TOO FEW BLACK MALES IN STEM:
Exploring how Black male STEM majors understand and explain their interests and success in STEM fields

A thesis presented
By
O’Neil Glenn Gayle

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Abstract

The purpose of this study was to examine how Black Male Science, Technology, Engineering, and Mathematics, (STEM) majors at a historically Black university, understand and explain their interests and success in STEM fields. This study was focused on the lived experiences and meaning-making of eight first and second-generation African American male STEM majors. It explored the participants’ lived experiences, and meanings ascribed to these experiences to make sense of them. Inadequate preparations in math and science have deprived many minorities of a good education because they do not have the necessary foundation to succeed in college-level classes. The main objective of this study was to help identify some of the reasons why so few African American males exhibit and pursue interests in STEM fields. In this qualitative study, the interpretive phenomenological analysis (IPA) approach was used. The researcher has sought to explore how Black male STEM majors understand and explain their interest and success in STEM fields. To investigate this phenomenon, the researcher conducted semi-structured interviews with eight black male STEM majors. Ogbu’s (1998) Cultural-Ecological Theory of Minority School Performance, a theoretical framework, posits that the way a group achieves minority status, coupled with community and family educational values, impacts academic achievement. This study has found that for the African American male STEM participants, in addition to internal motivations, passion, and self-efficacy, the pivotal forces (a) Attitudes toward math, science, and technology, will impact (b) choosing STEM as a major; and that, (c) the educational environment, (d) familial involvement and, (e) the availability of educational funding, were all important factors in the preparation and development of STEM interests.

Keywords: Black males, STEM, higher education, academic achievement, interpretive phenomenological analysis
Dedication Page

I would like to dedicate this project to my late parents, Carmen and Leslie Gayle, Jamaican farmers who raised and kept all 12 of us out of trouble until we became grown and productive adults. To my late uncle and family patriarch, Dr. A.S. Gayle, I certainly appreciate the generosity you’ve shown the entire Gayle family over the years, especially when you sponsored me on a student visa to study chemistry in the United States of American (U.S.A.). You not only paid my college tuition for four semesters, but also provided me free room and board with your family in Kensington, Maryland. I will be forever indebted to you and family for your support and encouragement during my university undergraduate years.

I came to this great country to secure a better future not only for myself but also for my son Andre Gayle and would like to dedicate this project to him and his loving family Amanda, son, Declan, and the Studds family. To my daughter, Erica, thanks for your encouraging words during the most difficult times of maintaining work-life balance. Dr. Dave Eng, many thanks for your generous feedback, endless support and encouragement.

Many thanks to my cousin, Dr. Karen Small, MD, and the Smalls family for their unwavering support and encouragement over the years.
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This has been a long and tedious experience and I would like to thank the Almighty God for giving me the courage and strength to endure this project. I now take this privilege and opportunity to express my deepest and sincere gratitude to all those who have encouraged me along the way, especially my professors, colleagues, brothers and sisters.

To my dissertation committee members, Professor Dr. Joe McNabb and, Dr. Kimberly Nolan, many thanks for all your commitments, dedication, patience, constructive feedbacks, support and encouragement throughout this monumental project. A special thank you to a gifted educator and my dissertation advisor, Dr. Joseph McNabb, for his patience, encouragement, and kindness throughout my journey in the program. Thanks, Professor McNabb for all your insightful advice, feedback and support throughout this project. To my son, Andre, his beautiful wife Amanda, and my grandson, you are the joy of my life, I thank God for you at every opportunity.

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Chapter One: Introduction to the Study

Expanding the inclusion of underrepresented minorities in science, technology, engineering, and mathematics (STEM), over the years, has become a national policy of the United States government. In a State of the Union address to the nation, President of the United States, Barak Obama called upon the lawmakers, challenging them to restore the country’s status as a global leader by increasing the number of higher education graduates to the highest in the world by 2020 (Obama, 2009). To achieve this task of global competitiveness, expanding the goal of higher educational achievement requires the inclusion of underrepresented minorities in highly technical fields such as STEM. The recruitment and engagement of Black males in STEM have not been adequately addressed in current literature. The talent pool from which higher education institutions draw students must include more underrepresented minorities. The United States has relied largely on a White male- dominated system of STEM workforce for a very long time (Babco, 2003).

The purpose of this interpretative phenomenological analysis (IPA) study, was to examine how Black male STEM majors at a HBCU, understand and explain their interests and success in STEM fields. Participants were selected from individuals with a minimum 3.0 GPA, and who have successfully completed a minimum of two years as a STEM major at a local HBCU. This pool of participants was drawn from either first or second semester seniors, juniors, or sophomores who are Black males and STEM majors. An interpretative phenomenological analysis (IPA) approach was used for this study because it focuses on understanding the meanings attributed by participants to their lived experiences. Knowledge generated is expected to inform higher education administrators, guidance counselors, and policy-makers on how to engage, improve or attract more Black males into the STEM fields. Insights into how Black
male STEM students made STEM a career choice may contribute to better ways of improving high school STEM curricula, training for guidance counselors, and career development coaches for young Black males. Understanding influences that affected an individual student’s decision to pursue a STEM major in college could provide insights into pre-college STEM student preparation.

This chapter begins with a brief overview of research related to educational disparities in the number of Black males in college and in the STEM field compared to Black women and other ethnic groups in the United States (Strayhorn, 2015); followed by a discussion of previous research about Black male unemployment and high crime rates, to provide context and background to the study. The rationale and significance of the study are next discussed, drawing connections to potential beneficiaries of the project such as college administrators, policy makers, society, and future researchers. The problem statement, purpose statement, and research questions are presented to focus and ground the study. Finally, the theoretical framework, Ogbu (1998) Cultural Ecological Theory of Minority School Performance, that serves as a lens for the study is introduced and explained within the context of this study.

**Context and Background**

Black women continue to outnumber Black men on college campuses by a two to one margin, which is the largest gap among gender in all races (U.S. Department of Education, 2012). According to Cuyjet (2006), the representation of Black males in the U.S. is greater than their representation on college campuses. It is easier for Black males to end up in jail or murdered than in college. Cuyjet (2006) noted that the decreasing number of Black men on college campuses disproportionally affects the pool of individuals from which college students might pick potential mates, since most people in the U.S. still date and marry within their own
Due to the low number of Black males who will go to college, this also limits the possibility for diversity outcomes which result from cross-cultural interactions among college students (Strayhorn, 2010b, 2013a). Therefore, meaningful changes are warranted that will successfully increase enrollment and success rates among Black men in higher education and the STEM fields.

The homicide rate for Black males between the ages of 12 and 24 years old is 17.6% for single victims; this is about 115 deaths per 100,000 Black males for this age group (The United States Department of Justice Bureau of Justice Statistics (USDOJ BJS, 2011). The crime and incarceration rates for poor Black males are astronomical compared to White males who commit the same or similar crimes, according to the National Crime Victimization Survey (NCVS, 2008; Crawford, Chiricos & Kleck, 1998; Crawford, 2000; Kautt and Spohn’s, 2002). Existing literature does not adequately address the need for marketable skills within the Black community. Expanding training in STEM would address the comparatively high rates of unemployment, poverty, and lack of educational opportunities within the Black community because STEM skills are in high demand.

Considerable research indicates that racial-ethnic achievement disparities begin prior to school entry and persist through secondary and postsecondary education (Matthews, Kizzie, Rowley & Cortina, 2010; Yeung & Pfeiffer, 2009). Ogbu (1998) Cultural-Ecological Theory of Minority School performance posits that how a group achieves minority status, along with community and family educational values, affect academic achievement. Reflecting upon Ogbu’s (1998) theoretical concepts, the purpose of this study will be to explore how environmental and other factors influence college major choices for Black males at a HBCU. The qualitative method will be used to investigate and analyze the academic choices of Black
male first or second semester senior undergraduate STEM majors. Therefore, the overall research question guiding this inquiry is: How do Black male STEM majors understand and explain their interests and success in college? This question seeks insights into why some Black male undergraduates, despite socio-economic struggles, choose the STEM fields as a major. It also seeks to ascertain the nature of academic influences, preparations, and persistence that leads to such a choice; whether they were spontaneously developed through internal motivation, through familial and cultural means, including school guidance counselors and teachers, or whether they are the result of self-efficacy. Self-efficacy is a quality that is developed because of adequate preparations for a task, which ultimately leads to high self-confidence.

New strategies are needed to enroll, engage and retain more African American males who are currently underrepresented in higher education institutions and as STEM majors. Many Black males who are STEM majors, are immigrants from the continental Africa and the Caribbean. According to a Science and Engineering Report by the National Science Board (NSB, 2012), African Americans are not only underrepresented in STEM but also less likely to complete a college degree in the field. African Americans earn 4.7% and 9.2% respectively in engineering and science undergraduate degrees compared to 66% for White students. In computer science, materials engineering, and math, Black males are in single digits or absent, despite efforts to address these disparities in the STEM fields, Strayhorn (2015). Strayhorn (2013a) noted that one third of all Black men who enroll in college, drop out. This is alarming, considering that college degree is important for upward social mobility and future job prospects.

Multiple extant literature on racial-ethnic disparities in education support claims that disparities do exist in the United States and that meaningful changes such as reforming the school system curricula will address this national crisis, (Aud, Fox, & Kewal-Ramani, 2010;
Nitardy, Duke, Pettingell, & Borowsky, 2014). Other research indicates that racial-ethnic achievement disparities begin prior to school entry and persist through secondary and postsecondary education (Matthews, Kizzie, Rowley, & Cortina, 2010; Yeung & Pfeiffer, 2009).

The following studies argue that educators should learn from the emerging international evidence of failure over the past three decades of the neo-liberal education policy ensemble (Alexander, 2009; Darling-Hammond, 2010; Hursh, 2008; Lingard, 2010). This study argues in favor of social and educational values within the education profession, for working with families and communities to provide better opportunities for young people, and to keep chipping away at the greater goal of achieving democratic schooling for social justice. It is about working in educational and political ways in schools and communities in the here-and-now to provide better recognition and opportunities for young people who are put at a disadvantage by the hardening of education policy and by prevailing societal norms and power structures.

**Rationale and Significance**

There are too few Black males pursuing STEM careers in the United States. In a time when STEM careers are in high demand and unemployment rates among Black males are relatively high, there is an urgent call to expand the pool from which most higher education institutions draw STEM students. The researcher investigated how Black males STEM majors at a HBCU understand and explain their interests and success in STEM fields. Understanding factors that influence Black male preparation for STEM in college can provide insights into how to improve existing curricula and funding allocations intended to address the disparities previously discussed. Knowledge generated from this study is expected to inform higher education administrators and policy-makers on how to engage, improve or attract more Black males into the STEM fields. Insights into why Black male STEM students made STEM a career
choice can also contribute to new ways of improving pre-college or high school STEM preparation (curricula, training for teachers, guidance counselors, and career development coaches) of young Black males.

Current reports indicate that the high school graduation rates in the United States for African Americans is about 72.5%, and Latinos 76.3%; National Center for Education Statistics (NCES, 2014). Much of attrition in these populations is poor children of color. African-American and Hispanic/Latino students are still graduating 5-10 points behind the national average, U.S. Department of Education, National Center for Education Statistics (NCES, 2013-14). Significantly fewer resources are committed to schools that have large numbers of minorities than for schools serving the more affluent communities (Darling-Hammond, 2004). The preparation of Black males for college and success in STEM fields are not widely discussed in existing literature (Strayhorn, 2015). In the U.S., large segments of the Black community live in urban areas, areas that often have poorly equipped schools, overcrowding, and high crime rates. Investigating how Black males who go to college and major in STEM fields describe their academic struggles is essential to providing insights into how much needed resources can be directed to these areas. Therefore, this study seeks to investigate how Black males at a HBCU understand and explain their interest and success in STEM fields. Its goal is to demonstrate how Black male STEM majors, despite socio-economic struggles, succeed. These findings can provide insights into how to better prepare future Black males for such careers.

Considerable research indicates that achievement disparities in poor minority groups begin prior to school entry and persist through secondary and postsecondary education (Matthews, Kizzie, Rowley, & Cortina, 2010). After several decades of studying the problem of achievement gaps and billions of dollars in federal funding such as the No Child Left Behind
(NCLB) Act of 2001, it seems as if there are no concrete solutions to such complex problems. Ogbu (1998) states that in order to understand the educational gap, both systematic and community forces must be examined (Ogбу, 1998). One common theme emerging from these pre-existing studies is that the American school curricula do not serve all people equitably due to the apparent correlation between wealth and educational opportunities. Currently, the best schools in the U.S. are in the most affluent school districts.

The problem with achievement gaps in education for poor minorities appear to be systematic and involve several complicated issues such as politics, socio-economic backgrounds, or a lack of interest and motivation by the student, all of which need to be addressed if education is to be viewed as a human rights issue. The educational achievement gaps are the result from a current system that is based on an old neo-liberal education policy ensemble (Alexander, 2009; Darling-Hammond, 2010; Hursh, 2008; Lingard, 2010); other contributing factors include the effects of low socio-economic status on education attainment as evidenced by the low levels of academic achievements and high crime rates in poor minorities communities.

**Research Problem and Research Question(s)**

A thorough examination of the life experiences of Black male undergraduates in science, technology, engineering, and mathematics (STEM), has not been fully explored. There are countless published studies on Black ethnic groups, and Black females in STEM, however; there are too few research studies describing the experiences of Black males in STEM, a relatively new field. The United States has relied heavily on a White male-dominated system of STEM workforce for a very long time (Babco, 2003). The inclusion of underrepresented minorities in STEM has been a national policy for several years. In a State of the Union address to the nation, President of the United States Barak Obama was very concerned about America’s global
standing in science and technology. In a speech to the nation, he challenged the American lawmakers to restore the nation’s status as a global leader by increasing the number of higher education graduates to the highest in the world by 2025 (Obama, 2009). To achieve this task of global competitiveness, there is a need for the inclusion of more underrepresented minorities in highly technical fields such as STEM. There is also a need for more underrepresented minorities in the talent pool from which higher education institutions draw students.

The research question that will be investigated in this study is: How do Black male STEM majors understand and explain their interests and success in STEM fields? This question seeks insights into how and why some Black male undergraduates, despite anticipated academic struggles, choose STEM as a major. Many STEM courses have a weighting of 3, 4 or even 5 Credit Points, plus labs with zero credit points, and are not only challenging, but also expensive. The above question seeks to ascertain the reason in choosing STEM, despite the financial demands, the academic rigor, and persistence requirements. The question seeks to explore whether these passions were spontaneously developed or through parental, familial, school guidance counselors or self-efficacy on the part of the student. Sub-questions include: what role does the family play in the participants' academic life? What role if any, does the family play in choosing STEM as an academic major? What effect if any, does socio-economic status have on choosing STEM as a major?

Definition of Key Terminology

To ensure clarity, the following key terms in this paper are defined below:

1. **Black male** refers to people of African descent from anywhere within the Diaspora including the United States, Caribbean, Continental Africa and international populations
who have enrolled in a college or university. The term, African American may be used on occasion when referencing particular studies, but should not to be confused with the students defined in this paper.

2. **Ethnic Minority** refers to a racial, ethnic, or social subdivision of a society that is subordinate to the dominant group in political, financial, or social power without regard to the size of these groups.

3. **STEM** refers to (science, technology, engineering, and mathematics) or a major field of study that falls under any or interdisciplinary combinations of these areas.

4. **HBCU** refers to historically Black college and university; predominantly Black college or university.

5. **White male** refers to White male or Caucasian; ethnic European ancestry

6. **African Americans** are an ethnic group of Americans with total or partial ancestry from any of the black racial groups of Africa.

7. **The System** describes how minorities are treated/mistreated in educational policies, pedagogy, and rewards for their school credentials;

8. **Community Forces** refers to how minorities perceive and respond to schooling, because of their treatment or lived experiences within the community.

The following section of this chapter will include a description and discussion of Ogbu’s (1998) Cultural Ecological Theory of Minority School Performance (theoretical framework) which will serve as the theoretical lens for this study.

**Theoretical Framework**

Ogbu’s (1998) Cultural Ecological Theory of Minority School Performance will be used to frame this research. This theory includes the total societal and school factors along with the
dynamics within the minority communities. In this theory, cultural refers to the context in which minorities see their world and interact or relate to it; society’s customs, norms, and expectations. The ecology is the environment or society where minorities live. Ogbu’s theory provides discussions and theoretical explanations to support the underlying causes behind achievement gaps within under-represented minority groups.

<table>
<thead>
<tr>
<th>“THE SYSTEM”</th>
<th>“COMMUNITY FORCES”</th>
</tr>
</thead>
<tbody>
<tr>
<td>Societal Educational Policies &amp; Practices</td>
<td>DUAL STATUS FRAME OF REFERENCE</td>
</tr>
<tr>
<td>Societal Rewards for Educational Accomplishments or Credentials</td>
<td>Instrumental Beliefs about Interpretations of Schooling (e.g., Role of Credentials in Getting Ahead)</td>
</tr>
<tr>
<td>Treatments of Minorities in School</td>
<td>Relational Beliefs about or Interpretations of Schooling (e.g., Degree of Trusting Schools &amp; Those in Control; Schooling as a Process of Subordination and Control)</td>
</tr>
<tr>
<td></td>
<td>Symbolic Beliefs about Interpretations of Schooling (e.g., Is learning curriculum, school cultural practices &amp; language a threat to minority cultural &amp; language identity?)</td>
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</table>

**MINORITY EDUCATIONAL STRATEGIES**

**SOCIAL ADJUSTMENTS & ACADEMIC ACHIEVEMENT**

**Figure 1: Two Parts of the Problem of Minority Schooling**

**Figure 1** represents what Ogbu calls the two parts of the problem of minority schooling, namely *The System* and *Community Forces*. The first column in Figure 1 is referred to as the *System*, describes how minorities are treated/mistreated in educational policies, pedagogy, and rewards for their school credentials; the second column, known as *Community Forces* represents how minorities perceive and respond to schooling, because of their treatment. Ogbu believes that how a group became a minority, affects their responses to schooling. Black immigrants who were not subjected to the same environmental practices appear to have more confidence, self-efficacy, and motivation in their education. Ogbu (1998) noted that understanding *The System* requires an examination of treatment by the establishment which creates barriers of
discrimination (such as employment, housing, social, and designation of minority culture and language known as symbolic discrimination). Because of past mistreatments of African Americans by the U.S. government, (such as the Tuskegee syphilis experiments), they are very distrusting of the System, and scientific institutions.

Figure 2: Collective Problems Faced by Minorities

Figure 2. Section 2 shows a list of three categories describing the Subsequent Discriminatory Treatment of Minorities, Categories: A - Instrumental; B - Relational; and C - Symbolic/Expressive. Category A represents discrimination which may be Economic.
(employment practices such as exclusion from mainstream status mobility system that result in job promotion; Political, Legal and Related Barriers: discrimination through political, legal & other means; Discriminatory Educational Policies and Practices: discrimination through educational policies & practices that create barriers for those with low socio-economic backgrounds, for example, high schools that are located in low-income neighborhoods are less likely to offer Advanced Placement (AP) courses. AP courses enhance college acceptance rates and are a gateway to college. Discrimination treatment described in Categories B, and C are described as Relational and Symbolic/Expressive, respectively.

The subsequent discriminatory treatment of minorities as described in Figure 2, have educational consequences described as the system (how minorities are treated in education based on educational policies, pedagogy and rewards for academic credentials). The system affects minority school performance through barriers faced by minorities. These barriers may be through instrumental discrimination, such as employment and wages, relational discrimination for example, social and residential segregation, and symbolic discrimination, such as denigration of the minority culture and language). These discriminations Ogbu calls collective problems faced by minorities (see Figure 2 above). Ogbu noted those minorities’ perceptions of and value to education is the result of the impact of societal mistreatment.
Figure 3: Minorities’ socio-cultural adaptations or collective solutions to collective problems

Figure 3 describes minorities’ socio-cultural adaptations or collective solutions to collective problems. It explains minorities’ perceptions of and their responses to education; how minorities reject the system through cultural group membership, identity and behavior. The cultural modeling or beliefs/interpretations of schooling can either be based on the value of schooling, relationship with school authority, or through cultural/language identity of schooling. Ogbu (1998) noted that societal and school discriminations against minorities are not the sole cause of low school performance; otherwise all minorities under discriminatory conditions would fail in school. The dual frame status of reference for community forces as described in figure 1 is also shown in figure 3 at the bottom of the table. Emihovich (1995) and Jacob & Jordan (1993) noted that cultural and language differences can be factors in minorities’ school failures. Cultural and language differences can contribute to learning problems; however, cultural and
language difference explanations do not explain the school success of some minority groups that face similar situations as do others that are less successful.

**Critics of Ogbu’s Theory**

Critics have cited Ogbu’s theory for the lack of acknowledgement for the diversity within Black ethnic groups, especially among involuntary minority groups (Foley, 2004; Foster, 2004 and Gibson, 1997). Involuntary minority groups include the African Americans who are the descendants of former slaves who arrived here in the United States against their will. These critics of Ogbu’s work argue that there’s no accommodation in his analysis for recognizing involuntary minority high-achievers, such as those whose motivations to strive and succeed, are deeply grounded in their experience as community participants (Foster, 2004). Ogbu argues that African Americans intentionally perform poorly because they do not want to be considered to be *acting white*. In a study conducted on Black male STEM majors in a Predominantly White Institution (PWI), Williamson (2010) argued that based on the stringent academic requirements to be admitted into this research institution, the African American student participants in this study were considered high achievers. Even though these students were not performing at equal levels as the African participants, they were determined to excel and persisted toward graduating with the STEM degree.

According to Foster (2004), Ogbu’s Cultural-Ecological theory highlights four important areas: (1) articulating that students’ academic success is impacted by community forces and system forces; that there is not enough focus on the ways in which community forces impact involuntary minority student achievement, (2) that voluntary, involuntary and autonomous minorities are distinct (3) the existence of universal, primary and secondary discontinuities between students and the schools they attend, (4) the idea that involuntary minorities such as
African Americans, have developed survival strategies, of which some promote academic success whereas others hinder it for example, client-ship or “Uncle Tomming”, collective struggle as in Black civil rights movements, hustling, emulation of whites and camouflage.

Foster (2004) argues that Ogbu’s narrative of ethnic minority success has long been shared among many black immigrants to the U.S. from the West Indies and Africa. Foster noted that Ogbu’s narrative is only suitable for the motivational needs of high-achieving black immigrants, like the way other narratives of racial uplift have historically promoted middle-class African-Americans in their desire for upward social and economic mobility (Gaines, 1996). In both examples, members of particular black ethnic groups look down upon other blacks, either as high-achievers (Foster, 2004), forthcoming, or as ignorant masses whom they perceive themselves to be superior. Foster noted that there are examples of instances in which involuntary minorities success grows out of community-based awareness of themselves and members within that community. He argued that Ogbu’s (1998) Cultural-Ecological theory on Minority school performance does not address these features of minority academic success.

Foster (2004) noted that the notion that community and system forces are both important for understanding minority responses to schooling. It is also important to note that, Ogbu did not assume there was no discrimination against minorities. Neither did he assume that discrimination had no direct negative effects on minority academic outcomes. Ogbu, however, believed that, even within the context of systematic discrimination, there was room for minority agency. Hence, he saw a need for systematic study of community forces to support the analyses of system forces. Unfortunately, according to Ogbu, involuntary minority agency was directed in ways that did not promote minority academic success. Therefore, Ogbu’s work involved
discussing the existence of racial discrimination, and then focusing on what he saw as underdeveloped territory; the role of minorities in their own academic failure.

**Rationale for using Ogbu’s Theory in This Study**

Ogbu (1998) Cultural-Ecological Theory of Minority School performance postulates that a minority’s educational views and experiences are correlated with the way in which they became a minority. This theory was selected to inform the researcher’s project due to its relevance to the study problem investigating the lived experiences and meaning-making of Black males in STEM. It provides a lens through which to filter each element of the study and its methodology. Information from those Black males who deliberately chose STEM as majors could provide useful insights into what their life experiences were like prior to college. Ogbu’s theory connects the researcher’s problem of practice with the intended study questions and method. It also provides a framework in which to conduct an Interpretive Phenomenological Analysis (IPA) study.

In describing how *community forces* shape the outcomes of Black male achievement in society, the researcher intends to inform the study using Ogbu’s framework. Ogbu’s framework provides some explanation for minorities’ perceptions of and their responses to education; why some minorities reject the *system* through issues surrounding identity, behavior and group membership. Ones perceptions and values attributed to education are culturally influenced. This could explain why most people in the developing world, whether rich or poor, place high value on education. To the poor, education is a long-term meal ticket. Understanding how these issues influence or impact undergraduate Black male STEM majors in the US, will help to put into perspective, how their educational choices are made.
Public discourse, research journals, policy reports, and various forms of media have always discussed problems, inequities, and deficit problems surrounding Black male college achievement. However, few have attempted to identify or explain the underlying causes behind statistics which show that 47% of Black male students graduated on time from U.S. high schools in 2008, compared to 78% of White male students (Schott Foundation for Public Education, 2010); Black male students are often comparatively less prepared for the rigors of college-level work (Bonner II & Bailey, 2006; Lundy-Wagner & Gasman, 2011; Palmer, Davis, & Hilton, 2009). Harper (2006a) and Strayhorn (2010) noted that in 2002, Black men comprised only 4.3% of students enrolled at institutions of higher education, the exact same percentage as in 1976. Black men are overrepresented in almost every area of revenue-generating intercollegiate sports teams, 55.3% of football and basketball players at public NCAA Division I institutions (Harper, 2012), however; in 2009, they were only 3.6% of undergraduate students. According to Harper (2006a) and Strayhorn (2010), Black male college completion rates are lowest among both sexes and all racial/ethnic groups in U.S. higher education. Black men’s college degree attainment across all levels of postsecondary education is alarmingly low. The U.S. criminal justice system is the destiny of so many Black males. There must be some formal study to ascertain what is going on with these dismal statistics as described above. Ogbu’s (1998) theory attempted to address how and why different minority groups adapt to schooling differently and why their achievement rates are different.

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Applying Ogbu (1998) Cultural-Ecological Theory to the Study

Ogbu’s (1998) Cultural-Ecological Theory of Minority School performance is quite related to the researcher’s intended study because gaining insights into the life experiences of undergraduate Black male STEM majors who are first or second semester seniors, can provide useful clues as to how STEM career choices are made, which hopefully could help to identify some factors which contribute to achievement gaps among Black males. The unemployment rates within the Black community are relatively high and even higher for Black males. Black females outnumber Black males 2:1 in college degree attainment (U.S. Department of Education, 2012). Ogbu’s (1998) theory addresses how and why different minority groups adapt to schooling differently and why their achievement rates are different.

Study involving Black male STEM majors at a historically black college could provide a wealth of information on their life experiences and the forces that shape their socio-cultural and religious identities. Implications from this study could help to inform student engagement procedures, raising the awareness that students experience college differently on all levels, depending on their ethnicity and race (Cabrera, Nora, Terenzini, Pascarella, & Hagedorn, 1999; Johnson, 2003; Reid & Radhakrishnan, 2003); also, direct the shaping of policy and practice in education departments within the United States.
Ogbu (1998) Cultural Ecological Theory on minority school performance describes what he called *community forces* as the result of socio-cultural adaptation within the minority community. He believed that understanding *community forces* was important in providing insights into why immigrant minorities tend to excel in school compared to non-immigrants.

**Summary**

There are too few Black males in the STEM fields in the United States. In a time when the global economy continues to expand, it is imperative to develop meaningful strategies to engage and attract more minorities, not only in higher education but also in STEM. Research has shown that by the mid-twenty first century, the United States will become a minority-majority. The lack of productivity for the unemployed could in the long run, be a liability to the State and Federal Government. Understanding what factors are contributing to educational disparities among minorities, including Black males is essential to addressing the high crime rates, including homicides, drug abuse, high unemployment, poor healthcare, and hopelessness within the African American community. A nation’s economy and global competitiveness will depend on the productivity and skill of all its citizens. The high unemployment rates within the Black community can be addressed with the redistribution of skill sets and training within the workforce and in education.

