother always stressed the importance of an education, even though she couldn't help me with my own homework. She always made that more important

than anything else. And she instilled that in us at a very early age. So, that's something I took really seriously.

Although Frank's father did graduate from high school, he did not attend college. Because Frank recognized the struggle that his parents endured while growing up, he made a conscious decision to work hard in school. "Just watching them and seeing how we had to grow up, I knew I didn't want to have that life for myself. And I wanted to make my mother proud. I did everything I could."

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