Using the IPA methodological approach, this current study was focused on the experiences of Black male STEM undergraduate senior and/or junior students, how they make personally salient meanings through their accounts, as shared during semi-structured interviews. Smith, Flowers & Larkin (2009) noted that the general principle behind IPA research deals with its capacity to capture the meaning that individuals attribute to major life experiences such that
others can understand, appreciate, and support them and those in similar situations in more meaningful ways.

The following chapter reviews existing literature relating to the underrepresentation of minorities in STEM fields. Taking into account the scope of the problem in the United States, the chapter also weighs the potential impacts of this trend on greater society, including our collective position on the global stage.
Chapter Two: Literature Review

Expanding the inclusion of underrepresented minorities in science, technology, engineering, and mathematics (STEM) over the years has become a national policy of the United States government. In a State of the Union address to the nation, former President of the United States Barack Obama called upon lawmakers, challenging them to restore the country’s status as a global leader by increasing the number of higher education graduates to the highest in the world by 2025 (Obama, 2009). To achieve this task of global competitiveness, expanding the goal of higher educational achievement requires the inclusion of more underrepresented minorities in highly technical fields such as STEM. The United States has relied largely on a White male-dominated system of STEM workforce for a very long time (Babco, 2003).

Existing literature has not adequately examined the recruitment and engagement of Black males in STEM by higher education institutions. The talent pool from which higher education institutions currently draw students must include more underrepresented minorities, particularly Black males. However, existing literature has revealed that there are issues regarding the preparation of Blacks for STEM careers, beginning in their high school years (Alexander, 2009; Darling-Hammond, 2010; Hursh, 2008; Lingard, 2010).

The most common themes in existing literature demonstrate differences in educational and socio-economic opportunities between underrepresented minorities and Whites. When viewed through the lens of gender, education disparities are much worse within the Black community where bachelor’s degree holders for Black males are far behind Black females (Snyder & Hoffman, 2004). Black males also have higher crime rates (homicide, robbery, assault and drug abuse), than the general population (Blake & Darling, 1994). Young Black males have become violent crime victims in every major city in America, for example,
Baltimore, Chicago, Los Angeles, and Washington D.C. Efforts made by the United States government to address the problems of high unemployment, social injustice, and high crime rates among Black males have been ineffective. The homicide rate for Black males between the ages of 12 and 24 years old is 17.6% for single victims. This is about 115 deaths per 100,000 Black males for this age group (The United States Department of Justice Bureau of Justice Statistics, 1992-2005). The 12-24-year-old age group is the most vulnerable for Black males in the United States. Black males within this age group are about 14 times more likely to be homicide victims compared to other members of the U.S general population (Bureau of Justice Statistics, 2009).

Williamson (2010) noted that the socio-economic and educational status of Black males in the United States are in a state of abandonment or jeopardy. This review of literature discusses current findings that draw attention to the need for more Black males in STEM. According to Leslie, McLure, and Oaxaca, (1998), Black males are more likely than White males to choose business as a major as opposed to choosing STEM. Hrabowski (2003) noted that Black males are less likely to major in the fields of science, technology, engineering, or mathematics (STEM). This is usually the case in the areas of mathematics and physical science. According to Hrabowski, (2003) disparities in degree attainment between racial minorities and Whites are due to the differences in educational and social opportunities, which Ogbu (1998) describes as the system and community forces (Refer to Chapter 1 of this paper).

Academic achievements in STEM are very essential to the American economy and realizing the American dream. STEM is also vital if we as a nation must remain globally competitive. STEM training also provides better job prospects for the Black community, which historically has endured long-term high unemployment rates and high crime rates. In a growing global economy, the need for new skills and training in STEM fields are in high demand.
Oakes (2004) noted that a large segment of the Black population lives in urban areas where schools are usually overcrowded and have high failure rates. Black students who enroll in college are often first-generation college students, whose parents may not have a college education, and educational opportunities may be limited. Existing literature discussed in this review, examines apparent factors or forces that are at play when Black male college students choose to enroll as STEM majors.

In this literature review, studies examining Blacks in STEM fields will be analyzed, followed by a review and analysis of literature focusing on too few Black males in STEM, additionally, the involvement of Blacks in the United States criminal justice system will be examined.

**Blacks in STEM Fields**

Existing research that examines the preparation of Blacks in STEM fields and their relative educational disparities will be examined first. Math and science have always been the gateway to STEM success. Students who attend schools that are lacking in these foundation courses will often struggle with or choose to avoid the challenges that STEM presents by choosing non-STEM careers. Non-STEM careers are among some of the lowest paid occupations available. STEM is the field where Blacks are largely under-represented. Many Blacks who choose non-STEM careers such as history, music, art, business, sociology and the like, are often less likely to afford a comfortable living due to low income, working multiple jobs to make ends meet, unemployment or under-employment.
Inadequate Academic Preparation for Blacks

Findings in this literature review have consistently demonstrated the under-achievement of Black males at all educational levels: elementary, secondary, and higher education (Fan, 2001; Steinberg, Dornbusch, & Brown, 1992). Murray & Jackson, 1999 have attempted to address the low teacher expectations, along with student enrolment in low ability classes and how they impair the students’ abilities in these types of educational environments. Lankford, Loeb, & Wyckoff, 2002, noted that underperforming schools with under-educated teachers and underachieving peer groups all contribute to these trends of low academic achievement. People are usually molded by their environment (peers, familial, social, economic, or academic). Thus, making drastic changes in the learning environment can help to improve the learning outcomes of all students.

Existing literature has shown that for many poor Blacks, the pre-college education system does not adequately prepare and motivate them to pursue STEM careers. The quality of education a child receives will depend on where that child lives. Many Blacks are not provided the opportunity to experience rigorous math and science (gateway courses in STEM) in seventh through twelfth grade classrooms, and from the engagement and support of experienced and certified teachers. According to Leslie, McLure, and Oaxaca, (1998) Black males are more likely than White males to choose business as a major as opposed to choosing STEM. Hrabowski (2003) noted that Black males are less likely to major in the fields of science, technology, engineering, or mathematics (STEM). This is usually the case in the areas of mathematics and physical science. Hrabowski, (2003) noted that disparities in degree attainment between racial minorities and Whites are due to differences in educational and social opportunities. Alexander, (2009); Darling-Hammond, (2010); Hursh, (2008) and Lingard,
(2010) argue that educators should learn from the emerging international evidence of failure over the past three decades of the neo-liberal education policy ensemble.

Themes from the following literature discuss the influence of the learning environment on students’ academic achievement. Atwater and Simpson (1984) noted that there is a positive association between high school characteristics, prior academic achievement, and future success in science and engineering programs. (Atwater and Simpson, 1984), noted that attitudes toward math and science courses are contributing factors to Black students’ success. Findings from Strayhorn’s (2010a) study have shown how educational and occupation aspirations are instrumental in Black students’ entry into college and STEM. Strayhorn’s findings have supported other previous studies such as (Atwater and Simpson, 1984) that without adequate educational preparation in math and science in their pre-college years, many students would not choose STEM as majors. These themes have emphasized the importance of adequate academic preparation in math and science for STEM majors because students who lack these foundation courses are less likely to have educational and occupational aspirations in these fields.

Strayhorn (2010a) noted that Black students who aspire to complete their education beyond high school are often successful in this endeavor. Since educational aspirations beyond high school are vital to every student’s success, including Blacks, it is essential to provide better opportunities for learning and engagement in and out of the classroom. Strayhorn (2010a) noted that much more is required to focus future efforts in guiding, preparing and nurturing Black males’ occupational and educational aspirations, including non-cognitive factors, in STEM. For example, schools must organize more STEM field trips, starting in elementary and high school. Field trips to industrial sites, once every year or semester, would be a good start to motivating students to real-life situations. Students who are hands-on would be able to apply classroom
projects or courses to their field experiences. Others may be able to engage or enrich their classroom discussions and relate and connect more with the subject material.

Most people live in areas they can afford. The poor has little or no choice but to live in areas that may have over-crowded, under-equipped schools that have low standards of achievement and high crime rates. Living in these high-risk neighborhoods, for many poor Blacks, is quite hopeless; many will not even dream of graduating from high school, let alone beyond that.

**Unequal Opportunities in Education**

In the United States, getting an opportunity for an excellent education depends on where one lives. A large segment of the poor minority population lives in urban areas where schools are usually crowded, where academic achievement is sub-standard and teacher turnover is higher. Several of these schools do not offer Advanced Placement (AP) courses, the gateway to college acceptance. Oakes, (2004) noted that urban schools are likely to provide fewer opportunities for advancement, have poor quality teachers, and high failure rates. Schools with high failure rates and attrition rates present challenges to federal, state, local governments and the local healthcare systems. Previous studies have shown disparities in post-secondary schooling, grade retention and school discipline for poor people of color. A National Assessment of Educational Progress, (NAEP, 2010) study shows the suspension rate for Blacks to be 50%, 33% for Hispanics and 20% for Whites. Babco, (2003) noted that these students are being disadvantaged, and in the end, are unprepared for a challenging future with little hope to participate in America’s merit-based society or the American Dream.
Darling-Hammond, (2004) has noted that inequities in educational opportunities have resulted in some schools that are better equipped while others are under-equipped. Some schools, particularly those in affluent neighborhoods, receive much more state and federal funding than those in low-income neighborhoods. Usually, state and federal government provide larger funding to richer schools, whereas the poorer ones receive smaller amounts and as a result, are less likely to afford competent teachers and purchase needed school equipment. States promote inequalities by (1) failing to use the equalizing formula in funding allocation to schools; (2) allowing provisions that work against the equalizing formula; and (3) inability to fund the full cost of education, resulting in rationing. According to Kozol (1991), children from poor socio-economic backgrounds are being disadvantaged based solely on their poverty status, which Kozol described as inequality under the law.

Educational disparities, based on race and social class, have been a major setback to the nation’s economy due to the lack of productivity. More than two-thirds of the teachers in colleges that have a White majority have certification compared to those in African American or Latino schools. One study conducted by the Educational Digest, (NAEP, 2010) shows the suspension rate for Blacks to be 50%, 33% for Hispanics and 20% for Whites. This is quite staggering considering the high incarceration rates of Blacks. Today, American preK-12 students are still struggling, and behind other countries (developed and developing) in STEM. The Organization for Economic Corporation and Development (OECD), states that students in the United States ranked 25 out of 34 countries, behind China, Singapore, South Korea, Hong Kong, and Finland (OECD, 2013; Hechinger, 2010). One major concern is the huge education attainment gaps, not only between black and whites but also within Black racial-ethnic groups.
America’s national and global economic strength are the driving forces, which constantly reflect how educated and productive its workforce is. The U.S. higher education system, which depends on the preK-12 pipeline, serves to provide and maintain a robust economy, driven by the competencies of all Americans. An education system that produces the nation’s STEM workforce is very critical, especially as the country faces the globalization challenges in technology, science, and economic uncertainties. Inequities in the United States preK-12 school system could possibly explain disparities in Black male STEM higher education.

Achievement Gaps within Black Ethnic Groups

Educational achievement gaps not only exist between White and Blacks but also within Black racial-ethnic groups. Understanding intra-racial and ethnic differences in academic achievement within any ethnic racial community can provide insights into how to improve services in this community. Williamson (2010) noted that (1) families are a pivotal force for Black male STEM students, (2) academic experiences vary across racial-ethnic groups, (3) interaction with faculty is essential to student’s success, and (4) that interaction between Black ethnic groups is lacking due to Black distancing. Black immigrants appear to have higher self-efficacy, self-esteem, and motivation about education, than African-Americans. Black male immigrants appear to perform better and likely to major in STEM than African Americans, (Williams, Fleming, Jones, & Griffin, 2007). Hrabowski, (2003), noted that overall, there is a relatively small percentage of Blacks who are STEM majors. Specifically, there are only a few Black males who choose to major in STEM fields.

Even though much attention has been given from researchers, politicians, and community organizations, the education achievement gap between Whites and Blacks continue to expand (Williamson, 2010). When viewed within the context of gender, the trend is even more
pronounced. Williamson, (2010) argues that the proportion of Black male college students continues to decrease relative to other ethnic populations. Findings from previous studies usually assume that the college experience of Black men and Black women are the same, which it is not the case. Black females outnumber Black males by 2 to 1, when it comes to college degree attainment (U.S. Department of Education, 2012). Williamson’s (2010) showed that only a few Black males attend college through graduation and at a substantially lower rate than other racial ethnic groups. Findings are, that of the small numbers of Black students who can matriculate in higher education and earn a bachelor’s degree, many do not major in STEM fields. The few that does, often major in the life science such as biology rather than the physical sciences such as chemistry, physics, chemical engineering, and mechanical engineering.

The Effects of the Family’s Role on Black Males’ Academic Achievement

Previous studies have shown that family environmental factors, such as undereducated parents, poverty (Duncan, Yeung, Brooks-Gunn, & Smith, 1998; McLoyd, 1998), and living in single-parent homes (Bankston & Caldas, 1993; Barbarin & Soler, 1993; Teachman, Day, Paasch, Carver, & Call, 1998), have negatively affected the Black family. However, little attention is given to the family functioning factors that influence Black male achievement.

Kumpfer & Alvarado, (2003) noted that parents can correct or change their parenting behavior in such a way that it can have positive impact on the child. Mandara (2006) noted that family functioning factors are the most important modifiable resources with which parents are equipped. Maranda (2006) noted that most socio-economic and family structure effects on achievement have been impacted by various family-functioning factors. Mandara & Murray, (2000) have criticized the lack of attention being given to the impact of family functioning factors on the influence of African American male achievement. Common themes from these
literatures are centered around the idea that policy and interventions are less likely to produce result if they are more focused on demographic factors rather than familial factors. Thus, the importance of the familial contribution to a child’s development must not be ignored.

Several researchers on the family have emphasized the importance of having an environment that fosters both supportive and nurturing (love and warmth), along with consistent guidance and demandingness. (Duncan, Yeung, Brooks-Gunn, & Smith, 1998; McLoyd, 1998; Bankston & Caldas, 1993; Barbarin & Soler, 1993; Teachman, Day, Paasch, Carver, & Call, 1998), have all supported the notion that proper parenting can have lasting positive effects on the learning outcomes of children.

**The Importance of Involving Parents in their Children’s Education**

The impacts of the involvement of parents in their children’s school activities and homework has been extensively discussed in existing literature. Reynolds (1989) noted that Black parents who are involved in their children’s homework and school activities have higher levels of achievement. Marcon (1999) noted that African American children whose parents are involved in their education showed higher scores in math, science, overall GPA, work habits, and social development. One study conducted by (Mandara & Murray, 2002), cited that Black boys whose parents neglected them, scored lower than Black boys with authoritative and authoritarian parents; regarding self-control, feelings of power, and identity integration. They define *authoritarian* parents as firm disciplinarians who lack the warmth of the *authoritative parents*, whereas, *authoritative* parents are high in both warmth and control. The familial element has been cited as essential to the learning outcome of the child. Children who have been neglected seldom have high self-efficacy and confidence in life. They need to be supported and guided as they navigate the treacherous pathways of life.
Black Women Outnumber Black Men on College Campuses

Black women continue to outnumber Black men on college campuses by a two to one margin, which is the largest gap among gender in all races (U.S. Department of Education, 2012). According to Cuyjet (2006), the representation of Black males in the U.S. is greater than their representation on college campuses. It is easier for Black males to end up in jail or murdered than in college. Cuyjet (2006) noted that the decreasing number of Black men on college campuses disproportionately affects the pool of individuals from which college students might pick potential mates, since most people in the U.S. still date and marry within their own race and social class (Lichter, 2010; Tsunokai, Kposowa, & Adams, 2009). Due to the low number of Black males who will go to college, this also limits the possibility for diversity outcomes, which result from cross-cultural interactions among college students (Strayhorn, 2010b, 2013a). Therefore, there are urgent needs for meaningful changes that will successfully increase the enrollment and success rates among Black men in higher education and the STEM fields.

New strategies to enroll, engage and retain more African American males in higher education institutions must be determined. Many Black males, who are STEM majors, are immigrants from the continental Africa and the Caribbean. According to a Science and Engineering Report by the National Science Board (NSB, 2012), Blacks are not only underrepresented in STEM but also less likely to complete a college degree in the field. African Americans earn 4.7% and 9.2% respectively engineering and science undergraduate degrees compared to 66% for White students. In computer science, materials engineering, and math, Black males are in single digits or absent, despite efforts to address these disparities in the STEM fields, (Strayhorn, 2015). Strayhorn (2013a) noted that one third of all Black men who enroll in
college, drop out. This is alarming considering that college degree is important for upward social mobility and future job prospect. The researcher agrees that not all people are “college material”, however; those who are not must have an opportunity to develop technical skills or trades such as plumbing, auto-mechanics, building construction and other areas. Since the industrial revolution, trade schools have become uncommon in the United States.

**Relatively High Homicide Rates for Black Males between the Ages of 12 and 24**

The homicide rate for Black males between the ages of 12 and 24 years old is 17.6% for single victims; this is about 115 deaths per 100,000 Black males for this age group (Department of Justice, Bureau of Justice Statistics, 2011). The crime and incarceration rates for poor Black males are astronomical compared to White males who commit the same or similar crimes (National Crime Victimization Survey, NCVS, 2008); (Crawford, Chiricos & Kleck, 1998; Crawford, 2000). Existing literature does not adequately address the need for marketable skills within the Black community. Expanding training in STEM would address the comparatively high rates of unemployment, poverty, and lack of educational opportunities within the Black community because STEM skills are in high demand just like auto-mechanics and plumbing.

Currently, national crime statistics has shown that there is a national crisis for Black males in the United States. A large number of Black males have been incarcerated or caught up in the criminal justice system (United States Department of Justice; USDOJ Crime Statistics, 2013). Due to the relatively high homicide and incarceration rates, so many Black children grow up in single parent households without their fathers or mothers’ contribution to their nurturing, upbringing, guidance, discipline, confidence, and self-efficacy. The long-term effects of these broken families on children are important.
Summary

This body of literature described the inadequate academic preparations, achievement gaps, and gender gaps that exist among Blacks from K-12 to higher education. Inadequate academic preparation among underrepresented racial and ethnic minorities such as Black males, has resulted in Black distancing by many, from the STEM fields as a career option. Inadequate preparation for STEM gatekeeper courses, such as math and science, has created obstacles to underrepresented minorities such as Black males, from majoring in STEM fields.

A large segment of the Black population lives in urban areas, where schools are often crowded, where academic achievement standard is lower and teacher turnover rates are higher. Several of these schools do not offer Advanced Placement (AP) courses, the gateway to college acceptance. Urban schools are likely to provide fewer opportunities for advancement and have poorer quality teachers and high failure rates.

Relative to other ethnic populations, the proportion of Black male college students continues to decrease. Previous studies assume that the college experience of Black men and Black women are the same, which it is not. Black females with a college degree outnumber Black males by 2 to 1. Black males are overrepresented in sports and other forms of entertainment. An overwhelmingly large number of Black males are also felons. More effort should be made by the United States government to reach out to a lost generation of Black males, through creating better educational and skills training opportunities.

The involvement of parents in their children’s education cannot be over-emphasized. African American males, who have parents that are authoritative, are more behaviorally and psychologically adjusted. They also perform better academically than those who do not. Those
Black males who are at risk are those who have permissive and neglectful parents. They are the ones who are at risk for psychological behavior, and academic problems. Implications from these studies can be used by policy-makers and academic administrators to involve and engage more Black parents into their children’s academic life. The guidance and support provided by their parents will help to develop more confidence and motivation.

People who are educated tend to make better healthcare and lifestyle choices. Those who are not skilled or educated enough to secure a good job with health benefits will, in the future, overwhelm the United States healthcare system. It is therefore, an urgent need for education administrators and policy-makers to address the inequities in educational opportunities that exist in our school system.

Too Few Black Males in STEM

Educational underrepresentation of Blacks in STEM, with specific focus on Black males will be reviewed in this section. Blacks refer to all Black people whose ancestral origins lie in groups of African descent (immigrants and non-immigrants), living in the United States.

The Underrepresentation of Black Males in STEM

Black Males are largely under-represented in science, technology, engineering and mathematics (STEM), programs, (Williamson, 2010). There is huge distrust between African Americans, Science, and the U.S. government (Shavers-Hornaday, Lynch, Burmeister, & Torner, 1997). Because of a dark period in history in the United States where Blacks were deceived by U.S. government officials who allowed them to participate in syphilis clinical studies without informed consent nor proper medical treatment (Tuskegee Syphilis Study, 1932-1972; Quinn 1991). From this experience, the levels of mistrust of medical researchers and the scientific
community have lingered over the years. Blacks are among the most unwilling to participate as clinical research subjects. Some Blacks are critical of science and scientific experiments involving humans (Scharff; Mathews; Jackson; Hoffsuemmer; Martin; & Edwards, 2010). Scharff, et al. (2010) noted that mistrust is due to historical events such as the Tuskegee syphilis study, and is reinforced by health system issues and discriminatory events that continue to this day.

The mistrust of science and scientific institutions by Blacks, have led to low levels of involvement in clinical studies. The lack of involvement by African Americans in clinical studies could in the future, affect the population (Shavers-Hornaday, Lynch, Burmeister, & Torne, 1997). This may be due to the limited available clinical data on such population. Plutzer (2013) noted that there is racial gap in confidence in science due to inequities in educational opportunities. Museus, Palmer, Davis, & Miramba, (2011) noted that the lower levels of achievement in science among African Americans could prevent interventions that are meant to increase involvement of African Americans in the STEM professions.

**Inadequate Preparation in Math and Science**

Strayhorn (2011) asserted that inadequate preparation for college-level math and science courses could be one of the reasons some Black males may leave STEM majors even after signing up. Cole and Espinosa, (2008), noted that some Blacks may leave STEM due to lost interest or due to difficulty establishing a connection or practicality between STEM and daily life. May and Chubin, (2003) noted that some racial ethnic minorities, including Blacks, equate math and science with negative connotations such as boring, nerdy and hard. These studies suggest that negative beliefs can have adverse impact on Black males for considering STEM as a career option. Low self-efficacy because of not having rigorous math and science preparation
along with attending low-performing high-need schools, reflect the reality of many poor
underrepresented minorities, including Blacks (Bonous-Hammarth, 2000).

According to the National Urban League, (2007), 36% of all Black youth grow up in
poverty, which is an alarming statistic, considering the limited opportunities available when
one is poor. Strayhorn, (2011), noted that limited exposure to rigorous math and science courses
and highly qualified teachers during the K-12 years can have long-term consequences on those
with STEM ambitions. In a Strayhorn (2009a) study, Black males found STEM subject matter
such as water filtration formulas or wind turbine operations too difficult or technical to relate to
real life problems. Strayhorn noted that without an ability to establish connection between
STEM and real-life situations, some Black men will become disengaged in the STEM classroom
or lose interest in the subject.

The Role of Historically Black Colleges and Universities (HBCU) in STEM

One issue that may have eluded researchers who have examined the racial-ethnic
disparities in education attainment in the United States is the disparity of Black males in STEM.
Pascarella & Terenzini, (1991) noted that Blacks who attend predominantly White institutions
are less likely to enroll in majors such as STEM, with high earning potential as students enrolled
in Historically Black Colleges and Universities (HBCU). Therefore, it is important to consider
how major choices influence persistence by Blacks in predominantly White universities in
comparison to Whites. (Pascarella & Terenzini, 1991) noted that understanding how these
influences affect underrepresented racial and ethnic minorities could have implications for state
and institutional efforts to promote diversity in higher education.
There is no clear explanation for the racial gap in self-efficacy when it comes to science in the U.S. schools and colleges (Buchanan, & Selmon, 2008; Konrad, & Harris, 2002). However, there are several contributory factors involved including socio-economic status, race, ethnicity and familial influences. Achievement gaps have resulted in the alienation of a large segment of the population and loss productivity. These untapped potentials are future talents, skills and innovation that could have made a difference in the United States and global economies. The high un-employment rates among the African Americans could be relieved with more skills in the STEM fields. Historically Black Colleges and Universities (HBCUs) have been the main source of Black college graduates, particularly STEM graduates; however, the number of Black male STEM graduates is relatively small compared to the overall percentage of Blacks in the national population.

Many scholars have made compelling arguments regarding important issues that are affecting underrepresented minorities’ perceptions of going to college. Hurtado & Ponjuan (2005), (Morris & Daniel, 2008) and Strayhorn (2013a), noted that racial-ethnic minorities may experience hostility and unwelcoming experiences on campus such as social isolation, racism, negative stereotypes about their academic ability in college and the like. Strayhorn (2015) noted in his previous study, that 88% of participants felt pressured to prove their intellectual ability, even with prior achievements and participation in a university scholarship program.

There have been few studies that address the experiences of Black male STEM majors and the forces affecting their persistence in college has been uncommon. Several existing studies have primarily focused on racial-ethnic gaps in education as compared to Whites. There are far more Black females (both STEM and non-STEM), with college degrees than Black males (Snyder & Hoffman, 2004; Strayhorn, 2011). Black female students outnumber Black males by
a two- to- one margin. Thus, studies focusing on the former are more common. More studies focusing on the experiences of Black males are highly warranted. Johnson asserted that despite countless school reform efforts aimed at closing the achievement gap, the problem persists. Boykin and Noguera, (2011) noted that doing more of what has not worked to improve educational opportunities, has been the case for many years.

**Comparing Afro-Caribbean and African American Students in Chemistry**

In a comparative study, Pinder (2012) examined the achievement pattern differences and the role that family factors play in these differences between Afro-Caribbean and African American Students in the United States. Findings from quarterly chemistry test score results have shown that the Afro-Caribbean students performed better. Differences in achievement between Afro-Caribbean and African American students could help explain how members of these groups arrived in the United States (Williams, Fleming, Jones, & Griffin, 2007; Ogbu, 1998). One critique of this study was that the study sample was too small to be significant and representative of the populations; however, statistical parameters showed that the results are within 95% confidence. Previous studies have also shown that Afro-Caribbean freshmen college students performed better in science and mathematics compared to African Americans (Williams, Fleming, Jones, & Griffin, 2007; Pinder, 2012).

**Caribbean Parents More Involved in their Children’s Education**

Pinder (2012), Codje, (2007) and (Lee, & Bowen, 2006) noted that Afro-Caribbean parents spend significantly more time assisting their children with homework than African Americans. Parents taking the time to engage students with their homework can make a difference through motivating them, and in reinforcing the importance of the assignment.
Teachers and parents both need to reinforce assignments and taking the time to engage students in these endeavors. A historical study conducted by Slaughter-Defoe & Schneider, (1986) found that middle class Black children adapt more easily to a wide range of educational programs than poorer children. Slaughter-Defoe and Schneider noted that the beliefs and values held by their parents about learning are consistent with the private school’s mission and goals. Parents who could afford to send their children there, select private schools; however, there are children whose parents are poor and cannot afford to send them to private schools, but to neighborhood schools of whatever quality. Slaughter-Defoe stated that when parents are actively engaged in their children’s education, schools engage in responsible teaching, and there is respect between both parties, Black children can learn just like any other. Beyond the pre-school years, the continuity of children’s development will depend on both family and school engagement (Slaughter-Defoe, 1995). Future studies on the role of parenting on learning outcome could provide insights into how to include other disadvantaged ethnic groups.

**Black Immigrants and Education Attainment**

Many immigrants, particularly Black immigrants, (for example Africans, West Indians Afro-Caribbean’s) within the United States appear to be highly motivated to succeed in school and are likely to excel due to the high value placed on education. According to (Pinder, 2012) Black immigrants appear to have high self-efficacy, and elevated status of living in the United States, “the land of opportunity,” (p.727), and (Williams, Fleming, Jones, & Griffin, 2007).

Pinder (2012); Codjoe (2007); and Lee & Bowen (2006), noted that Black immigrants appear to have better parental and familial support in their academic endeavors. The parents and other relatives of Black immigrants make extreme sacrifice to come to the U.S. and start over in order to provide better opportunities for their children’s future. Many of these immigrant parents
are unskilled and become integrated into American society by washing dishes, scrubbing floors, handy-man services and other low-income occupations. Coming to the United States from the developing world is a great opportunity for many immigrants who now have access to infinite resources and endless possibilities.

**Summary**

This review examined the educational underrepresentation of Black males in STEM fields. In a time when the unemployment and crime rates among Black males are alarming, providing more opportunities for learning new skills through STEM education, which is a high demand field, is an alternative. Previous studies have shown that involving more Black males in STEM must begin from early childhood and continue through 12th grade. Inadequate preparations in math and science during the pre-college years have made it more difficult for Black males to pursue STEM careers. Findings in literature for strand two have shown that Black males who do not show interest in STEM may have difficulty establishing a connection or practicality with this field and daily life. Many Blacks equate math and science with negative connotations such as that it is boring, nerdy, or hard. These negative perceptions can have adverse impact on those who are considering STEM careers.

Historically Black colleges and universities (HBCUs) have been the main sources of Black college graduates in the United States. Findings are that Blacks who attend predominantly White institutions are less likely to choose STEM as majors. It is therefore important to ascertain how major choices influence persistence by Blacks in predominantly White universities. Implications from these studies could help shape policy decisions that are geared toward promoting diversity in higher education.
One common theme among this body of literature is the presence of inequities in educational opportunities for Blacks who come from low socio-economic backgrounds. A huge volume of these materials focuses and address the widening education attainment gaps between Whites and under-represented poor minority groups such as the Blacks, Native Americans, and Hispanics. Only few address or explore issues from the perspective of the Black male preparation and personal experience in STEM.

Findings from the body of literature examined have shown that Black immigrants in the United States appear to have high motivation to succeed in school and are likely to excel due to the high value placed on education. Black immigrants appear to have better parental and familial support in their academic endeavors. The parents and other relatives of Black immigrants make extreme sacrifice to come to the United States and start over to provide better opportunities for their children’s future. Many of these immigrant parents are unskilled and become integrated into American society by washing dishes, scrubbing floors, handy-man services and other low-income occupations.

Evidence in the literature examined has shown that Black immigrants perform better in STEM courses and are likely to choose STEM careers. Many Black immigrants in the United States come from poor backgrounds in the Third World, yet still they perform better in school. Findings have shown that a more robust educational system in Third World countries, which provides a better academic preparation in math and science starting in k-12 grade, explains. Adequate k-12 academic preparation in STEM gateway courses along with familial involvement and a passion for the value of education may explain why Black Caribbean students perform better in chemistry than African American students who took the same exam. Findings have also indicated that Caribbean parents are also more involved in their children’s education. They show
more interest by providing guidance and engaging their children with their homework. It is important for both teachers and parents to engage their students in these endeavors.

In the United States, Black females, Hispanic females, and Native American females are much more likely to participate in higher education than are Black males, Hispanic males and Native American males. In addition, like all females, they are less likely to choose science and engineering fields as college majors. Reliable financial support may be an obstacle for Blacks and other racial-ethnic minority students to pursue higher education in any field. Blacks and other racial-ethnic minority students encounter more risk factors than most undergraduate population in the nation. These risk factors have threatened their ability to enroll in a postsecondary institution and to complete a degree and may be responsible to some degree, for education disparities. Delayed enrollment, part-time attendance, limited financial resources, having dependents, being a single parent, and working full-time may contribute to Blacks and other ethnic minorities not completing their degrees. The final strand, strand three which follows, discusses the state of Black people and the American Criminal Justice System.

**Blacks in the American Criminal Justice System**

Through a critical examination of existing research, this section focuses on the outcomes of Black males in America, many of whom are involved in the criminal justice system, with relatively high unemployment rates, high crime rates (homicide, robbery, assault), and huge achievement gaps in education. The review seeks to focus attention on the lack of educational opportunities within the African American community and the high incarceration and homicide rates of Black males in general.

**America’s Pre-school to Prison Pipeline**
The U.S. Department of Education, 2014, stated that African American schoolchildren are at least three times more likely to be suspended and expelled than non-Hispanic Whites. Even though African Americans are 0.5% of total enrollment, they are 3% of total expulsions. Widely over-enforced disciplinary measures such as suspension and expulsion have been frequently used on children of color, compared to White children. Data derived from a Texas A&M (2015) University study has shown that children of color make up more than two-thirds of the state’s population. In Austin, Independent School District, children of color make up 75% of the total enrollment. This school district has Caucasian teachers making up most the staff; resulting in a huge demographic gap between students and teachers.

Findings in the above study are that one of the most important predictors of long-term positive outcomes for children is the teacher-student relationship; the quality of child-teacher interactions in preschool is essential in shaping the behavioral outcomes through eighth grade. In one study, (Hamre, & Pianta, 2001) noted that teacher-reported closeness with students is positively related to growth in the children’s receptive vocabulary and reading abilities from preschool through second grade. Recommendations from these studies are that the rapidly changing demographics require that school districts implement strong social and emotional curricula for students. Adequate training for teachers is also warranted; school districts, administrators, and teachers must work together to overcome inherent biases which will foster high achievement and ultimately, better standards of school success.

**High Homicide and Incarceration Rates among Black Males**

The homicide rate for Black males between the ages of 12 and 24 years old is 17.6% for single victims. This is about 115 deaths per 100,000 Black males for this age group (The United States Department of Justice Bureau of Justice Statistics, 1992-2005). The 12-24-year-old age
group is the most vulnerable for Black males in the United States. The National Crime Victimization Survey (NCVS) Bureau of Justice Statistics (BJS, 2008), stated that Black males within this age group are about 14 times more likely to be murdered than any other members of the general population. This is the critical age group where people should be establishing a solid foundation in education in support of making a meaningful life, which ultimately, will lead to becoming productive citizens.

The BJS (2008), stated that the crime and incarceration rates for poor Black males are astronomical compared to White males who commit the same or similar crimes (BJS, 2008; Crawford, Chiricos, & Kleck, 1998; Crawford, 2000; Kautt and Spohns, 2002). This disparity in crime and justice is common throughout America. Instead of addressing educational inequities and school under-achievement issues, lawmakers in Washington seem to ignore the urgency of the situation. Americans should hold their politicians more accountable for the education of its citizens; which is one of the basic rights of democratic citizenship, not just job creation (Knoester, 2012).

When viewed through the lens of gender, education attainment gap is much worse in the Black community where bachelor’s degree holders for Black males, lag behind Black females (Snyder & Hoffman, 2004). Black males also have higher incarceration, death, drug abuse and unemployment rates (Blake & Darling, 1994). Recalling recent incidents highlighted in the mass media, showing video footages of rogue Police Officers in the act of gunning down unarmed Black males on the streets, without being charged is a moral outrage. Unfortunately, some victims lost their lives while in police custody. One victim lost his life in New York, in a chokehold for selling cigarettes out of the trunk of his vehicle. In another instance, a Black female motorist was arrested in Texas, for driving with a broken tail light; she later died in jail
and no one was charged with her death. A cell phone video footage also showed a Black male who was shot in the back in North Carolina, while running away from a rogue police officer. It took a lot of pressure from the public to get accountability for some of these deaths while in police custody. These are just a few of the many cases, including the Freddie Gray case in Baltimore, Maryland. The US is in a state of crisis because of its handling of the Black criminal investigation issues, it’s lack of transparency, and its racially-biased criminal justice system. Overall, the Justice System is biased against the poor, more so, against Black people and other racial minorities.

**Black Males and Poverty Rates**

Braveman, (2010) has shown that people who are poorer and who have less education are more likely to suffer from major health problems such as diseases, loss of functioning, to be cognitively and physically impaired, and to experience higher mortality rates (Adler, Boyce, Chesney, Folkman, & Syme, 1993; Adler et al., 1994; Washington, 2008). A clear majority of poverty-stricken minorities attend schools that are in urbanized areas where academic achievement is lower, schools are often over-crowded and teacher turnover rates are higher. These schools are likely to provide fewer opportunities for advancement, have poor quality teachers and high failure rates (Oakes, 2004). These challenges present unnecessary burdens on federal, state and local governments and local healthcare systems. Statistics have shown disparities in post-secondary schooling, grade retention and school discipline for poor people of color. One study shows the suspension rate for African Americans to be 50%, 33% for Hispanics and 20% for Whites, (National Assessment of Education Progress, NAEP, 2010).

Current reports indicate that the high school graduation rates in the United States for African Americans are about 72.5%, and Latinos 76.3%, (National Center for Education
Statistics, NCES, 2014). Most of attrition in these populations is poor children of color. African-American and Hispanic/Latino students are still graduating 5-10 points behind the national average, U.S. Department of Education, National Center for Education Statistics (NCES, 2013-14). Significantly, fewer resources are committed to schools that have large numbers of minorities than for schools serving the more affluent communities (Darling-Hammond, 2004). Existing literature on the preparation of Black males for college and success in STEM fields are limited (Strayhorn, 2015).

Hopelessness among Black Males

After several decades of studying the problem of achievement gaps and billions of dollars in federal funding for programs such as the No Child Left Behind (NCLB) Act of 2001, it seems as if concrete solutions to such complex problem have been quite elusive. Several research studies indicate that disparities in education begin prior to school entry and persist through secondary and postsecondary education (Matthews, Kizzie, Rowley & Cortina, 2010) and (Yeung & Pfeiffer, 2009). The problem with achievement gaps in education for poor minorities appear to be systematic and involve several complicated issues such as politics, low socio-economic backgrounds, apathy which leads to hopelessness; all of which need to be addressed, if education is viewed as a human rights issue. The educational achievement gaps are a result of a current educational system, which is an old neo-liberal education policy ensemble (Alexander, 2009; Darling-Hammond, 2010; Hursh, 2008; Lingard, 2010); other contributing factors include the effects of low socio-economic status on education attainment as evidenced by the low levels of academic achievements and high crime rates in poor minorities communities.

Researchers have noted that in the United States, there are correlations between poverty, race, ethnicity and educational attainment (Zigler, Gilliam, & Barnett, 2011; NAEP, 2010).
Achievement gaps based on race-ethnicity do widely exist within the school system and meaningful and urgent measures are required to correct them. African Americans, Native Americans, and Latinos lag far behind Whites and other Asian Americans. Racial Disparities in education among these groups are also comparable to racial disparities in socio-economic factors, healthcare and longevity.

**Future Implications**

Previous studies predict that the U.S. population will be minority-majority by the mid-twenty first century. Lichter & Daniel, (2003), predict that between 2025 and 2043, most children will be people of color. In some cities, children of color are already the majority, (Aizenman, 2008). Non-Hispanic Whites are having fewer or no children, thus, the European American fertility rate has fallen below replacement level. Immigration from European countries is quite stable compared to those from other countries. If people of color do not close the achievement gap with Whites, the United States will fall behind in its global competitiveness in technology, science, engineering, innovation and other talents. The U.S. economy will reach a critical point where it will be under more pressure to sustain itself. The extent of many decades of discrimination and neglect will begin to manifest itself at the turn of the mid-twenty-first century. Cultural boundaries will shift as will the meaning of minority. The minority-majority transition will result in shifting patterns of racial segregation everywhere from neighborhoods, the workplace, newly integrating, friendship networks, and interracial marriage and childbearing rates (Lichter & Daniel, 2003.)

There have been concerns as to what the future holds in America, regarding race relations. Lichter & Daniel, (2003) argue that race and ethnic diversity, now celebrated by America, may be a flash point for political conflict, cultural dis-unity and loss of community or
cohesion after the minority-majority transition in 2043, (U.S. Census Bureau 2012a; Lichter & Daniel, 2003). The future success and health of the United States will depend on how society deals with the disparities in educational opportunities among poor minorities. There is an urgent need to address the healthcare and quality of life of all Americans. Those with college degrees usually live healthier lives because they can make healthier lifestyle choices. The healthcare burdens of the poor could ultimately bring into focus, the importance of equal opportunities for education.

The turn of the twenty-first century will be a turning point for testing the United States decades of neglecting educational inequities. By 2025, minority groups will dominate public schools and this will be the pool of students supporting higher education institutions (Darling-Hammond, 2010). If the United States is to remain globally competitive, more funding and oversights should be geared toward closing the minority achievement gaps in education. How academic achievement will affect the economy will be more pronounced at the turn of the century during the minority-majority transition periods.

Summary

Review of existing literature discussed in all three sections has revealed countless evidence of racial and ethnic bias in the United States criminal justice system. A common theme among these materials is the presence of inequities in the enforcement of criminal justice throughout the nation. Findings have shown an alarming rate of incarceration, homicide, drug abuse, and violent crimes among Black males in the United States.

Between the ages of 12 and 24 years old, the homicide rate is 17.6 %, which is about 115 deaths per 100,000 Black males. This is the most vulnerable age group in the United States for
Black males. Findings from the literature examined have shown that the incarceration rates for poor Black males are relatively high compared to Whites who commit the same crimes. People who are college-educated usually make healthier lifestyle choices. Based on the literature examined, poverty within the Black community in the United States has been the underlying cause for major health problems such as diabetes, heart disease, high blood pressure, and ultimately, high mortality rate. Poverty is also responsible for limited opportunities in education. People usually live in areas where they can afford; for the poor, this can mean high crime areas with over-crowded and under-equipped schools with high failure rates. This is the story for the life of those who are Black and poor in America.

Studies have shown that the suspension rate for African Americans is 50% compared to 33% for Hispanics and 20% for Whites. The high school graduation rate is about 72.5% for African Americans and 76.3% for Hispanics. Researchers have noted that there are correlations between poverty, race, ethnicity and educational attainment in the United States. Achievement gaps based on race and ethnicity persist through the school system. Existing literature predict that between the years 2025 and 2043, the United States will become a minority-majority country. This is a result of immigration, with high birthrates for some ethnic groups and low birthrates for the others. Findings in the literature examined predict that with continued education achievement gaps and increased incarceration rates among Blacks and other poor ethnic minorities, the nation’s economy will be at some point unsustainable. The increasing cost of healthcare, maintaining prisons, and lack of productivity among the under-educated could at some point lead to political unrest and cultural disunity.

Through critical examination of existing research, this literature review reflected on the plight of Black males in the United States, the impacts of the criminal justice system, the high
homicide and un-employment rates within the Black community, and the huge academic achievement gaps between Blacks and other ethnic populations. The body of literature examined have revealed that the Black family in the United States is in a state of emergency. More needs to be done to address the high crime and incarceration rates of our youth.

Acquiring the needed skills to secure the American dream is an area that has long being neglected by the nations policy-makers. The purpose of this study was to explore specific issues regarding the lived experiences of Black male STEM college majors. Differences in educational and social opportunities have resulted in disparities in degree attainment between racial minorities and Whites. The area of interest in this study is the STEM fields. There are relatively so few Black males in STEM, and as such the researcher will explore how Black male STEM majors at a local HBCU make sense of their interest and success in STEM fields. Hopefully, this study will provide useful insights for educators, administrators, and policy makers to decide how to efficiently allocate funding which in the end, will effectively serve under-represented minority communities. Providing more funding for educational and social opportunities within minority communities will help to alleviate the relatively high un-employment and crime rates.
Chapter Three: Research Design

In this study, the individual experiences of African Americans male STEM undergraduate students will be examined to gain insights into how they understand and explain their interest and success in STEM fields. This chapter describes the research design for the proposed study. The sections that follow will discuss the research approach within the context of the constructivist-interpretivist paradigm, providing justification for the methodological options used. Later in the chapter those options are detailed, including the procedures involved and the informed consent process. Also discussed are the researcher’s biases, reliability of data, and possible limitations.

Research Question

Open-ended questions must focus attention on gathering data and providing a textual and structural account of the experiences (Gall, Gall, & Borg, 2003). Ultimately, these questions must lead to an understanding of the common experiences shared by study participants. The research question that will be the focus in this study is: How do Black male STEM majors understand and explain their interest and success in STEM fields? This question seeks insights into why some Black male undergraduates, despite anticipated academic struggles, chose and persisted in STEM fields. It also seeks to ascertain the nature of influences, preparations, and persistence that leads to such a choice; whether they were spontaneously developed, through familial and cultural means, including school guidance counselors and teachers, or whether they are the result of self-efficacy because of adequate academic preparation.
Qualitative Research Method

The qualitative research method with an interpretative phenomenological analysis (IPA) approach was used to investigate the research problem. This research approach was chosen because it will facilitate a better understanding on how STEM major choices are determined from the Black males’ perspectives. This approach would facilitate a better understanding of how to address the research problem. Qualitative research places much emphasis on subjective-meaning; it focuses on collecting and analyzing data in the form of texts or images, rather than as numbers and statistics (Flick, 2014). Qualitative research methods are important tools within the broader approach to applied research, in part because they provide valuable insights into the local perspectives of study populations. It provides culturally specific and contextually rich data for the study. Qualitative research is usually conducted in natural settings such as the home, schools, hospitals or the street (Willig, 2013). It utilizes many tools to focus and achieve the researcher’s goals. It involves in-depth study, inductive thinking, understanding, interpreting, describing, and an appreciation for words-themes and report-writing during the data analysis phase (Lichtman, 2012).

Qualitative research has links with interpretive research perspectives; however, this assertion is not universal. Goldkuhl (2012), noted that qualitative research and interpretivism are frequently linked to each other. This position is also supported by (Lapan, Quartaroli and Riemer, 2012) who stated that qualitative researchers apply either the interpretivist or critical perspectives in their research. Myers (1997 cited in Ritche, Lewis, Nicholls, and Ormston, 2014) noted that qualitative research may or may not be interpretive; that it depends on the researcher’s basic philosophical assumptions. Holloway and Wheeler (2013) asserted that the root of qualitative research is present in interpretive approach which focuses on social reality and the
lived experience. Merriam (2009) supports the premise that there is quite often an existence of qualitative research in interpretive research.

Shank (2002) describes qualitative research as “a form of systematic empirical inquiry into meaning” (p. 5). It is systematic because it is planned, ordered and public; it follows guidelines set forth by members of the qualitative research community. “Empirical” within the context of qualitative research, means that it is grounded in the world of experience (Shank, 2002). Researchers inquire into meaning to understand how others make sense of their experience. Qualitative research brings closer attention to the interpretive nature of inquiry. It situates the study not only within the cultural, political, and social context of the researcher, but also the reflexivity of the researcher and the accounts they present. Reflexivity is the process of evaluating oneself as a researcher and the research relationship. Reflexivity is very essential in qualitative research because the researcher is the primary “instrument” of data collection and analysis (Merriam, 2014; Russell & Kelly, 2002). Evaluating oneself as a researcher means assessing one’s assumptions and preconceptions and how those impact the research decisions and question formatting. Reflexivity is also important regarding the research relationship (one’s relationship with the research participant) and how that relationship affects question responses.

Researchers agree that reflexivity facilitates an awareness of what lens are being used, as well as what may inhibit their seeing (Russell & Kelly, 2002). This includes careful consideration of the phenomenon under study, as well the ways one’s own assumptions and behavior may be impacting the inquiry. Many researchers (Maxwell, 2005; Spradley, 1979) recommend journaling. Writing short notes, or memos, during the entire research process provide several benefits. They suggested that jotting down ideas in real time is the beginning of analysis. Writing notes to one’s self allows researchers to self-reflect in ways they did not know
were possible (Elbow, 1995; Huff, 1999; Woods, 1999). During the qualitative research process, researchers are required to maintain focus on documenting the meaning that participants ascribe to a given phenomenon or issue, not the researchers’ personal assumptions or biases.

Denzin and Lincoln (1994) noted that qualitative research is multi-method in focus and involves an interpretative, naturalistic approach to its subject matter. This implies that qualitative research should be conducted in the participants’ natural settings. Denzin and Lincoln (1994) also asserted that qualitative research should involve the studied use and collection of data from participants’ personal experience through methods such as life story interview, case study, observation, interaction, historical, and visual texts. Qualitative research enables one to conduct in-depth studies about a broad array of topics, including passionate topics, in plain and everyday terms. It allows researchers to explore the meaning of people’s lives, under real-world conditions; its findings thus represent the views and perspectives of the people (Yin, 2011).

The qualitative research method was chosen for this study because the researcher is interested in ascertaining how individuals make sense of their life’s experiences or events as they relate to the phenomenon of being a Black male higher education student in a STEM discipline. What differentiates them from Black males who have adequate preparation and skills in math and science yet choose not to major in STEM or even go to college? What meanings do they attribute to being a Black male STEM major? What is the overall quality of their experiences as a student in their field? The answers to such questions may offer insights into the essence of the meaning-making process as participants relate personal narratives to the shared experiences of a Black male STEM major.
This study is not intended to assess numerical variables or to test a theory, which is why the quantitative method was not chosen instead. The qualitative research method will enable the researcher to assess, through semi-structured interviews, how Black male STEM majors make sense of their real-life experiences and what motivated them to choose their field of study. Exploring what factors influence and shape choices made by Black male STEM majors will hopefully provide useful data that community leaders such as (policy-makers, college administrators, and high school guidance counsellors) can use to improve their learning experience.

**Philosophical Assumptions**

Philosophical assumptions are made by researchers in a qualitative study and are the guiding principles behind qualitative inquiry. These guiding principles or beliefs are called paradigms. A paradigm is a cluster of beliefs or a world view which guides the researcher into what should be studied, how it should be done, and how the results should be interpreted (Flick, 2009). Paradigms can impact one’s mind to the extent they form the lens through which they see the world. Hussain, Elyas and Nasseef (2013) asserted that paradigms can be utilized in the institutionalization of intellectual activity, and for the broad groupings of certain approaches, for example positivist or interpretive paradigms (Grix, 2010) which add perspectives to the study of any subject.

The researcher intends to inform this study utilizing the constructivist-interpretivist paradigm. That paradigm assumes reality is socially constructed through meanings and understandings that are developed experientially (Mertens, 2005). The constructivist-interpretivist paradigm assumes that we cannot separate ourselves from what we know; that there is no separation between researcher and object of the research. It shares the beliefs that our
knowledge of reality and reality itself are inseparable. Thus, reality is subjective, dependent on the subject experiencing it. The constructivist-interpretivist view emphasizes dialogue between the researchers and subjects who construct reality together. For example, through interviewing, observation, and text analysis. The researcher must rely upon the participants' account of the study problem. The impact of the researcher's own background and experiences is permitted and recognized.

**Methodology**

The interpretive phenomenological analysis (IPA) approach was used in this study. IPA was first used as a distinctive research method in the mid-1990s. Smith (1996) wanted an approach to psychology which would allow researchers to collect qualitative and experiential data, while maintain mainstream psychology. One requirement for an effective IPA study are participants that are homogeneous as possible. Another, that the participants have some common experiences with one another (Reid, Flowers, & Larkin, 2005). IPA draws on the accounts of a small number of people (1 to 15 participants). It uses such small purposive sampling to collect data from semi-structured interviews or focus groups, as some examples. Some goals for an IPA study include providing in-depth explorations of participants lived experiences, and providing close examinations of how participants make sense of these experiences. It is concerned with the individual’s perception, or account of events. It focuses on personal meaning and sense-making in a context for people who share a particular experience.

The researcher’s study was relatively small, comprising eight participants recruited from a pool of 15. Each participant was interviewed three times. Findings are not intended to be generalized to a larger population, but to provide some useful insights into how Black male STEM majors make sense of their experiences. IPA has a requirement for personally-salient
accounts of depth and richness. These accounts must be collected in a way which generates detailed verbatim or transcript to be analyzed by the researcher. For this reason, semi-structured interviews will be conducted and documented using digital recordings, then transcribed, coded, and analyzed. A coding system was developed which represents emergent themes of the participants’ responses. Thus, providing an opportunity to generate a coding profile, which can then be used in the study’s data analysis.

Reid, Flowers & Larkin (2005) noted that a good IPA analysis balances phenomenological description with insightful interpretation of the participants’ accounts. To do this, the researcher will keep a clear focus on meaning, rather than causal relations. Transparency is important in IPA and will be achieved by providing contextual details about the sample, a clear account of the process, data commentary, and with key points illustrated by verbatim quotes. Cooperative inquiry, cross-validation, or triangulation must also be used to add plausibility and transferability of an IPA study (Smith, 2011). Cooperative Inquiry: The main idea about cooperative inquiry is to “research ‘with’ rather than ‘on’ people.” It emphasizes that all active participants are fully involved in research decisions as co-researchers (Heron, 1996). Cross-validation also known as triangulation, involves using multiple data sources to analyze and form a final understanding and interpretation of a study’s results. Utilizing the analysis of methods, sources, and a variety of research theories, cross-validation can make a powerful argument to support existing research, and researcher hunches by presenting interpretations from multiple perspectives (Shank, 2006).

Using the IPA methodological approach, this future study will focus on the experiences of Black male STEM undergraduate junior or senior students, examining how they make meaning of their experiences through their accounts, as shared during semi-structured interviews.
(Smith, Flowers & Larkin, 2009) noted that the general principle behind IPA research deals with its capacity to capture the meaning that individuals attribute to major life experiences such that others can understand, appreciate, and support them and those in similar situations in more meaningful ways. The IPA researcher must elicit rich, detailed, and first-person accounts of the participants’ experiences. Besides mastering good listening skills and asking open-ended questions, the IPA researcher must be free of hidden assumptions, and able to establish rapport and trust with the participants. It may be necessary to begin the interview with warm-up discussions to relax the interviewee, making the participant more comfortable responding to the questions being asked. (Smith, et al., 2009) asserted that IPA study explores mental phenomena such as associations, thoughts, memories, and fantasies. While these common elements are important, they do not exclude verbal, non-verbal, and non-behavioral communication.

IPA has also been influenced by the phenomenological and existential perspectives of Heidegger, Merleau-Ponty, and Sartre. These perspectives consider a person as being embodied and embedded in the world, within the social, historical and cultural context. Smith et al. (2009) noted that IPA is grounded in three theoretical underpinnings: phenomenology, hermeneutics, and idiography. IPA uses these three theoretical approaches to support its research methodology and epistemological framework. To fully understand the principles behind IPA studies, Smith et al. (2009) discussed important concepts about phenomenology, hermeneutics, and idiography.

**Phenomenology.** The notion of phenomenology as a philosophy and as a research method has been in existence for a long time. Phenomenology is a study of the human experience and the way things are perceived to be to the consciousness (Langdridge, 2007). (Creswell, 2013) describes phenomenology as the “what” and “how” descriptions of the individuals who experienced the phenomena. Phenomenology describes the essence of the
experiences but does not analyze or explain descriptions. Phenomenology first began as a philosophy in Germany pre-World War I, and today still has a place in modern philosophy. There are many perspectives of phenomenology such as in the positivist (Husserl), post-positivist (Merleau-Ponty), interpretivist (Heidegger), and constructivist (Gadamer) paradigms. In the past, phenomenology was a huge challenge to the origin and nature of truth. As described by Moustakas (1994), it originated from the Greek *phaenesthai*, meaning to flare up, to show itself, to appear. Moran (2000) noted that, it was Franz Brentano’s use of the term *descriptive phenomenology*, which provided Husserl’s development of phenomenology.

Husserl’s (1970) description of phenomenology asserts that it is the rigorous and unbiased study of things, as they appear, to facilitate the understanding of the human consciousness and experience. Husserl was engaged in conducting a phenomenological inquiry based on his own experience. Husserl’s phenomenological philosophy provides IPA with endless ideas about how to approach IPA studies; how to examine and comprehend the lived experience. Moran (2000) argues that “explanations are not to be imposed before the phenomena has been understood from within” (p.4); that view is key to understanding Husserl’s phenomenology. According to Husserl (1970), the goal of pure phenomenological research is to essentially describe rather than explain; and provides a perspective that is free from hypotheses or preconceptions. Interpretation and reflection are essential elements for describing a phenomenon. Husserl has placed much emphasis on the importance of reflection to both the participant and the researcher.

German philosopher, Martin Heidegger (1889-1976) describes hermeneutic phenomenology as concerned with the human lived experience. Heidegger differs with Husserl’s view in how lived experience is explored in research. He believed in the use of
hermeneutics as a research method and that the lived experience is an interpretive process (Racher and Robinson, 2003). Heidegger (1962) has discussed the importance of not allowing the researcher’s preconceptions to influence the interpretation and findings.

Lester (1999), defines phenomenology as the study of experience from the perspective of the participant, without taken-for-granted assumptions and usual ways of thinking by the researcher. Lester’s perspective is that phenomenology explores the meaning-making of an experience or phenomenon by what was experienced and how. Phenomenology documents the participants accounts and use them as evidence for the existing phenomenon. Finlay (2009), describes phenomenological research as concrete descriptions of lived situations, or first-person accounts. They are presented in everyday language, avoiding abstract intellectual generalizations. Finlay stated that phenomenological studies are quite difficult because of its strict requirements for selecting the study participants; the participants must be chosen in such a way that fosters uniformity for the phenomenon under study. The researcher must be able to bracket his/her personal experiences in order to remain objective, minimize bias, and be open-minded during the study.

**Hermeneutics.** Hermeneutics, the second IPA underpinning, is the theory of interpretation, concerning textual meaning (Smith et al., 2013). IPA draws on hermeneutic approaches providing opportunities for interpretive analysis, placing participants’ accounts into context through reflections, thus making it possible to link findings to psychological literature. Smith et al. (2009) noted that a successful interpretation for IPA is one which is principally based on the text which the participant has produced. They also noted that a combination of both phenomenological and hermeneutic insights is essential for IPA. Phenomenological insights are required for getting as close as possible to the personal experience of the participant. However,
at some point it becomes an interpretive endeavor for both the researcher and participant. The multiple possibilities of interpretation have made it possible to capture rich data with a wealth of information from the participant(s).

The process of interpretation on the part of the researcher is usually two-fold: first, the participant making sense of their experiences, secondly, the researcher making sense of how the participant make sense of the phenomenon; this process is usually called *double hermeneutic*. Larkin, Watts, and Clifton (2006) have described the multiple possibilities of interpretation, ranging from insights into the participant’s life world, to a unique social interaction between two people, or unconscious conflicts and desires. (Larkin et al., 2006) noted that each of these possibilities offers a possible entry into the hermeneutic circle. IPA can engage with any of them if it can be traced back to the core account representing the participant’s world. (Smith et al., 2009) noted that IPA occupies a center-ground position where a *hermeneutics of empathy* can be combined with a *hermeneutics of questioning or critical hermeneutics*, as long as it produces the meaning of the experience. *Hermeneutics of empathy* occurs when the researcher assumes the role of the participant to ascertain their experience through their own lens. *Hermeneutics of questioning or critical hermeneutics* involves assuming the role of an outsider by interrogating and documenting the participant’s experience.

**Idiography.** This is the third theoretical underpinning of IPA. As described by Smith et al., (2009), IPA study is an approach in qualitative study that has an idiographic focus; meaning that the study’s goal is to offer insights into how a given person, within a given context, make sense of a given phenomenon. The phenomenon is usually an experience of personal significance, such as a major life event. The researcher attempts to understand the participants’ account about their experience through interaction. A researcher may choose to extract this
information through interviews, focus group discussions or other means. Idiography is committed to a detailed finely-textured analysis. Idiography, involves details and thorough analysis of small cases (Smith et al., 2013).

IPA’s idiographic focus is the main feature for this approach. IPAs idiographic commitment has produced more microscopic lenses, which emphasize the way in which the study of how psychological meanings are constituted, can be usefully pursued through the detailed examinations of the lives of unique individuals (Eatough & Smith, 2008). Smith et al., (2009) noted how individuals can offer a unique perspective about their experience with a particular phenomenon. Therefore, individuals can become a unit of study which is closely linked to rationale case studies. IPA studies can be composed of up to 15 participants. Smith et al., (2009) noted that the result of an IPA analysis is usually in the form of an idiographic interpretive commentary, interwoven with extracts of the participants’ accounts. According to Smith (2004), IPA is idiographic because one case is analyzed in detail before moving on to the next one.

Rationale for Choosing IPA

IPA is an approach in qualitative research that aims to offer insights into how individuals, within a given context, make sense of their lived experience. Yardley (2000) noted that there are four key dimensions through which qualitative studies can be assessed: sensitivity to context, commitment and rigor, transparency and coherence, and impact and importance. Sensitivity to context can be achieved in several different ways for example: sensitivity to the participants involved, or sensitivity the socio-cultural context of the study. Yardley (2000) noted that IPA sensitivity to context can be achieved by the initial choice of method and the rationale for its adoption. Yardley (2000) argues that sensitivity to context is important during engagement with
research participants, demonstrating sensitivity to their individual experiences, and with understanding of their circumstances. The IPA approach was chosen for the following reasons: addressing the research question, the researcher’s goals for this study such as providing an opportunity for detailed analysis of *verbatim* accounts from a small number of participants (less than 10), and because it usually requires semi-structured interviews (Larkin et al., 2008; Smith, 2004). It provides an opportunity to interpret meaning from experience, which is the purpose of the study.

The IPA study is quite appropriate for exploring how Black male STEM majors understand and explain their interest and success in STEM fields. Because IPA measurement is subjective in nature, it is quite suitable to assess the life experience of Black male STEM majors, including their academic and societal struggles. IPA posits that experience can be understood through examination of the meanings which people ascribe to it. Smith et al., (2009) noted that in the world people do things and reflect on what they do, and that those actions have meaningful, existential consequences. This focus on the lived experience and how the individual makes sense of it was why it was selected. The subjective nature of the IPA study requires careful documentation, evaluation, and preservation of the participants’ accounts of their experience for a particular phenomenon. This will preserve the integrity of the study, making the data more authentic and reliable for analysis. One fascinating aspect of using the IPA study approach is that it enables the researcher to see through study participants’ lenses; the way they perceive, organize, and experience, their daily lives.

**Participants**

The IPA approach focuses on personal meaning and sense-making. IPA usually requires small purposive sampling (up to 15) study participants (Larkin et al., 2008; Smith, 2004). Due to
the complexity of most human phenomena, IPA research usually benefits from a concentrated focus on a small number of participants (Smith et al., 2009). Small sampling population still generates a large amount of manageable data to be analyzed. The researcher recruited eight study participants, from a pool of 12 undergraduate Black male STEM students; mostly seniors and juniors, and one sophomore. The study was conducted at an urban historically Black university using semi-structured interviews. IPA studies are conducted in small sample sizes due to its idiographic approach, which is concerned with understanding particular phenomena in particular contexts (Smith, 2009); each individuals’ accounts of the phenomenon is also significant.

**Study Sample Characteristics.** IPA has a requirement for a homogeneous study population. Smith et al., (2009), noted that a homogeneous study population provides the researcher opportunities to identify convergent and divergent themes within the group. Therefore, the study participants for this study were Black male STEM majors who are either seniors or juniors. There was one sophomore physics major included in the study after it was determined through a one-and-one interview that he has passion for the subject and was excited to participate. The study population was first and second-generation African American citizens. Finding a homogeneous sample for whom the research problem will be meaningful can sometimes be a practical problem. For example, finding out which ways people vary from one another, and how much of that variation can be included in the analysis of the study problem (Smith et al., 2009). African Americans, are defined as Black people, with genetic lineage that is restricted to the United States; however, within the general definition, few of the participants were second generation African Americans, whose parents are immigrants. Ogbu (1998) refers to African Americans as involuntary immigrants, because they came to the U.S. through their
ancestor’s slavery. Voluntary immigrants include Blacks who immigrate to the U.S., looking for a better life.

Study participants were the traditional undergraduate, college age (approximately between 18 to 25 years old) most of whom completed at least three years of study in their major field. This will ensure that participants have a good amount of experience as undergraduate STEM major and have persisted which add to the significance of the phenomenon. The study participants were recruited from the university STEM departments, including biology, physics, and the various engineering disciplines. Since Black male STEM majors are underrepresented in these fields, there is a need to explore the experiences and successes of those who do. Many students who major in these fields have career aspirations such as pursuing the healthcare professions such as medicine, nursing, dentistry, and pharmacy.

**Sampling procedures.** Participants were recruited using purposeful sampling, which allows the selection of participants who have a common experience of a particular phenomenon and who also are able to inform the research problem (Smith et al., 2009).

Recruitment of participants were as follows:

1. After receiving IRB approvals from both institutions, initial recruitment emails were sent to the STEM department chairmen at the institution, requesting their help with the study. A study site sponsor was assigned to represent the researcher at the institution. The site sponsor coordinated the recruitment by providing contact lists (emails, contact lists) of potential study participants. Once these lists were received, arrangements were made to recruit the participants based on the study requirements. Junior and Senior African American male STEM students and one sophomore agreed
and were recruited at the research site. Some participants were recruited at a STEM award ceremony at the institution. Most of the other participants were recruited through legwork on campus at the study site. During the recruitment, each participant was presented with a copy of the recruitment email which included background information on the study, including consent forms, and the requirements to participate. The researcher explained to each participant what the study was all about. Interested students were asked to respond to the researcher directly.

2. Later, a follow up email message was sent to all students that received the initial recruitment material to encourage a response.

3. More details of the study were provided soon after, to those students who have expressed interest in participating. Included in this personalized email, were the interview guide, consent form, and meeting arrangements. Those students requiring additional information had an opportunity to do so via email or by phone. (Phone number was provided in this personalized email message). Each participant received a Dominoes gift card with a maximum value of $20, to compensate them for their time.

**Research site.** The research site is a private research HBCU within the Washington Metropolitan region of the United States. This site was specifically selected due to its historically Black status and has students from diverse socio-economic backgrounds. According to *US News & World Report* (2016), the research site has an acceptance rate of about 65%. The school admits and attracts a highly talented pool of mostly Black applicants each year. The *US News & World Report* (2016), stated that the most popular majors at Morgan State University include: business, management, marketing, and related support services; health professions and
related programs; computer and information sciences, and support services; public administration and social service professions; and engineering. The average freshman retention rate, an indicator of student satisfaction, is 74 percent.

The researcher sought African American male STEM undergraduates and used purposefully sampling procedure to achieve this objective. This institution is situated in a high crime, high poverty region where it can be very stressful and challenging being a student. Those who are admitted are there because they chose to achieve and do something positive with their lives. African American male STEM students who overcame various adversities and defied the statistical odds, are a good fit for the underlying goals of this IPA study.

**Procedures**

The IPA approach was used for this study and the study’s data collection and analysis procedures are based on this requirement. The sub-sections that follow describe the data collection, data analysis, ethical considerations, trustworthiness, research bias, and study limitations, followed by a summary of the discussions for Chapter 3.

**Data Collection**

The data collection procedure was initiated following the Institutional Review Board (IRB) approvals of this proposal. This study used a modified Seidman (2013) approach, which is a three-interview per participant recommendation. There was a preliminary interview, lasting approximately 30 minutes, for each participant. During this preliminary interview, the participants learned about the study. Those who decided to become involved were provided an opportunity to sign the Northeastern University Informed Consent Forms. The second interview consisted of approximately 16 open-ended questions which lasted between 45-90 minutes.
third interview was conducted for member-checking and varied in length, depending on the process. In each case the participant was allowed an opportunity to review their interview transcripts to ensure no misunderstandings or misinterpretations of responses and to ask any questions. Any concerns were also addressed at this time. If there were any discrepancies, each participant had an opportunity to add or remove any information from the transcribed interview material. Interviews were recorded after the informed consent was read out loud, and solicitation for questions, concerns, or comments. The consent form was then presented to be signed by each participant, after which the participant was notified and consented to be recorded. Two digital recording devices and extra batteries were available: one, a primary device, and the other serving as an emergency or backup, should anything go wrong with the primary device.

Pseudonyms provided by each study participant were used throughout the study to protect the privacy of the participants. All data and documents are preserved using a password-protected file that contains the participants’ actual names and their pseudonyms. All audio files and written documents containing data are electronically stored on the researcher’s personal computer. Files will be backed up using an external hard drive and through a secure data storage program online. Passwords and other security features will be enhanced to provide an extra layer protection. Any physical documents such as field notes, consent forms, etc., related to the study, will be stored in a locked cabinet and the key will be kept in the possession of the researcher. There will be a master list of data sources which will be used if needed, to access study-related information. In addition, per Smith et al. (2009), analytical memo was utilized to document field work observations and important notes. This can be useful during transcription and the data analysis process. It will be quite useful to document data-related materials or questions to facilitate procedural and interpretative decisions, as well as maintain a transparent audit trail.
Data Analysis

A five-step process was used in the analysis of data as recommended by (Smith et al., 2009). These steps will allow the researcher to be able to analyze and keep track of each individual interview before performing cross-case analyses and looking for emergent, divergent, and convergent themes between them. Each interviewee data was completely analyzed using the NVivo Pro software before moving on to the next until all the study participants’ data have been completed. The final step, step five, was to identify superordinate themes among the participants’ data. The researcher reflected on the data, seeking relationships and then clustering themes. Looking for connections between emerging themes, and possible divergent themes, the researcher grouped them by conceptual similarities. Each cluster was then assigned a descriptive label. These analyses were performed within the context of the theoretical framework which informs this study.

Analyzing the Transcripts

Step One. Study participants’ interview transcripts were analyzed soon after recording by reading and re-reading them individually (Smith et al., 2009). IPA analysis requires that the researcher complete a fully worked-up analysis on each participants’ data before moving on to the next (Forrester, 2010). This method enable the researcher to better focus and reflect on each participant’s data, as well as bracket personal assumptions or biases. The researcher attentively listened to each participant’s interview recording to become immersed and acquainted with the responses. The researcher then read and re-read the transcript, paying closer attention to the details each time, and making an effort to see through the lens of the participant’s experience (Smith et al., 2009).
Step Two. The essence of IPA resides in its analytic focus, namely the study participants’ attempt to make sense of their lived experiences. Step two involved a line-by-line analysis of the study data, paying close attention to experiential claims, concerns, and understandings (Smith et al., 2009; Larkin, Watts, and Clifton, 2006). The researcher then looked for emergent patterns within the experiential material, differentiating between convergent and divergent themes, and identifying commonality and nuance (Eatough & Smith, 2008). Using initial codes, the participants’ account was captured and summarized. Marginal notes were made on each transcript paragraph to facilitate easy referral and cross-referencing. The researcher has developed a structure, or gestalt, to display the relationships between themes (Smith et al., 2009).

Step Three. Involved initial comments on the transcript, through initial clustering and thematic development, into the final theme structures. This step was focused on organizing the interview material, and making and identifying emergent themes, by clustering and thematic development of information. This is to provide insights into significant accounts shared by the participants (Smith et al., 2009). The step involves careful evaluation of what the participant is saying during each segment of the interview. Collaboration, or audit, are useful to evaluate and develop the plausibility and interpretation of the data.

Step Four. In the final step, the researcher developed a full narrative with detailed commentary on data extracts. This narrative reflects on theme-by-theme data interpretation, which is supported by a visual guide or a simple structure. In this step, the researcher reflects on his own perceptions, conceptions and processes. This is important because qualitative study is subjective and warrants a full accounting of how findings were determined. The researcher’s personal bias or background might affect the interpretation of the data. Thus, it’s important to document one’s thoughts during critical stages such as the data analysis process. The researcher
then develops a full narrative with detailed commentary on data extracts, which reflect on theme-by-theme data interpretation (Smith et al., 2009).

Finally, the researcher established superordinate themes that capture the essence of the participant’s experiential account. Steps one through four were repeated for each participant until all interview transcripts have been fully analyzed. Each analysis was initiated with an open mind, and without any assumptions derived from previous cases.

**Step Five.** At the end of all analyses, this step involves looking for superordinate themes and patterns of meaning that run across all the participants in the study (Smith et al., 2009). The researcher looks for common experiences shared by the participants then create a display of the data representing the overarching themes derived from the interviews. Data from these analyses are used to provide a framework for discussing the findings and how they relate to the theoretical framework.

**Ethical Considerations**

Regardless of whether the research can do harm to the study subjects or participants, it is important to comply with ethical standards and guidelines (Forrester, 2010). IRB approval was sought and received, prior to conducting this study. The researcher has complied with established guidelines related to the informed consent process and the protection of human subjects, including concealing and preserving the identity and confidentiality of all participants. Confidentiality towards sponsors, colleagues, and participants will be maintained always.

**Trustworthiness**

The researcher took several measures to ensure trustworthiness throughout the data collection and analysis processes by providing transparency, following IPA guidelines and
procedures. These measures include providing contextual details about the samples, providing a clear account of the process, including adequate commentary on the data and including *verbatim* quotes to illustrate important points when compiling the final study reports. The study participants had an opportunity to share their experiences on three separate occasions, and using at least two different media (via in person conversation and email). Brannen (2004) describes triangulation as the use of results from one set of data to corroborate those from another type of data. Using multiple sources of data (data triangulation) will help to develop a comprehensive understanding of each participant’s perspective (Blaikie, 2000; Scandura and Williams, 2000). Member-checking was used for each participant during the data collection process, in which case the researcher presented the interview transcript to each participant for review. Any corrections warranted by participant feedback was made prior to finalizing subsequent drafts. The researcher also included a detailed account of all the participants, the research site setting, and other relevant information, so readers can make appraisals and any informed decisions about the study. The entire study process was carefully documented, to leave an audit trail.

**Potential Researcher Bias**

The researcher’s interest in this topic was motivated by overcoming the difficulties of growing up in a remote wilderness, that had no electricity, running water or highways. The researcher and 11 siblings were raised on a country farm in a remote area in a Third World country. There were no highways within three miles of the farm. The researcher identifies as a Jamaican Bushman. Foot-trails were the primary highways for transportation of farm produce. The donkey and mule were the only means of transportation. The researcher’s parents were not wealthy and life was quite difficult because resources were very limited; however, despite these hardships, harsh living conditions, and the help of his uncle, the researcher persevered in his
educational goals. Because of the constant encouragement and motivation provided by the researcher’s parents, Carmen and Leslie Gayle; uncle, Dr. Amos Gayle, and elementary school principal, Beryl Foster, the researcher persisted in his educational goals, resulting in an undergraduate degree in chemistry and graduate degrees in biotechnology and clinical research administration from ivy league universities in the U.S and the U.K.

The researcher was very fortunate to have an uncle (a dentist) who provided sponsorship on a student visa to the United States. The researcher’s uncle came to the U.S. during the Civil Rights struggles, during racial segregation times. He had worked as a dish-washer, switch board operator, and held other low paying occupations to pay for his dental education. The researcher was motivated by his dentist uncle, who was constantly mentioned by his parents when he was growing up. The researcher was educated at a Historically Black University (HBU) as an undergraduate, and earned graduate degrees from Ivy League, predominantly White institutions. As a student at a HBU, the researcher saw first-hand, the economic struggles, and occasional Black distancing and ridicule between Black immigrants and African Americans. The researcher will never forget the experience of walking across a Black university campus only to hear almost everyone looking and bursting out with loud laughter, steers and jeers. It took a while to realize that to them, I looked out of place in my cultural attire and with a thick Jamaican accent.

Even though securing funding for the researcher’s college education was quite difficult during the junior and senior college years, the researcher realized that education is a meal ticket for life, a door-opener, and therefore couldn’t give up no matter how challenging situations became. The researcher graduated and went on to graduate school after a few years serving as a banker, and a biologist. The researcher then served two years as a private high school science teacher in the U.S., three years as a community college biology adjunct in the U.S, and three
years as a science teacher overseas. The researcher has experienced significant difficulties in life, but persevered until his educational goals were realized.

It is important to recognize that because of the researcher’s experience and harsh upbringing; the researcher may not be as sympathetic towards those African Americans who may not be as motivated toward their education. However, the researcher understands that, unlike being a voluntary immigrant, the African Americans are involuntary immigrants and may be subjected to more stringent conditions because of their minority status. Some African Americans may have been exposed to socio-cultural experiences that have affected their self-concept, and self-efficacy. Others may have had difficult upbringing due to absentee fathers, parents, guardians, teachers who cared, or other important role models in their lives.

Black males are highly underrepresented in STEM fields. They need strong role models to motivate them into seeking high academic achievement, or to learn skills that can help them realize the American Dream. Not everyone is “college material”. Those who are not, they should learn practical skills such as auto-mechanics, plumbing, masonry, carpentry, just to name a few. In some respects, poverty in the U.S has resulted in lasting effects of educational inequities because where one lives will determine the quality of education and available opportunities. In the U.S., the best schools are in the most affluent school districts and counties. Educational opportunities in the researcher’s Third World country are similar regardless of where one lives or one’s socio-economic status. In the Third World, some of the poorest students are the smartest because they work harder to get out of poverty and to secure a better life for themselves and their families. In the U.S., these choices are quite minimal for the African Americans because the system and community forces as described by Ogbu (1998) make it more difficult to do so.

Limitations
First, the findings of this study are not intended to be generalizable because the study population was small, composing eight study participants. Since the participants recruited will be purposefully selected, they will not be representative of the general African American college male STEM majors. Secondly, this study focuses on African American male STEM majors admitted to a Historically Black university to explore their experience of persistence through academic difficulties during or leading up to college. African American male STEM majors in predominantly White schools may not have similar experience as those in a HBCU because significantly more resources may be available at these White institutions. In addition, Blacks in these White institutions may be under significant pressure to overcome negative racial stereotypes or to “prove themselves” worthy to be there. Finally, participants may differ based on their socio-economic status, religious, ethnic, cultural, or immigrant status.

College students may choose to major in STEM because of adequate preparations in math and science courses at the pre-college level. Some students whose parents are immigrants may place high value on education and such students may be reluctant to disclose academic difficulties, as well as the extent to which they have personally reflected on their circumstances and future. Therefore, the depth and richness of the interview data collected could generate convergent as well as divergent themes, which may make it more difficult for cross-case analyses.

**Summary**

This study explores how Black male STEM majors understand and explain their interest and success in STEM fields. It helps to explain how black male STEM majors make sense of their academic struggles in college while staying in school. An IPA approach was utilized to give voice and make sense of the participants lived experience, as shared during semi-structured
interviews. Data collection and analysis was conducted using strict IPA requirements and qualitative research guidelines. Critical reflection on data will only be made after the entire data have been analyzed. Rigorous data collection and analysis, including data triangulation will be used to minimize researcher bias. Overall, the strength of IPA research rests in transparency, detailed steps of the process from data collection through analysis, discussing any issues that may arise and how they were handled. The final data will be presented in such a way that others can visualize and follow the study participants’ accounts, or their lived experience, to appreciate, cultivate, and support those who are in similar situations to make the world a better place.
Chapter Four: Findings and Analysis

This study investigated how Black male college students majoring in Science, Technology, Engineering, and Math related fields (STEM), make sense of their interests and success in relation to their chosen field. The study’s scope was limited to a historically black university on the East Coast of the United States. After a review of study data, five superordinate themes relevant to the research question were identified. Further analysis uncovered varying numbers of subordinate themes for each superordinate theme, 15 in total. Themes and sub-themes were determined based on the frequency with which study participants discussed them; all of them appearing in at least four of the eight participants’ interview data. Those themes, and accompanying discussions, have been structured as follows for the purposes of this chapter:

1) Choosing STEM Fields Deliberately/ Internal motivations (1.1 Overcoming STEM challenges through Math/Science passions, 1.2 Enrollment in STEM Learning / After-school Tutoring Programs); 2) Familial Involvement in students’ education, (2.1 The Family’s Supportive Role, 2.2 The Role of Non-relatives); 3) Feeling Engaged on Campus fosters a sense of belonging, (3.1 Interaction with Professors/Faculty, 3.2 Peer-Peer Interactions, 3.3 Getting Help on Campus, 3.4 Campus Organization Membership); 4) Black Male STEM Students Most Important Concerns on Campus, (4.1 Limited Budget, 4.2 Limited Course Availability); 5) Considerations about Quitting or Perseverance (5.1 Personal Financial Struggles or Frustrations, 5.2 STEM Fields are too Challenging, 5.3 Perseverance through self-motivation, 5.4 Parental-guidance, support, encouragement; and 5.5 Peer Support). The superordinate themes and sub-themes were selected based on their frequency in at least four of the eight participants’ interview data.
### Table 1: Identification of Recurring Themes

<table>
<thead>
<tr>
<th>Superordinate Themes Sub-themes</th>
<th>Anthony</th>
<th>Bobby</th>
<th>D’Angelo</th>
<th>David</th>
<th>Ozzie</th>
<th>Jerry</th>
<th>Calvin</th>
<th>Tyrone</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Choosing STEM Fields Deliberately / Internal Motivations</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>1.1 Math/Science Passions</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>1.2 Enrollment in STEM learning / After-school tutoring programs</td>
<td>Yes</td>
<td>Yes</td>
<td>No</td>
<td>Yes</td>
<td>No</td>
<td>No</td>
<td>Yes</td>
<td>No</td>
</tr>
<tr>
<td>2. Familial Involvement in Black Male STEM Students’ Education</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>2.1 The Family’s Supportive Role</td>
<td>No</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>No</td>
<td>No</td>
</tr>
<tr>
<td>2.2 The Role of Non-relatives</td>
<td>No</td>
<td>Yes</td>
<td>Yes</td>
<td>No</td>
<td>No</td>
<td>No</td>
<td>Yes</td>
<td>No</td>
</tr>
<tr>
<td>3. Feeling Engaged on Campus (A Sense of Belongingness)</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>No</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>3.1 Interaction with Professors/Faculty</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>3.2 Peer-Peer Interactions</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>No</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>3.3 Getting Help on Campus</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>No</td>
<td>No</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>3.4 Campus Organization Membership</td>
<td>No</td>
<td>No</td>
<td>No</td>
<td>Yes</td>
<td>No</td>
<td>Yes</td>
<td>Yes</td>
<td>No</td>
</tr>
<tr>
<td>4. Black Male STEM Students’ Most Important Concerns</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>4.1 Limited Budget</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>No</td>
<td>Yes</td>
</tr>
<tr>
<td>4.2 Limited Course Availability</td>
<td>Yes</td>
<td>Yes</td>
<td>No</td>
<td>Yes</td>
<td>Yes</td>
<td>No</td>
<td>Yes</td>
<td>No</td>
</tr>
<tr>
<td>5. Considerations about Quitting or Persevering</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>No</td>
<td>Yes</td>
</tr>
<tr>
<td>5.1 Personal Financial Struggles or Frustrations</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>No</td>
<td>Yes</td>
<td>Yes</td>
<td>No</td>
<td>No</td>
</tr>
<tr>
<td>5.2 STEM Fields - too Challenging</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>5.3 Perseverance through Self-Motivation</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>No</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>5.4 Perseverance through Parental Guidance and Encouragement</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>5.5 Perseverance through Peer Support</td>
<td>No</td>
<td>No</td>
<td>Yes</td>
<td>Yes</td>
<td>No</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
</tr>
</tbody>
</table>

**Choosing STEM Fields Deliberately (Internal Motivations)**

Black males who choose STEM fields as a major tended to have long-term career goals and interests in the engineering and healthcare professions. Some of the long-term goals expressed by the study’s participants include giving back to their respective communities.
through service such as mentoring youth and participating in community rebuilding. Many participants heavily relied on robust support systems such as parents, other relatives, friends, high school guidance counselors, and faith as a means of sustenance in challenging times. Some participants had experienced personal financial struggles, along with little access to various support systems in college.

Choosing STEM Fields whether deliberately or through internal motivations, has emerged as the superordinate theme that sheds light on how Black male STEM majors are prepared and how they decided to pursue their respective majors. Through exploration of a vast amount of study data, writing descriptive summaries, documenting thoughts and reflections, interpreting and compiling results of findings, the researcher has identified two converging themes regarding choosing STEM as major: (1) Some STEM decisions were based on the participants’ self-efficacy and confidence level, derived from having a passion for their area of interests, and adequate pre-college preparations. (2) In high school, having a passion for math and science, exposure to special learning programs such as high school engineering courses, field trips, and after-school tutoring programs all have a positive impact on shaping the participants’ STEM interests. The two sub-themes identified are: Overcoming STEM challenges through Math/Science passions, and enrollment in Special Learning/After-school Tutoring Programs. Some participants must work while in school and are unable to participate in after-school tutoring programs or activities.

**Overcoming Challenges through Math/Science Passions**

There were eight participants in this study. Two electrical engineering Seniors (Anthony and Bobby), two industrial engineering majors (Ozzie – a Junior and Jerry, a Senior), a civil engineering Senior, Tyrone, two biology Seniors (D’Angelo and Calvin), and one physics
Sophomore, David. All participants have expressed their profound love for math and science. The engineering majors also have a strong desire to be surrounded by technology. Math and science are the foundations of STEM. Adequate exposure to these courses during the pre-college years, such as in elementary and high school, will equip the student with the necessary tools to succeed. The participants in this study have a passion for math, science, and technology.

Attitudes toward math and science have been more positive for those participants who were exposed from an early age. It appears from this study that participants’ passion for math, science, and technology have allowed them to gravitate toward STEM fields. Pseudonyms have been used throughout this study to protect the identity and privacy of the study participants.

When asked about choosing electrical engineering as his major, Bobby, an electrical engineering Senior, responded:

“This is something I’ve kind of been interested in since I was younger. Not necessarily I knew that it was STEM, but there were certain things like, math, was something that came easy to me for a long time. But the technology side of it was more of something I just; I like technology; working with it. Whether it be constructing things, or figuring out how things work or how things come together to solve problems, or just getting a task done was something I liked when I was younger, but that wasn't the thought in my head. I just kind of saw things, I liked it, but looking back on it now I can see, this is something I was doing then, that's all been kind of sort of into this field or into that area”.

Bobby believes his passion for electrical engineering was there from early on in his life. This passion was also nurtured by his family and high school environments. His aunt, high school
counselor, and attending STEM summer programs, all of which helped to spark his interest in STEM fields.

D’Angelo, a biology Senior, when asked about choosing his major, indicated:

“I tell everyone I had a chemistry professor in high school and she was beautiful. It was a real interesting class but she told me a lot about how people from different countries don’t really see a black man pursuing that profession, and I used to think why not? And it just made me want to strive to reach that goal further. I was a medical technology major and then I wanted to broaden my horizon so, I switched to biology. I’m applying to dental school now. I have applied to a few schools”.

D’Angelo has long-term goals to pursue dentistry. He’s currently applying to dental school and currently mentors elementary school children in STEM. D’Angelo’s favorite scientific demonstration to children is using edible materials from around the house to show the chemistry of DNA (deoxyribonucleic acid).

David, a physics Sophomore, stated:

“I was like, maybe, I'll be a brain surgeon, but eventually I concluded that I wanted to be someone who understands what everything is made of and how to come up with a solution to any issue. Physics, to me, that's the most universal topic in science because it investigates the most minute makeup of matter and energy at the very smallest. They have the Hadron Collider to smash subatomic particles into its most infinitesimal makeup. Physics is to figure out what things are made of and you can create anything if you know what it's made of and at its most very basic level, yeah! That's what inspired me because I feel like I can do anything with Physics. Its ramifications are more definite. I would
say more long-term than collecting baseball cards or being a sports star, to come up with the world's first nuclear fusion reactor, that's going to have a bigger impact on humanity than being the best basketball star. I feel like the system distracts us with that (sports), in my opinion”.

David has a passion for physics. He stated that at age 11, he was pretty good at figuring things out for himself. His parents enrolled him in after-school tutoring programs which he said worked and should be universal for all students. Despite personal financial struggles, David is determined to succeed. He stated:

“To me, knowledge is important, so I didn’t focus on music and entertainment like that. I saw everyone else focused on that, but I didn’t. So, I made sure that once I was in high school, I took a heavy math and science curriculum”.

Calvin, a biology Senior, believes that as he matured, he became more focused on his education. He was at first, reluctant to pursue biology as his major, but was encouraged by his mother to do so. He is currently doing well in biology and applying to dental school. When asked about choosing biology as his major, he replied:

“My mom, she said do biology! It’s the only thing that, if you’re going to make some money in the future. She told me, do it! I was like, what is bio? Why I’m doing biology? It was so much to memorize. Over the last maybe year and a half, is when I started getting good at it, but it took time. At first, I hated it, just like everybody else. It was just memorization. I'm like, I don't want to do this; especially I was young, and I wasn't in the right things growing up. I was worried about a basketball games, or football games, girls, and drinking and smoking”.
Findings indicate that most participants benefitted from enrollment in STEM-learning programs or STEM after-school tutoring programs while in high school. These various programs that appeared to prepare these participants for pursuing STEM fields and are discussed below.

**Enrollment in STEM Learning Programs**

Gains in the Education of Mathematics and Science (GEMS) is a summer STEM enrichment program that is sponsored by the Army, for middle and high school students that takes place in participating Army Research Laboratories. It is sustained by its overarching mission: to interest young people, who might not otherwise give serious thought to becoming scientists or engineers, in STEM careers early enough in their education so that they have the time to attain the appropriate academic training. The program is focused on age and grade-appropriate hands-on activities, in STEM areas such as science, engineering, mathematics, computational sciences, computational biology, biomedical sciences, chemistry, and biology. Communication, science, technology, engineering, and mathematics (CSTEM) started as a pilot study in 2002 at a single middle school campus as part of Dr. Reagan Flowers’ dissertation action research project. It provides schools with external partnerships which support teachers desire to increase student achievement in STEM.

For Inspiration and Recognition of Science and Technology (FIRST), serves the purpose of inspiring young people to be science and technology leaders and innovators through engagement in exciting mentor-based programs which emphasize science, engineering, and technology. These programs help to build self-confidence, self-efficacy, communication, and leadership. Student Science Enrichment Program (SSEP), provides career-oriented and practical programs needed to provide creative science enrichment activities for K-12 students who possess great potential and interest in STEM. TechBridge provides opportunities for students to learn
Discussions on study participants’ STEM preparation and interests now follow.

Anthony, an electrical engineering Senior, has a passion for technology and wants to use it to help people. He described his preparation for STEM through special learning programs and other training in his pre-college life, stated:

“I went to a magnet high school for automotive technology. I still have a computer that I used for a program called Dell Techno, back in middle school. I still make plans on working on it and doing certain things with it. I was also involved in other programs back in middle school and going to high school”.

Bobby, an electrical engineering Senior, believes he was exposed to STEM by taking special learning programs in Washington D.C. over the summer. When asked about what sparked his interest in STEM, he replied:

“There was a GEMS (Gains in the Education of Math and Science) program I went to over the summer in D.C. I caught the train, went up there. I was there for a good amount of the day. And we were doing projects, things like that, that helped expose and I guess nurture that yearning to consider the field. I would say some of it was my family”.

David, a physics Sophomore, responded:

“I’ve had struggles with maybe math and maybe some reading when I was in first, second, third grade. So, here’s what they did, they put me in the after-school tutoring program: Reading, English, and Math. They mainly emphasized Math. I’m not sure what, as bad as some of the urban city schools were, I’m not even sure how they even
David appeared to believe the after-school tutoring programs worked and should be mandatory in all city schools.

Regarding STEM, Ozzie, an industrial engineering Senior, stated:

“When I was in sixth grade I did a science program here at this institution. So, they took us all around from Spencer, which is the science building and they brought us to engineering, and they had a flight simulator. So, I got to play with the flight simulator, and they told us the mechanics around it, and everything. I fell in love that day”.

Enrollment in STEM After-school Tutoring Programs

The findings from the study indicated that STEM after-school tutoring programs provide support for STEM students. After-school STEM programs, learning communities, targeted orientation programs, and early involvement has been shown to improve students’ attitude toward STEM fields and careers (Afterschool Alliance, 2011). Participating in these programs appeared to increase STEM skills and knowledge, increase confidence, and also provide self-efficacy. After-school tutoring programs involving the use of peer-mentoring could benefit these students. Peer mentoring facilitates the opportunity for new students to learn a specific experience(s) from the older students. It is a form of a learning community in which there are endless benefits for the students. A large part of the impact of college is determined by the extent and content of one’s interactions with major agents of socialization on campus, namely, faculty members and student peers” (Pascarella and Terenzini 1991, p. 620). Based on the
participants’ accounts, peer mentors would be very helpful at this study site where there is a shortage of tutors. Traditionally, peer mentors are usually students who are in good academic standing and are recommended by the faculty or staff at the institution.

In this study, only three participants mentioned the importance of after-school tutoring programs in their STEM preparation. They were Bobby, David, and Tyrone. These participants believe STEM after-school tutoring programs were helpful in preparing them for future success in their fields of study.

Bobby, an electrical engineering Senior, stated:

“There was a GEMS (Gains in the Education of Math and Science) program I went to over the summer in D.C. I caught the train, went up there. Similarly, David, a physics major, believes after-school tutoring programs work”. Tyrone, a civil engineering major stated, “Not only did we take classes that helped prepare us for now, we also had after-school tutoring programs. We had a senior project, where we had to come up with a proposal. I feel like that experience, that senior year where we had to make a project, after having taken some courses, getting introduced, I feel like it sparked my interest and got me prepared for what's expected in engineering”.

It appeared that one reason only three participants mentioned after-school tutoring programs was due to their respective job commitments. Some participants work multiple part-time jobs to finance their education, help parents pay rent, buy groceries or for paying for school materials.

Conclusion

Based on the participants’ accounts, choosing the various STEM fields as major was either deliberate, or based on passion and internal motivations such as personal interests, long-
term goals, or other influences. The study appeared to show that STEM decisions were based on the participants’ self-efficacy and confidence level, derived from having a passion for their area of interests, and adequate pre-college preparations. In high school, having a passion for math and science, exposure to STEM-learning programs such as high school engineering courses, field trips, and STEM after-school tutoring programs all have a positive impact on shaping the participants’. Some participants believed that STEM-learning programs prior to attending university gave them the confidence and self-efficacy for overcoming the challenges they encounter in their respective STEM fields of study. Some of the pre-college preparations described include early exposure to STEM-learning programs, involvement in STEM summer programs, and working on special STEM-related projects.

One participant indicated he had reading problems in second and third grade but improved after his enrollment in an after-school tutoring program that involved reading, English, and math, with an emphasis on math. This participant believes STEM after-school programs, including after-school tutoring, and other student engagement activities, should be mandatory in all schools throughout all levels of the nation’s educational system. Next, the importance of familial involvement in the life of these Black male STEM students is discussed.

**Familial Involvement in Black Male STEM Students’ Education**

Familial involvement appeared to be essential in the academic life of these Black male STEM participants. They relied on family for support, encouragement, guidance, validation, and confidence. The participants seemed to believe family support was needed even more when things didn’t turn out as expected, such as during poor performance in exams, losing a friend or loved one. Based on the current study, familial involvement through support and encouragement
is important to the participants’ perseverance and success. This study appears to show that the involvement of parents or other family members in their child’s schoolwork is important, and helps them to stay focused, motivated and encouraged. Some participants credited their single-mother, father, both parents, or other relatives for steering, cheering and keeping them focused on their educational goals. These findings corroborated Marcon (1999) findings which indicated that African American children whose parents were involved in their education showed higher scores in math, science, overall GPA, work habits, and social development.

Familial involvement in Black Male STEM students’ education, has emerged as the superordinate theme that describes how important parental involvement is to the development of Black males. The researcher has found two convergent sub-themes among the eight Black male STEM participants that emphasize the important roles of family, and non-relatives in their education. The two sub-themes that are presented here are discussed: The Family’s Supportive Role, and The Role of Non-relatives.

**The Family’s Supportive Role**

The participants in this study have recognized that either their mother, father, either parents or other relatives have played vital roles in their education. The various roles of the family, particularly the parents of the participants described above have been significant since more than once, participants mentioned how involved in their education their parents were. Parents sometimes allow their children to choose which way to go about their education; however, some parents are authoritative and some are authoritarian. Authoritative parents have warmth and control when providing guidance to their children, whereas authoritarian parents are very strict and firm in their expectations (Mandara & Murray, 2002). Based on the participants’
accounts, their parents seemed to be authoritative. When asked about the involvement of his family in his academic life, Anthony, an electrical engineering Senior, stated:

“The family just helps, supports, and even comforts, especially when you may not do as well as you want to in other classes. It helps build confidence. It helps you push along; that you know other people are not just relying on you but they're pushing you, they're urging you to make the right decisions, to push through classes”.

Regarding the importance of the family in his academic life Bobby, an electrical engineering Senior, stated:

“I would say yes, definitely! Because a lot of the encouragement just as finishing school, it comes from them. They know there are a lot of opportunities out there for me, which is why they’re all so enthusiastic. …my mom was telling me about engineering, things like this, the field is very secure and there’s a lot of opportunities. There are always opportunities available for engineers and you can go do so much with it”.

D’Angelo, a biology Senior, stated, “My parents motivated me. Did they have any role in me choosing biology? They didn’t think that. I was into sports a lot, so when I told them I wanted to do that they were kind of surprised, they really didn’t know what I really wanted to do, so it was up to me. So, it was just watching it, my surroundings, everything that was happening around me and I kind of was interested in that, so I went for that”.

Similarly, David, a physics sophomore, explains the importance of the family’s role as follows:

My family encouraged me when they complimented me, I always felt like I fell short in everything. I always felt like I didn’t do enough. I felt like I was the one responsible to make sure I provided for everybody. When you’re worried about your mom losing her
house or the power going out every month, that's a distraction. We're in Baltimore, it gets cold in the winter. That cold can distract you. Going into the house with no power on, you can't see anything. Going beyond that, you could turn on the oil, and the lamps, but it might still be cold. So, my mom always encouraged me. My step-dad was very good at encouraging me. He really made me feel like I could do anything.

Ozzie, an industrial engineering Junior, explains the importance of family to his academic life as follows:

*Family keeps you motivated; keeps you going. They keep you from losing your mind. My dad played a big, big role in it, because I was going to do business, and he was just like (Look at engineering, you can always find something business-related in engineering to do; and a lot of industrial). So, I was just like, it's a win-win for both of us. You need family because you need them to keep you going when you're stressed out about midterms or finals, you need someone to tell you it's going to be okay. It's going to pay off. You're going to get there.*

Regarding family involvement, Jerry, an industrial engineering Senior, indicated:

*My father didn't force it. I didn't know what I was going to do and he was like, do engineering until you find out what you're going to do because you cannot go wrong with engineering. He played a good role, however; I feel like it's my own motivation. I feel like I'm self-motivated. But if I didn't have well I don't know. I have to want it.*

**The Role of Non-Relatives**

Based on this study, it appears that non-relatives also have essential roles to play in the educational success of their children. The African proverb, “It Takes a Village to Raise a Child”,

draws attention to the importance of community involvement in child upbringing. The participants in this study seemed to have credited their professors, mentors, school-teachers, guidance counselors, guardians, foster-parents, peers, and religious groups as having played important roles in their academic success. These non-relatives played a vital role in educating, grooming, and molding them in their respective achievements. Many of these participants spend most of their time away from home and with non-relatives. These Black male STEM participants have recognized the roles of non-relatives in shaping their future, preparing them for this current stage of their lives where they have learned to assume more responsibilities for their schoolwork, and be more independent in these roles. The roles of non-relatives could also be negative; however, these participants did not discuss any negative experiences with non-relatives. Discussions on the roles of non-relatives now follow:

Anthony, an electrical engineering Senior, was asked about anyone who had a major impact on his life, and he replied:

*My mentors; way back when I was in high school they were actually mathematicians and engineers themselves. They helped push me along for my first couple of years of college. They helped myself, my brother, and a couple of my other friends, helped us out as far as learning about engineering, just being gentlemen in general.*

Bobby, an electrical engineering Senior, stated:

*I’ve had professors that go over and above the call of duty as far as what is required of them as far as helping their students.* Similarly, D’Angelo replied, “*I had a high school professor, she wasn’t a science major, it was a computer class and she definitely was very blunt with me and I respected her. She really didn’t lie to you, you know I went to a very*
diverse school, so she was straight up with you and if she’d seen something in you, she would let you know and she told me a lot of things that other teachers didn’t and I really appreciated and it helped me get focused and I had the opportunity to graduate at 16 from high school.

David, a physics sophomore, replied:

At some point, I realized that with some professors, most of what you learn is going to be at home. I believe I was fortunate to acquire the know-how when it comes to studying. My experience is when I see some professors they'll just do the problem and that will be that. They don’t really explain; they don’t really get across the intuition. Therefore, when I tutor students I make sure I get across the intuition. My experience in college is that a lot of times I see the disconnect between the professors and the students.

Tyrone, a civil engineering Senior, stated:

I believe in my high school, it was a lot of my guidance counselors, trying to get everybody to join the engineer program at the school. Then all my friends said, yeah, we’ll try it. I said, yeah, I’ll try it as well, because I had already heard from family, it’s a good field to go into, all the benefits. If that answers the question.

Conclusion

The involvement of family in the educational goals of the student appeared to be a trend among these Black male STEM participants. Many of them spoke very highly and proudly about either parents or non-relatives, and the positive impacts these relationships had had on their educational motivation and achievements. They believe family keeps them focused on their school work.
Based on the findings of this study, it seems like when parents and other relatives take time to engage and support their children in their school work, it can make a difference in their achievements. Encouragement from family members goes a long way to these participants’ success. David, a physics Senior stated: *My mom always encouraged me. My step-dad was very good at encouraging me.* Ozzie, an industrial engineering Senior stated: *Family keeps you motivated. They keep you from losing your mind. My dad played a big, big role in it…* Some participants were encouraged and motivated when their parents emphasize the importance of having a good education and the rewards that come with it. Bobby, an electrical engineering Senior stated: *My mom was telling me about engineering, things like this, the field is very secure and there’s a lot of opportunities. There are always opportunities available for engineers and you can go do so much with it*. One parent made recommendations about the choice of major but didn’t force it. Jerry, an industrial engineering Senior stated: “*My father didn’t force it. I didn’t know what I was going to do and he was like, do engineering until you find out what you’re going to do because you cannot go wrong with engineering. He played a good role, however; I feel like it’s my own motivation. I feel like I’m self-motivated.*” Another participant, D’Angelo, a biology Senior, surprised his parent because he was involved in a lot of sports activities, yet he told them, he chose biology as major. He stated: *I was into sports a lot, so when I told them I wanted to do that they were kind of surprised, they really didn’t know what I really wanted to do, so it was up to me.* Since education is the key to success in life, engaging students help to develop an inherent passion to succeed in school. It also helps them to know that they are not alone and that someone is counting on them.

The role of non-relatives can easily be overlooked. Based on these participants’ accounts, non-relatives also play a vital role in educating, grooming, and molding children in the
right direction. Students spend most of their time away from home and with non-relatives. These Black male STEM participants recognized the roles of non-relatives in shaping their future. Anthony, an electrical engineering Senior stated:

> My mentors, they helped push me along for my first couple of years of college. Bobby, an electrical engineering Senior stated: I've had professors that go over and above the call of duty as far as what is required of them as far as helping their students.

Tyrone, a civil engineering Senior stated: I believe in my high school, it was a lot of my guidance counselors, trying to get everybody to join the engineering program at the school, I said, yeah, I'll try it as well, because I had already heard from family, it's a good field to go into, all the benefits. Thus, both relatives and non-relatives made important contributions to the development of these Black male STEM participants.

**Feeling Engaged on Campus (A Sense of Belongingness)**

It appears from this study that feeling engaged on campus provides a sense of belonging to the participants. Based on the participants’ responses, feeling engaged on this college campus was of paramount importance. Some engineering participants believed that the engineering building was too secluded and they were rarely in contact with the main campus. Many of them described using Apps, emails, and texts to stay in touch with peers and to stay engaged and updates with important bulletins. Other means of staying engaged by some of the participants involved becoming members of campus organizations and departmental organizations, which are later discussed under campus organization memberships. Areas of involvement for some participants such as Calvin (a biology Senior), D’Angelo (a biology Senior), David, (a physics sophomore) and Tyrone (a civil engineering Senior) include mentoring elementary school
children. Calvin, a biology Senior was involved in football as well as basketball but said he wanted to cut back on sports so that he can focus more on his schoolwork.

The following sub-themes which give a sense of belonging were derived from the study data: Interaction with professor or faculty; peer-peer interaction; getting help on campus, and membership in campus organizations. These sub-themes will be discussed under their respective headings, accordingly.

Interaction with professors and other faculty members, such as mentors, outside of regular class times were found to be very important to these participants success. Frequent professor-student face-to-face interactions seemed to be essential to helping the study’s participants integrate life, career, and educational goals. The study’s participants emphasized engaging the professor to understand their expectations, and to solicit their guidance as they navigate their various fields of studies.

**Interaction with Professors/Faculty**

Interaction with professors/faculty is the first sub-theme that helped the study’s participants develop a sense of belonging on campus. All participants appeared to support the notion that interactions with professors or other faculty member are important. They believed that getting to know the professors or connecting with their professors would be beneficial to them. When asked about the importance of interacting and engaging the professor outside regular class times, Anthony, an electrical engineering Senior replied:

*They help guide you. It's very important because they just help guide you. Like I said, this is if I'm able to talk to my professors. They're there to advise me. Not just engineering issues but just life in general, career issues. .... It's kind of important*
because you get to know them as well as they're knowing you. You get to connect with
them and ask them for help not just with classes.

Similarly, Bobby, an electrical engineering Senior indicated:

It's very important, just making sure you understand the coursework, and letting them see
your faces. Because we're a smaller university, there's very good chance of your teacher
recognizing your face in the hallway or just on campus... I've had teachers help talk
through difficult times, just to be there, just to help push you forward.

Bobby believes interacting with professors is very important. He stated:

It’s extremely imperative because talking to them and talking to older people, just people
that’s been through the college experience and the things that you haven’t been through
or seen is knowledgeable and you could add that to your repertoire as you move along in
the future. He believes that shared experience and advice from the professor/faculty, can
be beneficial to the student.

David, a physics sophomore is more of a self-motivator who does most of his school
work independently. He’s sometimes disappointed with professors who don’t take the time to
connect and explain concepts to students but leave them up to the TAs (Teaching Assistants).

David stated:

With me, at a certain point, I was more of an independent type student. I occasionally
got into situations where, why can't I get this? What happened? I went to my professor,
... at a community college. This was Calculus 2, I think. I went to her. It was either Cal.
2 or 3. I went to her and I said,... What am I missing here? She showed me a simple way.
She said, first you must take a break. Your brain is fried. ... Watch me do this. ... I was
like, oh my God. I see now. That was important at that moment because apparently, I was
burnt out and my brain literally wasn't working.

Ozzie, an industrial engineering Junior believes the accessibility of professors is critical
to the learning process. He stated: “I’ve learned over time that, the more that a professor knows
about you, it’s better for you; some professors are inaccessible due to their constant involvement
in research”.

Jerry, an industrial engineering Senior believes establishing a connection, or a
relationship with the professor could make a difference in how one performs in class.
Calvin, a biology Senior believes that getting the professor to know you was important.
He also thought that physical appearance was important to connect with the professor.

Regarding the importance of face-to-face interaction with professors, Calvin stated:

That's when I get the A's. I remember taking a physics class last semester, and
everybody had about C in the class, or the tip of a B. I did my work ahead of time. I
hand in my assignments early, so, I was seeing that, the way I presented myself when I go
see the teacher, I go hand in the work early, at the end of semester, I had a B in the class.

Tyrone, a civil engineering Senior believed that support, advice, and guidance from professors,
or other faculty members were essential. He stated:

I feel like it's something that I've started to do more … it's important because it's just
good to have a relationship with your professors, especially in this field because like I
said, the support is good to have ... It's good to, if you ever wanted to get inside or hear
stories or words of encouragement, they've already done it, and so it's good to reach out
to those resources.
Peer-Peer Interactions

Peer-peer interactions are the second sub-theme that helped the study’s participants develop a sense of belonging on campus. Campus engagement through peer-peer interactions, collaboration within study groups, networking, and staying connected has emerged as one common interest among the participants. Based on their accounts, it appears peer-peer interaction facilitates better opportunities to learn specific experiences from the experienced students. It is a form of a learning community in which students engage, collaborate, and learn from each other. Peer-peer interaction helps to educate and support the learner. Through peer-peer interaction, new ideas may emerge, which could challenge the learner(s) to move beyond their comfort zones.

Peer-peer interactions were essential to the development, validation, and sense of belonging, of these study participants. It seemed as if it was through these interactions that some participants learned about opportunities on/off campus from which they could benefit, or a better way to approach an on-going problem or how to access useful resources on campus.

Anthony, an electrical engineering Senior believes interacting with peers build relationships through interaction, and collaboration. He stated:

They're helping you and you're helping them. It's interesting to see a lot of my friends who have graduated and those who I'm graduating with and how they help me in class, how they help me with my projects, and how I'm able to help them as well. We're able to help each other especially with projects because we're going to be working on huge projects in different engineering companies. This shows how one can get along with different people from different backgrounds and just build relationships from there.
Bobby, an electrical engineering Senior describes peer-peer interaction features as follows:

*A lot of teachers say you're not going to graduate by yourself; in the sense as, you must pull the class with you. If people in your class are struggling; if you're struggling in your class, the chances are, there are others around you struggling. ... you can then work with your classmates to try and get everyone's grade up. It's beneficial to all.*

D’Angelo, a biology Senior describes peer-peer interaction as networking, engaging, communicating, and staying focused on a common goal. He believes that peers must engage, support and collaborate with each other. Those with similar goals or aspirations must stay connected and support each other as they pursue common goals, and interests. D’Angelo indicated:

*Yes, I believe engaging and communicating and networking with our colleagues and everything is very important. It keeps you consistent, it keeps one focused, it keeps everyone striving for the same thing, basically...*

David, a physics sophomore describes the importance of peer-peer interaction features as follows:

*I see value in peer support because I even had a student who graduated ahead of me, who came in and helped me create my schedule for a semester or two. That made me feel like, ... Get this done and you'll be fine. This is Physics. You know how old some people are when they discover things? That peer-peer interaction, that was very encouraging. That encouraged me a whole lot.*

Ozzie, an industrial engineering Junior believes that peer-peer interaction provides the parties with support and encouragement for each other. He replied:
Yeah, it's good for work ethic, because they have a heavy load and then I have a heavy load, so it's just like, come together and we know we just must work.

One exception to the importance of peer-peer interaction was Jerry, an industrial engineering Senior didn’t believe peer interaction was important for his academic success. He replied:

*I'm self-motivated so having another peer around it doesn't really motivate me or play a difference, a role because I'm really motivating my own self so to me it's no important but it is good though. Don't get me wrong. I feel like it is good to see other men doing the same thing.*

Calvin, a biology Senior indicated that peer interaction was important for support, motivation, collaboration, and for forming study groups. He replied:

*We’re here because when you have somebody with you, you are going somewhere. You're working hard together. Same time, when you have assignments due and you’re like, well all right, you do this half of the assignment, you do this half of the assignment, and then we’re going to put them together. We’re going to get this A”. ….*

Similarly, Tyrone replied. *I feel like peer-peer interaction helps you sharpen your skills, talking with people that are in the same situation with you. When you need help and they can help you with. They may need help with something. Just helping each other to progress and get through it.*

**Getting Helped on Campus**

Getting help on campus is the third sub-theme that helped the study’s participants develop a sense of belonging on campus. Every college student, at some point in their lives, may require some form of assistance on campus. It may be directions (Even
though in today’s high-tech world, once you have a smartphone, or a computer with a connection to the Internet, you can find the answer to basically any common problem you might encounter on a college campus). Yet, not all problems can be solved with technology. Sometimes some leg-work may be required. These participants appear to have benefitted from campus assistance and have found it to be quite helpful.

Anthony, an electrical engineering Senior described the importance of finding tutoring help when needed. He also stated that knowing where the campus library or writing centers were located were also important. When asked about the importance of seeking assistance on matters of concern campus, Anthony replied:

*It’s important! If you don’t say anything nobody knows that you need any help. It’s important; unless you’re one of those students that just doesn’t need any help at all, who has everything down in the bag. I think that’s one in a million. It’s kind of important to get help as soon as you can and to seek all opportunities, all ways for help to come in. Tutoring, writing centers, the library, anything.*

Regarding getting help, Bobby, an electrical engineering Senior replied:

*I would say it’s actually very helpful. I was seeing advisers regularly; it’s going to be two years now, I was seeing them on a weekly schedule just because I was having struggles within the school. Personally, and mentally, I was having issues and they really did help as far as just trying to give me solutions as to what I can do to help overcome some of those things. And then just having someone to talk to, knowing someone’s in your corner, and helping to motivate you.*

D’Angelo, a biology Senior believes that the university campus library is only open certain hours of the week and that this is an inconvenience to the students. He stated: …. *Our campus does*
not have twenty-four-hour library service, it's kind of unfair, other schools have it. So, I thought the GPA and the grades would go up a lot for the students if there was better library access.

Financial issues, which will be later discussed, have been an on-going problem at this institution. The availability of educational assistance at this institution, though limited, gave David some hope and knowing that the institution is doing all it could to secure financial aid for the students. David, a physics sophomore, when asked about seeking assistance on matters of concern, stated:

*It's important because my impression is that the resources are very limited. We don't get the same treatment as traditional schools. Advisors listening and letting me know that they're going to reach out to try to assist me with, book, money or tuition or even some basic things that you need to survive while you're in school. I just think that there's so much neglect when it comes to black kids and black people in general. For the last three semesters, I've been in and out of different advisor's offices and they've been assisting me in getting funding for my books, book vouchers, tuition. If they didn't even try to help the way they did, I probably would've quit school, at least for a little while.*

Ozzie, an industrial engineering Junior who is from an affluent family, when asked about getting help or seeking financial assistance on campus on matters of concern stated, *“I never had a situation like that, where I had to go see a counselor on campus”*. His parents support his financial and other needs in college. He did not have to worry about tuition or other expenses. It is possible that this participant may need assistance in other ways such as tutoring, writing center, or library access somewhere in the future.

Regarding seeking assistance or getting help on campus, Jerry, an industrial engineering Junior replied, *“I don’t think I’ve ever seen the counseling office. I don’t even know who's a counselor.*
I don't know what they do. In high school, yeah but I've never seen, here it's like you talk to somebody that you can relate to or somebody that's really special. I know that there are a couple people here that I can talk to about certain things but they're not counselors”.

Caine, a civil engineering Senior replied:

I feel like it's good when there needs to be counseling on campus and I feel like it's important that people know where it is. You don't break down and you don't become overwhelmed and you know where your resource is if you ever need to vent or to get something...

Campus Organization Memberships

Based on this study, it seemed like becoming a member of a campus or departmental organization can be very helpful to the student as he navigates the intricacies and complexities of the learning environment. Many participants were either a current campus or departmental organization member or had served in the past. For those who have served in the past, the reason for the discontinuance was due to college work-load. The Seniors, who were taking upper-class courses stated that the challenges were too great and that they needed to focus on their schoolwork. Others believe they needed more free time so they can work to pay bills. Some of the participants work multiple part-time jobs while carrying a full course load. One participant didn’t feel engaged on campus and thought it was not necessary for him to join campus organizations nor interact as much with peers because he is self-motivated.

Regarding on-campus organization membership, Anthony, an electrical engineering Senior stated that he thought it was important to become a member of a campus organization, even though he wasn’t currently a member. Bobby, an electrical engineering Senior wanted to
concentrate more on his schoolwork. That’s the reason why he’s not currently any organization member. He stated:

*I used to be a lot more involved on campus during earlier years. I was in various organizations. Morgan Mile, Collegial 100, Strong Men Overcoming Obstacles Through Hard work, it's abbreviated "SMOOTH", that's an organization that started here at this institution, but I kind of fell off a bit. The opportunity was there early. For me, I kind of felt like I was losing focus on my school work...*

D’Angelo, a biology Senior replied:

*Unfortunately, I am not involved, but I am working on that with one of my colleagues to start up one. Currently, I haven't really found the organization that I really found suitable for me, and I also have been focusing more so on my grades and since they're important for graduation, things like that.*

Similarly, Ozzie, an industrial engineering Junior replied:

*Okay, so I would say up until my junior year, I was very involved on Main Campus. Very involved, well known. But then it came to the time, where like, all right, my classes are getting a lot harder. People, a lot of the people I know aren't really STEM majors, so they're majors are kind of easy and they're leaving. So, I'm just like, there’s only a couple of us here, it's time to really buckle down. So nowadays, I don't even leave this building. Main campus, I can go without seeing that for months.*

Tyrone, a civil engineering Senior indicated:
I'm involved in several organizations, and student governments. I feel like I'm connected and I feel like that has helped me because I like gaining other perspectives and knowing what other majors are going through, other students, their situations...

Conclusion

Feeling engaged on campus provided these study participants with a sense of belongingness. The subtheme, interacting with professors or other faculty members appeared to be important to the participants in this study. Getting to know the professor and connecting with that professor was valuable. Some participants emphasized engaging the professor to understand their expectations, and to solicit their guidance as they navigate their various fields of study. Engaging the professor is a vital tool in understanding the material, which at times can be quite difficult to comprehend. Participants believed that engaging with someone with more knowledge and experience in their respective field was very vital to their success. Therefore, these participants were very interested in interacting with their professors outside regular class times as it helped to advance their academic success.

As Black male STEM majors at this HBCU, most participants described similar peer-peer interaction experiences that were important to their success. They encouraged each other through support, motivation, collaboration, group studying, and networking. Peer-peer interactions in college provide the advantage of being surrounded by those of similar interests, goals, and aspirations. People with similar goals and aspirations, when subjected to the same environment, will motivate each other. The participants believed that engaging, communicating, collaborating, and networking with peers and professors will keep them consistent, and focused on their school work.
Most participants in this study were engineering majors who enjoyed math and technology. Throughout their engineering coursework, students are oftentimes assigned group projects that require much planning and collaboration. Collaborating with each other on group projects teaches teamwork and individual responsibility. Such derived skills are crucial for personal and professional success and will continue to serve these students later in life. Engineers need to depend and trust each other since it’s not always possible to go around verifying team members’ work. Group studying was also important to the participants because one of the advantages it provides include presenting different approaches or perspectives to problem-solving. One person in the group may have a better way of solving a particular problem or to explain how to arrive at a better solution.

Seeking assistance on matters of concern or getting help on a college campus is another subtheme that was important to most participants in this study. Even if it’s not utilized, just knowing that the resources were there, is very helpful to reassure the student that everything was okay because being a student, can be very stressful at times. Participants who described themselves as self-motivated, for instance, Jerry, an industrial engineering Senior, and Ozzie, an industrial engineering Junior, were less likely to seek assistance on campus.

Involvement in campus organizations were key elements to some participants while on campus. Many study participants had been members of various campus organizations. Those who were not current members claimed that the upper classes had been more difficult and they needed more time to stay focused and to keep up their grades. Other participants needed to work while in school, to pay bills. Some participants, who are non-members of any campus organizations worked multiple part-time jobs. One participant, Ozzie, was not a member of any such organizations and was financially supported by his parents.
Most Important Concerns on Campus (Black Male STEM)

Some salient concerns were raised by the participants during the interviews. The domino effect of not having enough financial capital has been evident. Based on the participants’ accounts of their campus experiences, it seemed there were not enough professors available to teach courses. There seemed to be shortages of not only professors but other staff, including advisors, tutors, and mentors. In addition to not having sufficient numbers of educators, some participants have expressed disappointments about not getting better access existing ones outside of class-time. Industrial engineering Senior, Jerry, described the learning facilities as having dated equipment; broken equipment, middle-school quality lab facilities. The underlying cause for all these inadequacies appeared to be institutional financial issues. Quantity, as well as quality professors, are essential to meeting the students’ learning needs. Two converging areas relating to the participants’ most important concerns identified by the researcher were: limited budget and limited course availability. Insufficient funding at the institution has resulted in shortages of professors/advisors and tutors, and limited course availability. Funding issues have been relatively common at HBCUs. Because of financial difficulties, some HBCUs rely heavily on alumni donations to stay afloat. Some participants were frustrated about working hard, getting good grades and in the end, not being able to secure available scholarships, tuition assistance, and other needed help such as living expenses. The two sub-themes identified were: Insufficient Funding and Limited Course Availability.

Insufficient Federal/State Funding

The effects of insufficient funding on the participants have led to some degree of frustration with, as one participant calls it, “the system”. Limited funding has resulted in limited resources and sub-standard facilities and equipment at this institution. Financial stress can lead
to the “domino effect”, in which case, everything that requires funding is affected; from hiring a sufficient number of administrators, professors, tutors, class schedules and library access, to facility maintenance and security.

When asked about his most important concerns as a STEM major on his university campus, Anthony replied:

*The availabilities of the professor for classes, for certain classes. Personally, because I'm biased as far as renewable energy, I like more renewable energy courses being offered. We are starting to see a little bit of a change where some other professors are either coming in or even occasionally students are being trained to become professors or instructors for certain classes during a semester because there's a high volume of students coming in nowadays for engineering, which requires more availabilities for different types of classes or more sessions open for a particular class.*

Dangelo explained his most important concerns as indicated:

“I actually wanted to go and speak at a counsel hall meeting and it was difficult because our campus has a non-24-hour library service. Improving library access, he thought would improve the GPA (Grade Point Average) for a lot for the students. DAngelo believes that not having a 24-hour library service at this institution is an inconvenience. Offering 24-hour library services are expensive. Limited funding prevents these services at some institutions, such as this relatively small HBCU.

David explained how insufficient funding is affecting his institution as follows:

*Our graduation rate is low. I attribute that to lack of resources like being able to address the basics. Like I said, there's some students who don't even have a place to stay. So, their potential is not being tapped into because they don't have the basics. We’re starting
to put up nice buildings and stuff and then apparently, we're getting some people on the outside looking to see how they can come and benefit themselves instead of addressing the actual problem as to why our students and not graduating, and have a low GPA. We know we don’t get the same treatment as Towson University.

David believes that if the basic needs of the students were met, their academic performance would improve. He believes that the low graduation rate is tied to insufficient funding and poverty. David indicated that insufficient funding has also negatively impacted the university’s administration from hiring enough professors, advisors, and tutors. This has also contributed to poor learning facilities which one participant has described as “middle-school quality labs”.

Ozzie indicated that the allocation of resources at his institution is a problem. He believes funding is not being spent where it is most needed. When asked about his most important concern on university campus, He stated:

> We need more teachers. I don’t like how a class is only offered once a year; and if you don’t take that class, it pushes you back a whole year. I feel like at this university, we have too much money and that we are spending our money on other things. We could hire more teachers than worrying about the appearance of the university. Granted, now that I think about it, the appearance is what brings more money because it brings the students in. But I just feel like, if you bring ... what’s the point of bringing the students in if they, when they get here they're unhappy because they can’t go through their matriculation in a timely fashion. I just feel like; we need more staff. At one point, I felt like there was just professors here, to collect a check, because some of them are just unreasonable and just difficult, and just seem like they were just taking the easy way out. So, I would just say more staff; more people who have the passion for what they're doing.
Regarding important concerns on campus, Jerry replied:

*We could update some of the labs because there’s no way our labs should be looking like middle school labs; you know what I mean? Science labs, I feel like we should be more high-tech with it. If we cannot get a new building. We at least need to upgrade some of the rooms and equipment in the labs.*

**Limited Course Availability**

Limited course availability is the result of limited funding. An institution can only offer courses for which it can afford to hire professors to teach. When funding is limited, administrators are find better and efficient ways to manage what is available. Limited course availability has been an inconvenience for most participants in this study. For those who must work while in school, or those who need to meet the credit requirement in order to graduate, there is extra stress because of these concerns.

When asked about his most important concerns on campus, Anthony replied:

“*I don't know if I truly have some. It's more of the availabilities of the professor for classes, for certain classes. Personally, because I'm biased as far as renewable energy, I like more renewable energy courses being offered*”.

Bobby indicated:

*There are some classes that are only taught by one teacher. So, there's one professor for this class and that's it. You can't do anything else about it. I've had friends who haven't gotten along with certain professors, but because that professor is teaching the only class*
they are obligated to go back to that professor, regardless of whether they wanted to or not. Thus, more flexibility in the schedule is needed.

Bobby believes some professors are willing to do extra time to provide support for the student, whereas others seem frustrated and delegate the responsibility to the T. As (Teaching Assistants). The shortage of professors, advisors and tutors at this institution have resulted in the domino effect such as shortage of class sections, a rigid course schedule which does not meet the needs of most students. Bobby has stated:

“I think the availability of classes all around would help and then, for not study-hall essentially, but like for tutoring, I do think that relying on your classmates is necessary if you really don’t understand something. Because when you get to the higher up things, there’s no tutor. It’s just other students that can maybe help you out. There’s no tutoring”.

The most important concerns on campus, as indicated by Tyrone:

Increasing the availability of courses, and probably adding additional counselors. I also found when it’s time to make schedules, it's not necessarily a hassle but with so many people going to the same advisor, is like a lag time. Just having more advisors or more resources that could advise you, other than the designated person. Just more flexibility I guess, in the courses and then the advisor. Having more resource in those areas, more options. They get overloaded and they have all these things to do.
Conclusion

Black males STEM majors, especially in historically Black colleges (HBCUs), are often faced with challenges that are incomparable to traditional institutions, yet, many persevere to achieve their ultimate goals.

Limited budgeting at this HBCU has resulted in shortages of much-needed resources as described by these participants. Sub-standard equipment and facilities are also because of limited financial resources. The shortages of professors, advisors, and tutors have resulted in a limited number of available courses and classes for the students each semester, and each year. As a result, some participants are frustrated because they must wait much longer to graduate because their curriculum is extended. More time in college means more expenses for them.

Overlapping themes discovered in this section were Limited Budgeting, Insufficient Professors/Advisors, and Tutors; and, Limited Course Sections. Overlapping was due to the budget-limiting factors between these themes. Without adequate funding, administrators were not able to hire enough professors, advisors, and tutors; neither were they able to improve the learning facilities such as labs and classrooms. Some HBCUs have suffered because of limited funding from the federal and state governments. Some institutions mostly rely on alumni donations to supplement their budget shortfalls. Predominantly White institutions (PWI) institutions usually have reliable sources of funding and can afford to hire some of the most high-bid and tenured professors. Based on the accounts of one participant; getting good grades (B and above), will not guarantee scholarships or financial aid. This is frustrating. Participants have described scavenging for financial aid and scholarships, just to stay in school.
Considerations About Quitting

After carefully listening, recording, reflecting and processing the Black male STEM participants’ accounts of their lived experiences, a few participants thought about quitting. Many participants persevere due to having high self-efficacy, established from earlier on when parents allowed them to participate in summer programs, after-school programs or having a tutor. All these activities are expensive and unfortunately, not all parents can afford to hire tutors for their children, nor send them to summer school. Yet, having a very supportive network made a huge difference in their lives. Based on these participants’ accounts, important resources such as parental support and encouragement, support from relatives, peers, professors, advisors, tutors, and religious faith were useful sources of courage and strength.

Themes derived from this study have above all, heightened the importance of having parental support and encouragement as a student. Parental support is important, especially during difficult times when a student is failing, frustrated, or under an enormous amount of pressure. Some of the reasons why some participants thought about quitting were: it’s a difficult field; personal financial struggles; even though I have a high GPA, I receive no tuition assistance; I had to repeat several classes, or it’s taking too long to graduate. Therefore, for this superordinate theme, five converging areas across participants were identified as sub-themes. They were: Personal Financial Struggles or Frustrations, STEM Fields too Challenging, Self-Motivation, Parental-guidance and Encouragement, and Peer Support. Below, Personal Financial Struggles or Frustrations are discussed separately to provide more context to these issues.

Personal Financial Struggles
Financial struggles of any kind can create many obstacles for advancement. Yet, many participants in this study described these experiences and how difficult it was to survive day to day, while in school; to find food, shelter, and have a place to live. Some participants described working multiple jobs while in school full-time. The African American family faces many struggles just like any other ethnic group in America, however; one apparent reason the financial struggle is unique to this ethnic group is the relatively high unemployment rates. Many young African Americans grow up in single-parent households, where the financial burdens can be overwhelming. Parents who are always working to make ends meet have very little time to spend with their children, to raise and provide guidance, establish bonding, and to promote self-confidence which is important in their development.

The participants in this study are over-comers who have endured and persevered through many difficult challenges to be where they are right now; STEM majors, seniors, juniors, and one sophomore. These students, many of whom want to give back to their various communities, will hopefully one-day graduate and ready to make a difference in society. Below, starting with the subtheme personal financial struggles, study participants’ share their various reasons for wanting to quit and why perseverance.

Dangelo, a biology Senior described his personal financial struggles as a Black male STEM student by stating:

*Over the years, I’ve had some financial issues and I would say it caused a negative effect in me because I wasn’t aware of some of the resources on campus, like that. But as I networked, talked to some people and got involved, I became aware and found out about some of these things, like scholarships and programs and things like that.*
David, a physics sophomore stated:

*It got into my feelings a couple of times like, "Man, you know, I'm going to quit," sometimes let's say I'm at a 3.0 or higher and then feel like when I go to get help for basic things, the money to cover my tuition, why is it such a struggle? Or the money to go a bit beyond that and make sure I can buy groceries, or helps me support my ability to have housing, my ability to get to school and back. When I see that, I have above a 3.0 and can't even get help with basic stuff, it's like why should I even do anything?...*

**Personal Frustrations**

Some participants articulated their personal struggles and frustrations as Black male STEM majors. Due to apparent budget limitations at this research site, administrators were only able to hire what limited budgets could allow. In the end, it is the students who face the consequences. Anthony, an electrical engineering Senior has expressed his frustrations by stating, “I definitely should have graduated a little bit earlier than this. I spent a little bit too much time in school”. The apparent shortage of professors, advisors, and tutors have resulted in rigid course schedules along with limited class sections, and in the end, low graduation rates due to extended matriculation.

When asked about having enough professors, Bobby replied:

*I would say, for the size of our school I would say yes, for the most part. But there are some classes that are only taught by one professor. You can’t do anything else about it. I’ve had friends who haven’t gotten along with certain professors, but because that professor is the only one teaching the course, they’re obligated to go to that professor, regardless of whether they want to or not... It would be nice to have more flexibility in*
The schedule. We have certain classes that are only offered maybe in the spring. So, if you could have graduated in the fall, or in the spring, you took a class and didn't pass, now you have to wait a whole 'other year to come back and take this so you can progress.

**STEM Fields Too Challenging**

The participants in this study represent those who persevered in their respective STEM fields. Some factors of perseverance include high self-efficacy, and knowing someone wants them to succeed and is counting on them. The academic challenges such as workload, rigor, and time commitment, faced by STEM majors, can be overwhelming to the point of which some participants thought about quitting. Some challenges faced by the participants include having to repeat classes, workload, rigorous coursework, grades, not being able to register for a class because it’s only taught by one professor and offered only once per year, and graduating on time. One participant switched to another STEM major due to challenging coursework. Many of these concerns were beyond the participant’s control and were due to federal-funding limitation issues at the institution.

Regarding thoughts about quitting his major, Anthony, an electrical engineering Senior replied:

*Yeah, it's difficult! Much more difficult than I expected. Like I said, it's a hard field.*

*Having to repeat classes and things like that, it kind of makes one feel hopeless.*

*However, I think that, my faith, family, hopes as far as my goal, are helping me focus and hopeful, to keep pushing and persevering. To give up at any certain point it's too easy to do that.*
Bobby, an electrical engineering Senior commented about being a STEM major:

*I would say, some of the coursework are very challenging. I'm not saying it's impossible, but I know it can be intense sometimes. Especially if you have a high course load. Me personally, there was one point where I claimed to be a student but I was working three jobs. I wasn't a student; I was just enrolled, essentially because I was trying to work on living out here, paying my rent as well as paying for other things. Trying to do all that at once while trying to do a full coursework, it didn't work out and was discouraging. But it just let me know that I can't play around as much. I would say earlier in my school career; I was able to coast. I didn't have to study as much. Getting to this level, I came to classes where I could not succeed unless I sat down, studied and put in the time and effort to do it.*

Bobby persevered due to family members, loved ones and friends who always encouraged him. He stated:

*"The fact that I made it this point where I'm only 35 credits away, there's no reason for me to give up now. Even if I get the degree and just be like okay, fine I want to do something else, so be it. But at this point it would be unwise of me to let go of the progress I've made so far".*

D’Angelo, a biology Senior when asked about ever having the feeling of quitting his major, responded:

*Actually, yeah, I thought about it before I switched to my new major. I did bad in organic chemistry and I was like "Wow, I'm going to have to graduate a couple years behind" and I was mad because I really wanted to do medical technology and I ended up*
talking to some people and they told me what I could do with a biology major and I was absolutely interested in it. I just went ahead and switched my major and I found out if I would have been a biology major from the beginning, it would have been a lot easier on me. I was a lot more interested in biology than I was in medical tech. My parents motivated me.

About thoughts of quitting, David, a physics sophomore replied:

“Because if I allow my circumstances to cause me not to do what I need to do for my people, why should I let the system in place ... that’s not broken, by the way. It's built that way. Why should I let that type of system win? I'm going to keep going because it's not just about me, it's about our people. It's about our students”.

David described society as “the system” and believes it has made it more difficult for “his people” to get ahead. Another participant, Ozzie, an industrial engineering Junior stated:

“I felt like giving up at least twice one semester. I felt like I had people counting on me, that’s one; and then two, is people who came before me always say don’t give up, you’re almost at the finish line. Everything will be worth it at the end of the day. I like to have hope. I like to believe that it will all work out.

About thoughts of quitting, Jerry, an industrial engineering Senior replied:

Not at all! I believe in challenges. I like the challenge and feel like anything is possible when it comes to school. For instance, right now, this semester I look at my grades and I did terrible this semester but thing is I know that I could've done some things that would've made a difference, so now I know when I go on, I have a lot of things to overcome, so I must pay a price but that doesn't mean I'm going to back away.
Regardless of his circumstances, Jerry still has the desire to succeed. He indicated that this summer he was going to take some summer classes and make up.

“I never look at something and give up because if that was the case we’d still be in slavery as people. A lot of these inventions wouldn't materialize because they're not easy, so no, I don't give up. I like to persevere”.

Calvin, a biology Senior believes that his mom, sister who is a lawyer, and one of his friends helped him to persevere. He said, “I want to impress my mother; she always encourages me. I want her to no longer work. I want to retire her”.

About quitting school, Calvin explained:

_The time I wanted to give up was, when I see I took the 18 credits, I maxed the classes, and I still couldn't play football. Even though I was on scholarship, I still couldn't play a game, because they told me to catch up on these credits. I did what they told me to do, and I still couldn't play. That one crushed me. I was like, "Why am I even doing this anymore?" Because of that situation, it told me, listen this sport, you have accomplished something already. Let it go, because now it's time for you to accomplish school. That was what it did for me._

Similarly, Tyrone, a civil engineering Senior explained that there were times he had to reassess his work load because in addition to all the classes, he was involved in a lot of organizations on campus. Tyrone stated,

_“It does get overwhelming with all the classes, all those requirements, and all the study hours; then at the same time, trying to run or volunteer in the organizations. It can test your limits, as far as your schedule and your capacity for work”._
Regarding perseverance, Tyrone stated that he was encouraged by having mentors; someone who showed him that they cared about his success. He indicated that living on campus was his first major on-campus living experience, and that he felt like it was good because he liked the environment that was created in his residence building. He stated:

*It made me want to be a Resident Assistant (RA). So, I’ve been doing that ever since my sophomore. Been my third year in the same building, I really feel like from my resident director and the RAs, they were good mentors. They were engaged with me constantly. Whenever I had questions about campus or what to do, they always were helpful. That inspired me, I wanted to do what they were doing. I’ve been a RA for three years now and that’s just been my connection. I really love the on-campus living and feel like, as students, one must find something on campus that is appealing, whether it's academic or social. I feel like this has been one of the things, that really helped me. The mentoring I received, I wanted to pass it on, so I got involved on campus by becoming an RA and that's how I mentor.*

**Self-Motivation**

Despite the many challenges experienced by these participants, they persevered through enduring personal qualities such as self-motivation, faith, career goals, aspirations, having a supportive family, self-efficacy, and engaging with their professors or mentors. Some study participants were frustrated and felt like giving up because of having to repeat classes but persevered because of self-motivation and wanting to make their parents proud. Anthony, an electrical engineering Senior, stated:
“Having to take over classes and things like that it kind of makes one feel hopeless. However, I think that, like I said, my faith, my family, my hopes as far as my goal is helping me focus and keep hope and keep hope alive and keep pushing or persevering. To give up at any certain point it’s too easy to do that”.

Bobby, an electrical engineering Senior who works three jobs, to make ends meet while being a full-time student, stated:

Some of the coursework, it's very tasking. Me not wanting to give up myself, because I knew this was something I could do, it wasn’t something that was out of reach of my abilities. I just know I had to focus, and I just had to buckle down”.

Bobby’s family members, loved ones, friends supported and encouraged him. He credited his mom for bringing him to this point in his life; she had paid for his first year of school. He indicated, that, after the first year he realized he couldn’t give up. He stated that he needed only 35 credits, and no reason to give up. Thus, having a robust support system such as the family, has helped Bobby maintain s focus on his goals and aspirations and to continue to persevere, despite the many challenges.

David, a physics sophomore and a self-motivating student stated that he relies on his own motivation and efforts to succeed. He stated:

“At some point, I realized that with some professors, most of what you learn is going to be at home. I believe I was fortunate to acquire the know-how when it comes to studying. My patience level is very high. I will sit there for an entire day and read two chapters in Physics and do every example. When I see some professors they’ll just do the problem
and that will be that. They don't really explain; they don't really get across the intuition.”

Parental Guidance and Encouragement

In his response, D’Angelo, a biology Senior emphasized the importance of parental guidance and encouragement by stating:

“My parents motivated me. My mom and my father, them being here and up here, they push me a lot to strive, do a lot better than what I think I can do myself. Just helps me push myself to the limit and stay consistent in what I do. Also, the youth, I have a lot of younger cousins, so I just try to be the example for them.”

Bobby, an electrical engineering Senior has reaffirmed his self-motivation and commitment to succeed by indicating that his parents did not have any role in his choosing STEM. He stated: “Actually, they didn’t actually think that. I was into sports a lot, so when I told them I wanted to do that they were kind of surprised, they really didn’t know what I really wanted to do, so it was up to me”. Regarding his family’s role in his success in STEM, Bobby stated:

It is important because a lot of the encouragement just as finishing school, it comes from them. They know there are a lot of opportunities out there for me. Which is why they're all so enthusiastic. My mom was telling me about engineering, that the field is very secure and there are lots of opportunities. I can go to the private sector, or do government work, whatever else, there's just so many opportunities out there. If I can secure this for myself, I shouldn't be in the position where I'm hunting for a job for too long.
Perseverance Through Peer Support

Collaboration with peers is important in STEM for group projects and discussions. All participants have spoken favorably about peer-support in their STEM journey. D’Angelo, a biology Senior stated that peer-support allows networking, communicating, the ability to engage each other staying focused which, in the end, facilitates the learning process. Ozzie, an industrial engineering Junior stated that “teamwork makes dream work”. Teamwork is essential in engineering which depends on the trusted skill of those who are connected to a particular project. Jerry, an industrial engineering Senior stated that peer-support, while it may work for others, to him it is unimportant because he is self-motivated.

Calvin stated:

“You’ve got to work together in college. Everybody thinks you can do it by yourself. No, you're not going to do it by yourself. I don't care how smart you are. You need to work with people. This is how you're going to get better. Maybe you study by yourself a little bit, but then you come together before the test, two, three days before and you talk. That's how you're going to remember stuff.”

Tyrone, a civil engineering Senior’s response to peer-support stated:

“I feel like it definitely helps you sharpen your skills, talking with people that are in there with you. People that are at your school, being able to relate to somebody, similar circumstances, similar situation, it's like you're all in it together. When you need help and they can help you with. They may need help with something. Just helping each other to progress and get through it.”
Conclusion

Most participants appeared to think about quitting at some point, for different reasons such as having financial struggles, challenging courses, having to repeat numerous classes due to poor performance, academic probation, having good grades but no available tuition assistance, and for other reasons such as frustration and discouragement. These participants deserved to be commended for their efforts under these circumstances. According to them, their institutional administrators are doing all they can to aid them with the little funding received from state and federal government. Based on one student’s accounts, having good grades does not guarantee financial aid or tuition help. HBCUs constantly struggle to stay afloat due to limited budgeting and decreased federal funding allocations.

Themes derived from this study have supported the importance of parental support and encouragement throughout the student’s academic life. Parental support is important, especially during difficult times when a student is failing, frustrated, or under an enormous amount of pressure. Reasons why some participants thought about quitting were: it’s a difficult field; personal financial struggles, high GPA but no tuition assistance or other incentives; having to repeat several classes; it’s taking too long before graduation and other personal issues. Only one participant, D’Angelo, a biology Senior, described switching his major due to its difficulty, however, this switching was from one STEM to another. This participant was quite satisfied and is currently applying to dental school. Self-efficacy was an important factor in all these participants choosing STEM majors. According to them, perseverance, not giving up, knowing that someone is counting on them, is an important motivator. They believed that they could overcome the many challenges and, in the end, will succeed in all their endeavors.
This study did not cover Black male STEM students, who for whatever reason, dropped out of the program. Therefore, the findings are only representative of those STEM majors who persevered in their respective programs. Despite these limitations, this study is one of few to have investigated the academic experiences of Black male STEM majors at a small HBCU, their academic challenges, and the role of their families these challenges.

Conclusion

The analysis and findings of this study data have yielded five superordinate themes. The five superordinate themes were: Choosing STEM Fields, Familial Involvement, Feeling Engaged on Campus, Most Important Concerns, and lastly, Considerations about Quitting/Persevering. The research problem under which this study was based is, “How do Black male STEM majors understand and explain their interests and success in STEM fields?” The findings in this study indicated that choosing STEM fields was significant to all participants. The participants attitude toward math, science, and technology either through internal motivations or deliberately, supported this premise. Adequate pre-college preparations in math and science and having a passion for these subject areas, as well as a love for technology, have given self-efficacy, and motivation to the participants. Despite the many challenges over the years that seemed so endless, these participants have endured and persevered in pursuing their ultimate goals and aspirations. Based on the participants’ accounts, choosing STEM fields as major was based on personal interests, long-term goals, internal motivations or self-motivation, self-efficacy, or familial influences. All participants appeared confident with their choice of major. The driving force for their choice appeared to be the practicality of their respective fields and the prospect of having rewarding careers.
Some participants believed involvement in STEM special learning programs, various STEM after-school programs and activities prior to attending university gave them adequate preparations for taking on the challenges expected in their respective STEM fields. Some were prepared by attending magnet high schools, early exposure to personal computers, involvement in summer programs, working on special projects over the summer break, or working on automobiles and staying engaged in schoolwork. Others mentioned the importance of having after-school tutoring programs, working on STEM projects, which in the long run sparked their interests. After-school programs, including after-school tutoring, and other student engagement activities, are important factors in preparing for a future in STEM.

Familial involvement was an important motivating factor to these participants’ perseverance and success in their respective STEM fields of study. Knowing that someone is counting on them, having the guidance and support of the family helped them stay focused. Findings indicate, parental support is an important element, especially during difficult times when a student is failing, frustrated, or under an enormous amount of pressure. The involvement of family in the educational goals of the student has been a motivational factor in the lives of these Black male STEM participants. Participants spoke very highly and proudly about the important roles their parents, or non-relatives had on their academic choices and success. They believe family keep them motivated in their work.

Feeling engaged on campus was identified as a superordinate theme which describes the student’s feeling of belongingness on campus. Two important factors were interaction with professors/faculty, and campus organization memberships. The first factor, interacting with their professors outside regular class times was supported by all participants. Getting to know the professor provided intelligence on his or her expectations and also provides clarification on any
subject matter that may be unclear to the student. The availability of professors outside regular class-times can sometimes be a daunting task, especially if there are not enough professors at the institution or if the professor is involved in research projects. The other engagement factor, campus organization membership, was another key element to student engagement on campus. Many Black male STEM study participants had memberships in various organizations. Those who were not involved explained that the upper classes were more difficult and they needed more time to stay focused and to keep up their grades.

The most important concerns cited by these participants were limited funding opportunities and limited course availability at the institution. The availability of limited federal funding to HBCUs has resulted in shortages of much needed resources. Sub-standard learning equipment and facilities, the shortage of professors, advisors, and tutors have resulted in a limited number of available courses and classes for the students each semester, and each year. As a result, some participants are frustrated because they must wait much longer to graduate because their curriculum was extended. More time in college means more expenses for them.

Considerations about Quitting or Perseverance were the final superordinate themes cited by this study. This study did not involve Black male STEM participants, who for whatever reasons, dropped out of their programs. Therefore, the findings are representative of those STEM majors who persevered in their respective programs. All participants at some point, thought about quitting school for reasons such as personal financial struggles, challenging courses, having to repeat classes, academic probation, good grades but no available tuition assistance, and for other reasons such as frustration and discouragement. Perseverance on the part on these participants, was because of their commitment, determination to succeed, support knowing someone was counting on them, peer-support, and their self-efficacy.
The results of this study indicate that Black males who chose STEM fields as major, were based on the following factors: internal motivations, a passion for math, science, and/or technology, familial involvement, adequate pre-college preparations in these subject areas, involvement of school guidance counselors, self-efficacy, and career aspirations. Based on this study, these were all important contributing factors that shaped the potential STEM student.
Chapter Five: Discussion and Implications for Practice

The purpose of this qualitative study was to examine how Black male STEM majors at an HBCU understand and explain their interest and success in STEM fields. Participants were selected from individuals with a minimum 3.0 GPA, and who have successfully completed a minimum of three years as a STEM major at a local HBCU. An interpretative phenomenological analysis (IPA) approach was used for this study because it focuses on understanding the meanings attributed by participants to their particularly lived experiences. Semi-structured interviews were conducted on eight purposively selected Black male STEM participants for the study. Data generated by the study was used to reflect on the lived experiences of these participants. A double-hermeneutic model was used to make sense of the participants’ accounts as they make sense of their lived experiences. Relatively few African Americans pursue STEM fields in college and even less for the number of Black males. This study was informed by Ogbu’s (1998) Cultural Ecological (CE) Theory of Minority School Performance. Ogbu’s theory attempted to explain achievement gaps within underrepresented minority groups. Ogbu believes that how a group became a minority, affects their responses to schooling. The contents and structure of this chapter are arranged based on findings with reference to the theoretical framework. Five superordinate themes were determined from the study during the well-focused analysis. The superordinate themes were:

- Choosing STEM fields
- Familial involvement
- Feeling engaged on campus
- Most important concerns
- Quitting/or Persevering
These findings, as well as how they situate in current literature are further discussed in detail in this chapter as indicated. The first finding, “Choosing STEM” examines the relationship between the pre-college preparation of Black male STEM majors and their decision to pursue STEM programs based on internal motivations, passion, self-efficacy, and confidence. It also examines attitudes toward math and science for the Black male STEM participants. Lastly, this section ends with a discussion of the pre-college education system in the United States, and its shortcomings regarding educational opportunities for low-income minorities. The second finding, Familial Involvement, discusses the role of the family and non-relatives in sparking the STEM interest. The third finding, Feeling Engaged on Campus, addresses concerns participants have while being a student at their institution; the fourth finding, Most Important Concerns, discusses students’ concerns about various issues that affect their campus life experiences; the fifth and final finding, Quitting/ or Persevering discusses how the study participants persevered throughout their college experiences.

**Choosing STEM (Internal Motivations)**

Math and science are the foundational courses for success in STEM careers (Strayhorn, 2011). Schools lacking proficiency in teaching these courses will often produce students who struggle with, or choose to avoid altogether, the challenges that STEM courses present. As has shown to be the case, many underrepresented minorities attend low-performing, high-need schools where they are not always exposed to rigorous math and science courses taught by well-qualified teachers (Bonous-Hammarth, 2000). Williamson’s (2010) expands on this troubling trend to state that only a few Black males attend college through graduation and at a substantially lower rate than other racial-ethnic groups. Additionally, his findings show that of the small
numbers of Black students who can matriculate in higher education and earn a bachelor’s degree, many do not major in STEM fields.

The National Science Board (NSB, 2012), reported that African Americans are not only underrepresented in STEM but also less likely to complete a college degree in the field. African Americans earn 4.7% and 9.2% respectively in engineering and science undergraduate degrees compared to 66% for White students. However, the preparation of Black males for college, and relatedly, success in STEM fields are not widely discussed in existing literature (Strayhorn, 2015). In computer science, materials engineering, and math, Black males are represented only in single digits, or absent entirely, despite efforts to address these disparities (Strayhorn, 2015).

Attitudes toward math and science affected the field of major and the determination of future career choices for the participants in this study. Students with a natural inclination towards math and science may more easily gravitate toward STEM areas, possibly due to internal motivation, passion, self-efficacy, and confidence. On the other hand, even those without such natural inclinations, have been found to be successful in STEM fields, provided an investment of additional effort and determination. Establishing a solid foundation in these subject areas from an early age increases confidence, or self-efficacy, within the student. However, there are no clear explanations for the racial gap in self-efficacy when it comes to STEM in the U.S. schools and colleges (Buchanan, & Selmon, 2008; Konrad, & Harris, 2002). A growing body of research has demonstrated the role that non-cognitive factors, for instance, academic self-efficacy or confidence in one’s academic potential, plays in college student achievement (e.g., Chemers, Hu, & Garcia, 2001; Heilman, 1996; Maple & Stage, 1991; Strayhorn, 2009c). These findings are also consistent with Strayhorn’s (2015) study, in which the study participants emphasized the importance of academic self-efficacy for their success in
college and in STEM fields. Participants used words and phrases like “confidence,” and “I feel like I can do it” to describe their motivations to achieve academically and persist in college, despite setbacks and being a STEM major. Supportive programs such as after-school tutoring in STEM, Communication, Science, Technology, Engineering and Mathematics (CSTEM), For Inspiration and Recognition of Science and Technology (FIRST), Student Science Enrichment Program (SSEP), TechBridge, Tech Corps, and TechREACH have been shown to increase STEM students’ interests, self-confidence or positive attitudes (Afterschool Alliance, 2011).

Many students who have a passion for math and science, will gravitate to areas of interest that fulfill that passion. As this study’s findings will later show, most study participants expressed their natural inclinations toward math, science, and technology even from seventh grade. Such findings are supported by the available literature (Strayhorn, 2015). Some participants have grown to love these subjects through authoritative parents who drive and motivate them in their schoolwork. Consistency and focus along with warmth and control, in the reinforcement of parental discipline, can ultimately help a child develop a passion for any subject area. Maple & Stage (1991) study data analyzed High School and Beyond and discovered four important factors for Black males’ choice of STEM major. These include parent’s education (i.e., mother), math attitudes, confidence in one’s abilities, and prior math and science, and learning experiences. Math and science ambition has been underscored in other studies too (Strayhorn, 2011).

Various bodies of literature have revealed that there are issues regarding the preparation of Blacks for STEM careers, beginning in their formative high school years (Alexander, 2009; Darling-Hammond, 2010; Hursh, 2008; Lingard, 2010). Hrabowski (2003) noted that Black males are less likely to major in the fields of science, technology, engineering, or mathematics
Strayhorn (2011) asserted that inadequate preparation for college-level math and science courses could be one of the reasons some Black males may leave STEM majors even after signing up. Cole and Espinosa, (2008), stated that some Blacks may leave STEM due to lost interest or due to difficulty establishing a connection or practicality between STEM and daily life. May and Chubin, (2003) indicated that some racial-ethnic minorities, including Blacks, equate math and science with negative connotations such as boring, nerdy and hard. These studies suggest that negative beliefs can have an adverse impact on Black males considering STEM as a career option. Low self-efficacy due to a lack of rigorous preparation in the math and sciences, along with attending low-performing high-need schools, reflect the reality of many poor underrepresented minorities, including Blacks (Bonous-Hammarth, 2000).

Strayhorn (2011), noted that limited exposure to rigorous math and science courses and highly qualified teachers during the K-12 years can have long-term consequences on those with STEM ambitions. In a Strayhorn (2009) study, Black males found STEM subject matter such as water filtration formulas or wind turbine operations too difficult or technical to relate to real life problems. Strayhorn noted that without an ability to establish a connection between STEM and real-life situations, some Black men will become disengaged in the STEM classroom or lose interest in the subject. Fortunately, the participants in this study have expressed fondness for math, science, and technology. The importance of these foundation courses has been corroborated by extant literature discussed above.

Formal STEM learning programs in high school have been cited by many participants as being very helpful in preparing them for STEM career choices. Some participants took specialized courses in engineering in high school, enroll in STEM summer school programs, or high school field trips to various STEM industries to reinforce classroom activities and real-life
experiences. Special programs such as GEMS (Gains in the Education of Math and Science) offered over the summer in D.C were also mentioned in sparking the researcher’s study participants’ interests in STEM. A list of activities that sparked STEM interest as mentioned by participants in this study and were also corroborated by (Strayhorn, 2015) study. These include (a) playing with computers, (b) being surrounded by technology, (c) working on old cars, (d) participating in STEM summer camps, and (e) talking candidly with someone about STEM jobs and careers.

After-school tutoring programs in STEM have helped many participants overcome reading and math deficiencies. One participant, David, a physics sophomore, believes after-school tutoring programs should be mandatory for all students throughout the U.S. school system. Another participant, Tyrone, a civil engineering Senior, believed an after-school tutoring program in engineering and math was helpful to prepare him for engineering. This participant indicated that in one after-school tutoring program, students were given specific senior projects after completing certain pre-requisite courses. They were then responsible to design a proposal to complete the project. Assignments like these sparked this participant’s interest in engineering.

Based on extensive literature, support for STEM students include: (1) after-school STEM programs, (2) student-learning communities, (3) targeted orientation programs, and (4) early encouragement. Past research has shown that attending after-school STEM programs (a) improve attitudes toward STEM fields and careers, (b) increases STEM knowledge and skills, and (c) students have a greater chance of graduation and pursuing a STEM career (Afterschool Alliance, 2011). Support programs such as For Inspiration and Recognition of Science and Technology (FIRST), Student Science Enrichment Program (SSEP), Communication, Science,
Technology, Engineering and Mathematics (CSTEM), appeared to increase interests, self-confidence or positive attitudes towards STEM fields among students who participate (Afterschool Alliance, 2011). In addition to the previously cited literature above, (Nelson-Royes & Reglin, 2011), indicated that reading improvement had occurred for every student who attended after-school tutoring programs, whose attendance was consistent; that there is a need for increased funding to institute more national after-school tutoring programs that enhance reading skills.

Today, many people appear to live only in areas they can afford. Those from low socio-economic backgrounds have little or no choice but to live in areas that may have over-crowded, under-equipped schools with low standards of achievements and high crime rates. For many poor minorities living in these high-risk neighborhoods is quite hopeless; many will not even dream of graduating from high school, let alone higher education. Atwater and Simpson (1984) noted that there is a positive association between high school characteristics, prior academic achievement, and future success in science and engineering programs. (Atwater and Simpson, 1984), also noted that attitudes toward math and science courses are contributing factors to Black students’ success. Findings from Strayhorn’s (2010a) study are that educational and occupational aspirations are instrumental in Black students’ entry into college and choosing STEM fields. Strayhorn’s findings have supported other previous studies such as (Atwater and Simpson, 1984), which indicated that without adequate educational preparation in math and science in their pre-college years, many students would not choose STEM as majors.

In the United States, a large segment of the poor Black population live in urban areas where schools are usually over-crowded, academic achievement is sub-standard, and teacher turnover is high. Many of these schools do not offer Advanced Placement (AP) courses, the
gateway to college acceptance. Oakes, (2004) noted that urban schools are likely to provide fewer opportunities for advancement, have poorer quality teachers, and high failure rates. Schools with high failure and attrition rates present challenges to federal, state, local governments and the local healthcare systems.

Minorities who identify with low socio-economic backgrounds do not get the educational foundation preparations needed to provide confidence in STEM fields pursuits. They are deprived opportunities to experience rigorous math and science curricula from seventh through twelfth grades. Also denied are the opportunities to be engaged and supported by experienced and subject-certified teachers. Leslie, McLure, and Oaxaca, (1998) noted that Black males are more likely than White males to choose business as a major as opposed to choosing STEM fields. Hrabowski (2003) noted that Black males are less likely to major in the fields of science, technology, engineering, or mathematics (STEM). This is usually the case in the areas of mathematics and physical science. Hrabowski (2003) also noted that disparities in degree attainments between racial minorities and Whites are due to differences in educational and social opportunities.

Black males’ occupational and educational aspirations, including non-cognitive factors, in STEM, must be nurtured (Strayhorn, 2010a). Black males need more opportunities to establish connections between school-work and real-life. For example, schools must organize occasional STEM field trips to industrial sites or university campuses, beginning in elementary and high schools. Field trips to industrial sites, once every year or semester, would be a good start to motivating students to connect real-life situations with classroom learning experiences. Students who are hands-on could learn how to apply classroom projects or courses to their field experiences. Perhaps other students may be able to engage or enrich their classroom experiences
which may help them to better comprehend and connect more with the subject matter. The second finding, Familial Involvement, discusses the role of the family and non-relatives in sparking the STEM interest is next discussed.

**Familial Involvement**

The second finding, familial involvement, discusses the role of the family in shaping the STEM interests of the student. This study suggested that familial involvement was essential to the academic success of these Black male STEM participants. These participants relied heavily on familial support, encouragement, guidance, and validation. Based on the study participants’ accounts, familial support was needed especially when things didn’t turn out as expected, such as poor performance in exams, or losing a friend or loved one. Study participants indicated that familial involvement was important to their perseverance. All participants had high regards for their parents and indicated how involved they were in their education, by providing encouragement and emotional support. These findings were corroborated by Williamson’s (2010) findings which indicated that (1) families are a pivotal force for Black male STEM students, and (2) interaction with faculty is essential to student’s success.

The impacts of the involvement of parents in their children’s school activities, including homework, has been extensively discussed in existing literature. Reynolds (1989) noted that Black parents who are involved in their children’s homework and school activities have higher levels of achievement. Marcon (1999) indicated that African American children whose parents were involved in their education showed higher scores in math, science, overall GPA, work habits, and social development. A study conducted by Mandara & Murray (2002), indicated that Black boys whose parents neglected them scored lower than Black boys with authoritative and authoritarian parents; regarding self-control, feelings of power, and identity integration. They
define *authoritarian* parents as firm disciplinarians who lack the warmth of the *authoritative parents*, whereas, *authoritative* parents are high in both warmth and control. The familial element has been cited as essential to the learning outcome of the child. Children who have been neglected seldom have high self-efficacy and confidence in life.

The participants in this study have expressed high regard for their parents, mentors and school guidance counselors. Many believed that their parents’ encouragement, with emphasis on high educational achievements from an early age, were important factors in their development. Knowing that their parents were always counting on them has also helped them persevere in school. All but two study participants reported getting parental financial support while in college. As expected, most of these Black male participants were from low socio-economic backgrounds and must work (some, multiple jobs), while in college. One student reported helping a parent keep the lights on and providing heat during the cold winter months. This is an extra burden for any student. Based on current literature, students who worry about how to pay for college cannot focus on their academics (Maton & Hrabowski, 2004; Patitu, 2000; Rice & Alford, 1989). More importantly, the study participants wanted to make their family members proud, by performing well academically and ultimately graduating.

In agreement with Ogbu (1998), this study confirms that the participants’ families played a major role in their educational experiences and perseverance. The participants in this study reported that the value of education and obtaining a college degree was instilled by their parents at an early age. These participants’ families were also very engaged and involved through their motivation and support. All but two participants reported that their family played a role in their college attendance.
Feeling Engaged on Campus (A Sense of Belongingness)

The third finding explores the study participants’ accounts about feeling engaged at their institution. Interactions with professors/faculty were significant in the findings of this study. The participants believe that getting to know the professor or other members of the faculty, by establishing a connection or rapport, will be beneficial in the long run. Engaging the professor/faculty, to gain a better understanding of their expectations, and to solicit their guidance in their respective fields will motivate and encourage the students to persevere in their work. Several bodies of literature have supported the effect of student-faculty interactions on students’ college experiences (Kuh & Hu, 2001). Numerous scholarly articles have corroborated the findings that student-faculty interactions generally have positive influences on the cognitive growth and development of college students (Astin, 1993; Pascarella & Terenzini, 2005). The more meaningful contacts students have with faculty, the more likely the students’ satisfaction, adjustment to college, and academic success will be positively influenced (Chang, 2005; Garrett & Zabriskie, 2003; Kuh & Hu, 2001; Pascarella & Terenzini, 1978). The more connected the students feel to the institution, the more likely are they to succeed. When students feel connected to their campus, their academic engagement is enhanced, and this also foster positive feelings toward their discipline (Good, 2012, Johnson, 2011). Thus, establishing a sense of belongingness on campus for the students, is a must.

Based on the study’s findings, peer-peer interactions are just as important as interactions with faculty outside regular class times. Participants believe peer-peer interactions has helped them to establish important relationships, rapport, support, encouragement, and collaboration. The following literature has corroborated these findings: (Kuh 1993, 1995) indicated that student peer-peer interactions can positively influence their overall academic development, knowledge
acquisition, analytical and problem-solving skills, and self-esteem. The people with whom students associate and spend time with, are important factors in their achievements in college and also on how they feel about their experiences (Kuh 1993). "A large part of the impact of college is determined by the extent and content of one’s interactions with major agents of socialization on campus, namely, faculty members and student peers" (Pascarella and Terenzini 1991, p. 620).

Chen and Soldner (2013), noted that a student’s choice of major is strongly dependent on parental and peer influences. Students should be encouraged to organize and engage in STEM learning communities, where they can get an opportunity to interact and collaborate with STEM practitioners. Peer-peer interactions are very helpful in situations such as group projects, problem-solving, classroom discussions and many other areas where collaboration is important. Shared responsibilities foster trust and motivation, knowing that someone is counting on you. Available literature on the subject (Maton & Hrabowski, 2004; Moore, 2006; Treisman, 1992), shows that ongoing support and relationships with faculty members, advisors, and peers solidify students’ feelings as a part of the community, and that familial involvement in the students’ collegiate experiences were essential elements.

Even in today’s high-tech world, seeking and receiving assistance on a college campus helps students stay engaged and focused. Since not all problems can be solved with the use of technology, the participants of this study shared their experiences of reaching out for help. Important areas where the study’s participants needed help were: the campus library, writing center, academic advice, tutors, and group projects. Most participants in this study did not feel satisfied with the level of support they received from their advisors. Most believed their advisors were over-worked, and that more advisors were needed. Empirical literature shows that the quality of academic advising is the most powerful predictor of satisfaction with the students’ life
within the campus environment for four-year colleges (National Survey of Student Engagement, NSSE 2005). The need for having a structured academic advising system is important for helping students navigate through college (Cohen and Brawer 1996; Kramer and Associates 2003).

(Tinto, 2004) found that advising positively affects retention and graduation rates when advisors address the needs of undecided students, those who decide to change their major, and first-generation students, who may not have the same knowledge of how to successfully navigate higher education. (Kramer and Associates 2003) noted that advising is most effective in promoting student success when integrated into academic support services and when sensitive to the students’ developmental needs. They must also challenge students to become engaged with peers become involved in campus activities and organizations, investing their efforts in educational activities known to promote student learning and development (Braxton and McClendon 2001–02; Kuh et al. 2005b).

The college campus environment is expected to cultivate a sense of belonging through student engagement, support, and encouragement. Staying connected through opportunities that establish social identities will affect a students’ sense of belonging. That sense, in turn, shows a heightened awareness of the importance of mattering. Strayhom (2012a) has advanced a theory for belonging in college that includes four major assumptions: it assumes that members matter to one another and the group, a person’s perceived indispensability within a system, an individuals’ sense of identification in relation to a group, and a students’ sense of being accepted, valued and cared about in academic spaces. In contradiction to this theory, the engineering participants in this study believed that the engineering building is too secluded and they are rarely in contact with the main campus. Many described using Apps, emails, and texts to stay in touch with peers
and to stay engaged with important bulletins. Other means of staying engaged by some of the participants involved becoming members of the campus and departmental organizations. These participants believe more campus organizations are needed to engage them. At least one participant was involved in campus organizations up until Junior year, after which he withdrew since the upper classes were more challenging and there is less time for anything else. A few didn’t care much about joining any organizations due to their hectic schedules such as working multiple jobs while carrying a full course load. These participants were more interested in focusing on their grades. The fourth finding, Most Important Concerns, discusses students’ concerns about various issues that affect their campus life experiences is discussed next below.

**Most Important Concerns (Black Male STEM)**

The most important concerns as expressed by the study participants were the shortages of professors, advisors, tutors, and mentors all of which appeared to be funding-related. This finding examines these concerns as well as others such as limited course time-slots and dated learning facilities. The U.S. Department of Education’s Title III budget provides federal funds designated for educating underrepresented populations and includes funds set aside within the budget specifically for HBCUs (Gasman, 2010). Due to global economic pressures, the federal government is forced to trim its budget allocations and as a result, HBCUs took a hit (U.S. Department of Education, 2012). This perceived decreased funding to HBCUs is also experienced at the state level (Minor, 2008). In a comprehensive examination of state funding for HBCUs, Minor (2008) highlighted inequities in state support for HBCUs in comparison to predominantly White colleges within four states: Alabama, Mississippi, Louisiana, and North Carolina.
Insufficient state and federal funding at this HBCU, has resulted in shortages of much-needed resources. It has also negatively impacted the institution administration’s budget. Insufficient funding has resulted in the shortage of professors, advisors, and tutors, and with limited course offerings and time-slots. Hiring enough professors, advisors, and tutors could be the result of limited finances, budget mismanagement or both. In addition to not having a sufficient number of professors at the participants’ institution, some participants have expressed frustrations with getting access to professors outside regular class-times. Granted, some professors may be inaccessible due to their involvement in research projects. Quantity, as well as the quality of professors, are essential to meeting the students’ learning needs.

Funding issues have been relatively common at HBCUs. Because of financial difficulties, some HBCUs must rely heavily on alumni donations to stay afloat. Some participants were frustrated that their academic achievements were not enough to secure scholarships, tuition assistance, and other needed financial support. Empirical literature supports the notion that the more important organizational features for instance, institutional size, selectivity, resources, and faculty-student ratios are, the more effect they will have on student performance. Bean’s (1983) student attrition model, posits that beliefs shape attitudes, attitudes shape behaviors, and behaviors signal intents. A student’s beliefs are affected by their experiences at their institution of learning, and these beliefs in turn, affect their perception and sense of belonging to the institution. According to (Berger and Braxton 1998), students’ perceptions of the fairness of institutional policies and the responsiveness of faculty and staff also will affect decisions to persist or leave the institution. Policy-makers and senior administrators also affect students’ satisfaction and adjustment. Pike and Kuh (2005) corroborated this notion by stating that negative perceptions of the campus environment are
associated with a variety of general institutional characteristics, including size, control, mission (i.e., Carnegie classification), and location (urban, suburban, rural).

The unequal distributions of federal, state and private funding have drastically affected some minority schools and colleges. Darling-Hammond (2004) has noted that inequities in educational opportunities have resulted in some schools that are better equipped while others are under-equipped. Some schools, particularly those in affluent neighborhoods, receive much more state and federal funding than those in low-income neighborhoods. According to Kozol (1991), children from poor socio-economic backgrounds are being disadvantaged based solely on their poverty status, which Kozol described as inequality under the law.

The availability of courses and classes at the institution each semester and each year are limited. As a result, some participants are frustrated because they must wait much longer to graduate because their curriculum has extended. More time in college also means more money from the students. Some classes are only taught by one professor; therefore, if students have any issues with a professor, there are no other options besides dropping out and waiting a whole year or go back to that professor. Student-faculty interactions, both inside and outside of the classroom, are considered a key component of academic integration for Black students (Patitu, 2000). Available literature shows that the more meaningful contacts students have with faculty, the more likely the students’ satisfaction, adjustment to college, and academic success are positively influenced (Chang, 2005; Garrett & Zabriskie, & Hu, 2001; Pascarella & Terenzini, 1978).

Participants stated that more flexibility in the course schedule was needed. Certain classes are only offered maybe in the spring. So, if a student could have graduated in the fall possibly, and didn't pass a particular class, that student has to wait a whole other year to take it
and to progress in the class. These issues of limited courses and time-slots are due to institutional constraints. Limited course availability or rigid class schedules had been disadvantageous to the participants of this study, especially those who must work while in school. Administrators at this institution must consider the expansive utility of technology in order to alleviate some of these challenges.

According to (Twigg, 2005), courses that are taught using technology, particularly those that require participation in specific experiences and on-demand support services, have been found to be positive for underserved students, especially those who are low income, first generation, and working adults. More course offerings online could be convenient for working adults. Twigg, (2005) also stated that online resources are attractive to adults and students of color used the online resources for self-remediation. Rather than feeling stigmatized when seeking help, students could find what they needed on their own time and without anyone’s knowing. The fifth and final finding, Quitting/ or Persevering discusses how the study participants persevered throughout their college experiences is now discussed below.

**Considerations about Quitting or Persevering**

This study was more focused on those Black male STEM majors who persisted, rather than those who for whatever reason, dropped out or changed their majors. Many participants thought about quitting school or their major for various reasons such as personal frustrations, STEM being too difficult, financial challenges, having to work multiple jobs as student, having good grades but no financial incentives, academic probation, having to repeat several classes; or it’s taking too long to graduate, just to name a few. Participants persevered due to high self-efficacy, parental support and encouragement, and knowing that someone was counting on them.
Past studies involving STEM education indicated that students with high self-efficacy were likely to do well and persevere longer than those with low self-efficacy (Rittmayer & Beyer, 2008). Other sources of support that helped students to stay focused include professors, peers, advisors, and tutors. There are certain factors that must be considered when dealing with STEM majors. According to Chen and Soldner (2013), STEM grades are relatively lower by at least one grade point than non-STEM grades. STEM programs also do not give students enough time to participate in extracurricular activities. These concerns could impact student attrition and switch-outs. Other concerns involve laboratory courses that are usually included in STEM programs. Laboratory courses are usually coupled with lectures; however, the laboratory courses often carry zero credits, for instance, if a student is taking a four-credit chemistry course three times a week, this student must also take labs two times a week in addition, but only gets four credit hours for the course. Considering that labs have additional costs or fees which can be as much as $100 or more per class, and in a time when maximum rewards are expected for minimum effort in the least possible time, students cannot accept the credibility of workload versus rewards concept in these situations. These issues could be the reason why some STEM students become frustrated with the curriculum design and program requirements.

Financial challenges have created many obstacles in the life of the student. Some participants described the difficulty of supporting oneself while in school. No student should have to worry about finding food, shelter, and paying tuition, while in school. These challenges will make it more difficult for any student to concentrate. As a result, many students drop out of college because they cannot afford to pay the tuition and other educational expenses. Two-thirds of Black male students who start out public colleges and universities do not graduate in six years. This is the lowest college completion rate in all racial groups in higher education (Harper 2012).
There should be educational or campus policies that allow students who are from low-income families, receive a tuition waiver or tuition discount. High self-efficacy and familial support have been instrumental in helping the participants in this study, stay the course. It is through this persistence that these participants will succeed in achieving their ultimate goals.

Academic advising has been one of the frustrations that some participants have expressed during the study. Not having enough advisors at the institution has placed unnecessary burdens on the few that are available. These advisors are often inundated with work. When this happens, the propensity for making several mistakes is high. One participant complained about being given bad advice to add more STEM courses that semester, even after knowing he had two part-time jobs while in school. Academic advising is of paramount importance for every student’s academic life. Berdhal (1995) indicated that initial advising is very instrumental in alleviating fears and concerns about the student’s success. Student advising processes such as aligning the curriculum with the student’s career and life goals, sharing the responsibility in monitoring progress, and referring to resources for non-academic issues and co-curricular activities have been proven to be important in the student’s academic achievement. (Berdhal, 1995) stated that every student is unique and requires advising that is tailored to their individual circumstances and needs. The advising process needs to be organized and structured. This process is more difficult for larger institutions.

**Conclusion**

This study explored how Black male STEM majors at a local HBCU, understand and make sense of their interests and success in STEM fields. The qualitative method with an IPA approach was used to interview Black male STEM participants’ accounts of their lived experiences and meaning-making. The findings of this study, based on the collected data suggest
that Black male STEM students at this institution pursued their respective fields based on internal motivation, passion, self-efficacy, attitudes toward math, science, technology, occupational aspirations, and familial involvement. These findings are consistent with Strayhorn, (2011), findings that limited exposure to rigorous math and science courses and highly qualified teachers during the K-12 years can have long-term consequences on those with STEM ambitions.

A solid pre-college educational experience; implementing formal/informal activities such as taking rigorous courses in math and science through STEM special learning programs, STEM after-school tutoring programs, and STEM summer programs, is important to spark students’ interests in STEM. Current literature has supported the notion that there is a positive correlation between high school preparation and future success in STEM fields. Unfortunately, some schools do not offer advanced placement (AP) courses, which are important factors for college admittance. Strayhorn, (2015) noted that pre-college self-efficacy is also an important factor in influencing Black males’ preparation for college and success in STEM fields. Strayhorn’s data has supported the findings of this study that Black male participants who were self-confident in their academic capabilities, may choose their major in the STEM fields.

Strayhorn (2010a) study has demonstrated how educational and occupational aspirations are instrumental in Black students’ entry into college and STEM. Strayhorn’s findings are supported by other previous studies such as (Atwater and Simpson, 1984) that without adequate educational preparation in math and science in their pre-college years, many students would not choose STEM fields as majors. Strayhorn, (2011), indicated that limited exposure to rigorous math and science courses, along with poorly qualified teachers during the K-12 years can have long-term consequences on those with STEM ambitions. Strayhorn has stated that without an
ability to establish a connection between STEM fields and real-life situations, some Black men will become disengaged in the STEM classroom or completely lose interest in the subject.

The second finding, familial involvement explored the importance of family engagement with the student. This study suggested that family involvement was essential to the academic success of the Black male STEM participants. These participants relied heavily on familial support, encouragement, guidance, and validation. Previous studies have shown that familial environmental factors, such as under-educated parents, poverty (Duncan, Yeung, Brooks-Gunn, & Smith, 1998; McLoyd, 1998), and living in single-parent homes (Bankston & Caldas, 1993; Barbarin & Soler, 1993; Teachman, Day, Paasch, Carver, & Call, 1998), in many instances, have negatively affected the Black family. However, little attention is given to the family functioning factors that influence Black male achievement. In a study conducted by (Mandara & Murray, 2002), Black boys whose parents neglected them scored lower than Black boys with authoritative and authoritarian parents; regarding self-control, feelings of power, and identity integration. Participants in this study had high regard for their parents, whether their parents were single or married.

Several researchers who have studied familial relationships have emphasized the importance of having an environment that fosters both supportive and nurturing (love and warmth), along with consistent guidance and demandingness (Duncan, Yeung, Brooks-Gunn, & Smith, 1998; McLoyd, 1998; Bankston & Caldas, 1993; Barbarin & Soler, 1993; Teachman, Day, Paasch, Carver, & Call, 1998). Additionally, they have all supported the notion that proper parenting can have lasting positive effects on the learning outcomes of children. Other noted factors which may play important roles in educational dynamics include how engaged on campus the students feel, and whether matters of concern were addressed by campus administration.
Feeling engaged on campus was important to the participants’ sense of belonging, support, and encouragement. Staying connected through opportunities that establish social identities affects a student’s sense of belonging. This sense of belonging shows a heightened awareness of the importance of mattering. Students feel engaged on campus through interacting with professors, advisors, tutors outside of regular class-times, peer-peer interactions finding help when needed, and participation in various activities such as organizational memberships, science clubs, and sports. These findings were corroborated by several studies showing that the more meaningful contacts students have with faculty, the more likely the students’ satisfaction, adjustment to college, and academic success are positively influenced (Chang, 2005; Garrett & Zabriskie, 2003; Kuh & Hu, 2001; Pascarella & Terenzini, 1978). Various scholars have indicated that student-faculty interactions generally have a positive influence on the cognitive growth and development of college students (Astin, 1993; Pascarella & Terenzini, 2005). This study has raised the awareness about contributing factors to the Black male participants’ choice of STEM fields as majors. Some of these factors include a solid pre-college preparation in math, science, or technology; educational/occupational aspirations, familial involvement, campus engagement activities, and interaction with professors or other faculty members outside regular class times. It seemed that internal motivations, passion, self-efficacy, and confidence all worked together to motivate and stimulate the participants’ interests in STEM.

Recommendations for Practice

The goals of this study were to explore and ascertain how Black male STEM majors at a small HBCU understand and explain their interests and success in STEM fields. Based on the study findings, there were areas for consideration of practice. The researcher intends to share the recommendations from this study with the Office of the Provost, the Dean(s), Chairperson(s),
and other representative(s) of the study institution’s STEM programs, to discuss and share findings and to make recommendations for practice. The researcher will also present this study’s findings at numerous organizations, including international organizations such as the National Association for Research in Science Teaching (NARST) and the American Educational Research Association (AERA). NARST is a global organization for improving science teaching and learning through research. This organization utilizes the knowledge generated from research to improve science teaching and learning. Its purpose is to be a facilitator in the achievement of science literacy to learners. AERA is a global non-profit professional organization that represents educational researchers. The goal of AERA is to improve the educational process by encouraging scholarly inquiry in education and evaluation. It facilitates the distribution and practical application of research findings and in so doing, promotes the use of research to improve education. The researcher will also be presenting at STEM conferences at the study site’s institution and are sponsored by Verizon and National Science Foundation. The researcher will continue his work of exploring the interests and success of Black male STEM majors through the established alumni networks and communities at the study’s institution. The researcher will be a change agent through engagement and collaboration with college administrators, school leaders, and community leaders such as policy-makers. The presentation of compelling research evidence on black males in STEM fields can be utilized as effective strategies to raising the consciousness of policy-makers about the importance and urgency of making legislative changes needed to enact these initiatives.

**Ensure Adequate Well-Trained Faculty and Staff.** Literature by Maton & Hrabowski (2004), Moore (2006), and Treisman (1992), all agree that ongoing support and relationships with faculty members, advisors, and peers, solidify students’ feelings as a part of the community,
and that familial involvement in the students’ collegiate experiences are essential elements. Findings in this study indicate a shortage of academic advisors, professors, and tutors at the study institution. Over-worked staff will not lead to good outcomes. Where budget is limited, administrators may consider recruiting temporary staff or adjunct instructors to fulfill these roles. Formal training for supporting staff may be necessary to ensure the required knowledge, skills, and abilities are maintained in their service to the student’s needs. Academic advising has been one of the frustrations expressed by some study participants. Not having enough advisors at the institution may cause unnecessary burdens on the few that are available to serve.

Berdhal (1995) indicated that initial advising is very instrumental in alleviating fears and concerns about the student’s success. At the high school level, better training is required for STEM teachers, school counselors, and administrators. Specialized training may be required for STEM teachers and school guidance counselors, all of which may require additional funding. It is therefore important to engage policy-makers to muster legislative changes which are required to fulfill these outcomes. Literature available on the subject, including empirical studies, reveals how important the quality of academic advising is to the student’s academic life. They also indicate that the quality of academic advising is the most powerful predictor of satisfaction with the students’ life within the campus environment for four-year colleges (National Survey of Student Engagement, NSSE 2005). In this light, a structured academic advising system is important for helping students navigate through college (Cohen and Brawer 1996; Kramer and Associates 2003).

**Technology-enabled Collaboration with Peers.** Students must be encouraged to collaborate and engage each other in STEM learning communities nationally or internationally, using technology. Technology-enabled collaboration can be used to facilitate student
interactions and engagement by presenting new challenges and problem-solving skills which may enhance their learning and thinking skills. When STEM students engage each other at the national and international levels, they enrich their learning experiences through collaboration and engagement and learn to develop an appreciation for global and cultural diversities.

Legislators and educational administrators should consider investing in the utility of technology to foster collaborative learning. The use of technologically enabled collaboration to facilitate the teaching and learning process in STEM may help to stimulate the interests of prospective STEM students. Technology-enabled collaboration can be performed using various technologies. It requires that students work together in groups or interact by other means, for instance, long-distance via a virtual medium such as in video-conferencing to stimulate their learning experiences. This form of collaboration can be performed nationally and internationally. It usually requires a facilitator such as a teacher or an instructor (Resta and Laferriere, 2007; Zhu, 2012) – often with facilitation from the teacher (Resta and Laferriere, 2007). Technology-enabled collaboration can be combined with other learning approaches to form part of a project or supplement face-to-face learning (Resta and Laferriere, 2007).

**The Importance of Peer-Peer Interaction.** Collaborating with peers is important for problem-solving projects and mastering challenging materials. In a time when institutional tutors may be limited, peer- collaboration should be encouraged both at the institution and with other institutions. Collaboration fosters a better understanding of the subject material and equips students with the necessary tools to overcome other challenges they may encounter in their academic lives. Peer-peer interactions are vital when working on group projects, seeking the help of others or helping others, and working through course materials in preparation for exams. It is recommended that university administrators encourage STEM students to engage,
collaborate, and network with STEM students from other institutions within and outside their communities. These can help to develop and expand student’s knowledge base and skill sets in their respective fields of study. (Kuh 1993, 1995) indicated that student peer-peer interactions can positively influence their overall academic development, knowledge acquisition, analytical and problem-solving skills, and self-esteem. "A large part of the impact of college is determined by the extent and content of one’s interactions with major agents of socialization on campus, namely, faculty members and student peers" (Pascarella and Terenzini 1991, p. 620).

**Explore Other College Funding Opportunities.** Many students who attend HBCUs and other non-traditional colleges do so for the purpose of obtaining a quality education at a lower cost. Unfortunately, due to recent cutbacks from federal, state and private donations, many colleges sought alternative means of financial support to offset budget shortfalls. Institutions must consider engaging the global alumni community for financial support. Alumni may hold powerful positions in the public or private sectors and are able to help, offer scholarships, or donate to the institution. Institutions must also explore federal, state, or private grants for scholarships that are needs-based. For instance, programs could be based on parental income, disability, service in the military, and wages.

In addition to federal funding allocations or federal, and state regulators, HBCUs could establish partnerships with local industrial leaders or with larger higher education institutions in their communities or states. For instance, partnerships with federal contractors such as Northrop Grumman, Boing, and General Electric to conduct job fairs could provide long-term employment, potential internships, grants, or scholarship for the students. Thus, long-term relationships between colleges and the private industry could be promising for the students and for the institutions future. Developing stronger relationships with the private industry and with
legislative leaders are important. HBCU higher education leaders must find a way to connect with Congressional leaders, to educate and raise their awareness about the relevance and importance of HBCUs, their missions, and contributions to the nation’s economy.

Since HBCUs are tuition-driven, administrators must consider expanding the scope of their admissions process by reaching out to other minority groups such as Latinos, Pacific Islanders, students with disabilities, veterans, and international students. Diversify student campus engagement activities to include other ethnic groups and cultures, for instance, Hispanic organizations, classroom translators, or sign language, and international campus fairs for students could be helpful in attracting other minorities.

**Remove Financial Barriers to Academic Success.** Financial aid officers must assist students with finding other means besides student-loans and off-campus work, to pay for their education. There are numerous external scholarships, which ultimately pay educational costs not covered by Pell Grants, work study, and other common forms of student aid. Students with strong GPAs and who are also involved in student leadership roles such as tutoring, mentoring and so forth, with the support of staff and administrators, should be able to secure external scholarships and grants. According to (Harper, 2006c; Kimbrough & Harper, 2006), Black men are typically underrepresented in paid student leadership roles. Black men are also underrepresented in resident assistant positions that come with free room and board (Harper et al., 2011). More needs to be done by administrators who are involved in student affairs and residence life to provide more opportunities to entice more Black men to apply for these positions. Professors and other faculty members could be used to recommend students to these positions.
Familial Involvement. The impacts of the involvement of parents in their children’s school activities and homework have been extensively discussed in the current literature. Current research indicates that families play a vital role in the academic achievement of Black students who are undergraduates (Kiah, 1992; and Herndon & Hirt, 2004). Individual, family factors and institutional factors, all affect Black male students’ retention and graduation (Moore, 2006). Reynolds (1989) noted that Black parents who are involved in their children’s homework and school activities have higher levels of achievement. Marcon (1999) indicated that African American children whose parents are involved in their education showed higher scores in math, science, overall GPA, work habits, and social development. Black boys whose parents neglected them scored lower than Black boys with authoritative and authoritarian parents; regarding self-control, feelings of power, and identity integration (Mandara & Murray, 2002). Several researchers studying familial relationships have indicated how important it is to be in an environment that fosters both supportive and nurturing (love and warmth), along with consistent guidance and demandingness. (Duncan, Yeung, Brooks-Gunn, & Smith, 1998; McLoyd, 1998; Bankston & Caldas, 1993; Barbarin & Soler, 1993; Teachman, Day, Paasch, Carver, & Call, 1998), all have supported the notion that proper parenting can have lasting positive effects on the learning outcomes of children.

Alleviating the Shortage of Professors. The study’s participants have expressed dismay about having to wait up to a year to take classes that are required to graduate, just because the courses are only taught by one professor and the classes get filled rather quickly. A useful strategy for addressing the shortage of professors would be to expand the use of technology by offering online undergraduate degree programs. Administrators could then hire adjuncts to serve as facilitators for these programs. This could possibly provide students better options to
matriculate and would also be a convenient alternative for students with families or those who must work while in school. Courses that are taught using technology, particularly those that require participation in specific areas and on-demand support services, have been found to be positive for underserved students, especially those who are low income, first generation, and working adults (Twigg 2005). At the study’s institution, current programs offered online, only include post-graduate certificates and graduate degrees. Other options to explore include establishing alliances with other higher education institutions such as universities and colleges to offer remedial courses or to facilitate credit transfers of all students, could provide more flexibility for those who are underserved at their home institutions.

**Recommendations for Future Research**

Future research involving a larger HBCU study, with multiple reciprocal relationships between Black male STEM majors and their familial, academic, and institutional experiences, could generate a comprehensive context on the role that these factors play in the Black male STEM experience. Other research could involve the role of generational status and Black male’s persistence in difficult majors such as STEM. Broader research is warranted across higher educational institutions in general, to examine the effects of institutional climate on the academic and social integration of Black males (Chang, 2005; Flowers, 2006). Future research could also explore why Black males change their majors from STEM to non-STEM, to ascertain their academic experiences and the underlying cause of changing their majors. Getting a clear picture of the academic, social, and psychological factors at play in the Black male STEM majors experience could inform the creation of retention programs to help Black males persist as STEM majors. Future studies could investigate any possible effects field trips have on elementary and high school students’ interests in STEM career choices. Also, explore any effects negative
beliefs or peer pressure may have on a student’s STEM career choice. Other areas for future research could explore why some people who have great math and science aptitude may choose non-STEM careers.

Many participants in this study describe STEM courses as either hard, difficult, or challenging, yet they persevere due to internal motivation, passion, self-efficacy, determination, and encouragement from family members, knowing that someone else is counting on them. The findings in this study support some of the findings in the current literature which suggests that some Black males avoid STEM due to its challenges and level of commitment required. This may explain the relatively small number of Black males pursuing STEM fields. Future studies could explore whether advice provided by high school guidance counselors could negatively impact the students’ learning outcome or ambitions. Future studies could explore students who may have shown interest in pursuing STEM fields but are not recognized by their school guidance counselors, mentors, parents, or guardians. For instance, if a high school student is interested in pursuing medicine and wants to take biology but was told by the school counselor he was not yet ready for biology, he should wait a year, this student could become discouraged or frustrated. It is the intent of this researcher to do a follow-up on these study participants in a few years to ascertain whether they have completed the programs and in what fields they are serving. It is expected that some will be dentists, physicians, engineers or other occupations.

This study involved a small sample size and therefore, findings cannot be generalized to explain the experiences of all Black male STEM majors. This study did not cover Black male STEM students, who for whatever reason, dropped out of the program. Therefore, the findings are representative of those STEM majors who persevered in their respective programs. Despite these limitations, this study is one of few to have investigated the academic experiences of Black
male STEM majors at a small HBCU, their academic challenges, and the role of their families in these challenges. Findings can be used to develop existing theory on the importance of pre-college preparation in math, science and technology.
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Appendix A

Participant Recruitment Email (Initial Message)
Northeastern University College of Professional Studies Doctor of Education Program

Subject Line: O’Neil Gayle Requests Your Participation

Dear Students,

I am a Doctoral student in the College of Professional Studies at Northeastern University. I am currently conducting a study for my doctoral dissertation and need research participants.

In a time when the Black community is experiencing relatively high unemployment rates, even when there are available positions in the science, technology, engineering, and mathematics (STEM) fields, one concern is that there are too few Blacks in these fields. The purpose of this proposed study is to investigate how Black male STEM majors understand their interest and success in STEM fields. My goal is to potentially ascertain how and why Black STEM majors choose STEM, which appear to be unpopular among Blacks. Findings from this study will hopefully, reflect on the Black or African-American male STEM majors’ experience and hopefully strengthen policies, along with administrative, faculty, and staff, support services.

If you choose to participate in this study, I will be interviewing you about your academic experiences. The expected time commitment is between two and three hours over the course of three interactions (two in person, and one either in person or via email). Study participants will be compensated with a $20 gift card.

If you are interested in learning more about this study, please email me at and include the information listed below. I will provide you with additional details about the study.

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Thank you for considering participating in this study.

Kind Regards,

O.G. Gayle, M.Sc. Researcher
Appendix B

Research Questions

1. How would you describe your ethnicity? In which country, were you born?
2. Why did you choose the STEM fields as a major?
3. How did your pre-college years prepare you to be a STEM major in college?
4. Can you describe any formal and informal experiences that appear to nurture your initial interest in STEM careers or majors?
5. What are some of your academic experiences in higher education as a STEM major?
6. In what ways if any, did these experiences affect your academic outlook as a STEM major? Why?
7. Can you describe a time when you felt like giving up? Why didn’t you?
8. What involvement if any, does the family have in your academic life?
9. What role if any, does the family play in choosing STEM as a major?
10. Do you see the role of family as important to your success in STEM? Why? Why not?
11. How important to you is interacting with your professor(s) outside regular class times? Why? (What features of faculty interactions are supportive to male student persistence in STEM?)
12. What features of peer interactions are supportive to male student persistence in STEM?
13. How important is it for you to seek assistance on matters of concern from the university counselling office?
14. Describe how connected or engaged do you feel on campus? Why?
15. What are some of the most important concerns to you as a STEM major at this university?
16. If you were asked by the university administration to be part of a team of change agents in the STEM program, what improvements if any, would you recommend?
Appendix C

Unsigned Informed Consent Form
Northeastern University College of Professional Studies
Doctor of Education Program

Title: Too Few Black Males in STEM: Exploring How Black Male STEM Majors Understand Their Interest and Success in STEM Fields

Principle Investigator (PI): Dr. Joseph McNabb, Northeastern University

Co-Investigator: O’Neil Glenn Gayle, Northeastern University

Purpose: You are invited to take part in a research study. The purpose of this study is to examine how Black males in science, technology, engineering, and mathematics (STEM) majors understand their interest and success in STEM fields. The overarching goal of this study is to help improve the life of Black or African American male STEM majors. You are invited to participate in this study because you are a Black male STEM major who is majoring in science, technology, engineering, mathematics (STEM) and is senior or junior college student. In this study, you will meet with the researcher, O’Neil G. Gayle three times; two in person and one either in person or via email. Your first contact will be an initial meeting with the researcher who will provide you more details about the study, so you may make an informed decision of whether or not you wish to participate (approximately 30 minutes). Your second meeting will be an in-depth interview with the researcher (approximately 45-60 minutes). The third point of contact will be a follow up conversation with the researcher. You may choose to meet in person (approximately 30 minutes) or you can respond to the researcher via email (time varies). These interviews will be audio recorded for transcription and analysis purposes, with your consent.

Procedure: Should you decide to take part in this study, you will be asked you to participate in individual interviews. As noted above, we will have three meetings: two in person and one either in person or via email. For the in-person interviews, you may select the location which is convenient and/or comfortable for you. All in-person interviews will be audio recorded and transcribed into writing. Any information both written and verbal, will also be analyzed. All data and additional materials will be securely stored and your name replaced by a pseudonym of your choice. The pseudonym that you and the other participants provide, will be used to organize the information.

Risks: The primary risk associated with this study may be any discomfort felt during discussing your academic struggles. During the one and one interview, you will be allowed to skip any questions that you do not wish to answer. You will be provided additional resources relative to your situation if needed.

Benefits: There will be no direct benefit to you for taking part in this study. However, the researcher hopes that the information gathered through this study will raise awareness for what it is like to be an African American Black male STEM major. The findings from this study will be shared with faculty, staff, and administrators with the intention of strengthening support services for African American male STEM students on college campuses.
Confidentiality: Your participation in this study will be confidential. Only the researchers will see the information about you. If you decide to participate, you will select a pseudonym that will be used throughout the study to protect your identity. Any reports, presentations, or discussions associated with this study (i.e., doctoral thesis, journal articles, conference presentations) will utilize this pseudonym and will not include any personal information linked directly to you. Information about your age, gender, race, and field of study will be included to help others understand and interpret the research findings. Our interviews will be audio-recorded and transcribed into writing and analyzed. The researcher will code the written transcript to identify patterns and themes within your interview and across interviews with other participants. All physical documents or files related to this study will be stored in a secure location or locked file cabinet. All electronic files will be stored in a password-protected online file storage program and on an external data storage device. Only the researcher will have access to these storage mechanisms. All data will be retained for seven years and then destroyed.

Voluntary Participation: Your participation in this study is strictly voluntary. You may choose to participate or withdraw at any time without any consequences. You are not obligated to answer all questions that are asked of you during interviews. You may indicate your desire to skip question by stating “pass.”

Will I be paid for my participation?

You will be offered a $20 gift card for your participation.

Will it cost me anything to participate?

You will be responsible for the cost of traveling to the interview site. However, you will be able to select an interview site that is convenient and comfortable for you.

Contact Person: Please contact O’Neil Gayle at …………. or via email at gayle.o@husky.neu.edu or Dr. Joseph McNabb who is overseeing my research at mcnabb.j@husky.neu.edu if you have any questions about this study. If you have questions about your rights as a participant, you may contact Nan C. Regina, Director, Human Subject Research Protection, 960 Renaissance Park, Northeastern University Boston, MA 02115. Telephone: 617-373-7570, email: irb@neu.edu. You may call anonymously if you wish.

I agree to take part in this research.

____________________________   __________________________
Signature of the person agreeing to take part   Date

____________________________   __________________________
Printed name of person above   Date

O.G. Gayle, M.Sc., Student Researcher   Date