AN EXPLORATORY STUDY ON INITIAL STEM CLASSES AND AFRICAN AMERICAN FRESHMAN MALES WHO ARE STEM MAJORS AT A LARGE MID- ATLANTIC STATE UNIVERSITY: FACTORS AFFECTING SELF-EFFICACY BELIEFS AND PERSISTENCE IN THE STEM PIPELINE

by

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A Dissertation
Submitted to the
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The Requirements for the Degree
of
Doctor of Philosophy
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An Exploratory Study on Initial STEM Classes and African American Freshman Males Who Are STEM Majors at a Large Mid-Atlantic State University: Factors Affecting Self-Efficacy Beliefs and Persistence in the STEM Pipeline

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Dedication

I dedicate this dissertation to all my family and friends who supported me through the successes and challenges of this process.

To my parents, thank you for your unconditional love and support of all my academic endeavors.

To my son Braylen, thank you for continuing to push Daddy to get his fancy hat.

To my wife Karen, no amount of words will ever be enough. Thank you.
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Abstract

AN EXPLORATORY STUDY ON INITIAL STEM CLASSES AND AFRICAN AMERICAN FRESHMAN MALES WHO ARE STEM MAJORS AT A LARGE MID-ATLANTIC STATE UNIVERSITY: FACTORS AFFECTING SELF-EFFICACY BELIEFS AND PERSISTENCE IN THE STEM PIPELINE

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George Mason University, 2013

Dissertation Director: Dr. Gary Galluzzo

The purpose of this study was to test how well social cognitive career theory (SCCT) explains the effects of an introductory freshman year science course on the career perspectives of African American males at a large, public mid-Atlantic state university. Embracing SCCT as the foundation of this project, the dissertation intended to gather data from these young men to develop insight into how and in what ways their self-efficacy throughout the semester was influenced by their first science course, and changing their outlook on Science, Technology, Engineering, and Mathematics (STEM) careers while in school and after graduation. To a small number of freshman African American male students who have declared themselves STEM majors, I utilized a qualitative study investigating this phenomenon. The major findings detailed themes that affected these young men including concerns about mathematics preparation, isolation,
balance, microagression, and help-seeking. Results indicate that there was an impact on the confidence, achievement, and goal setting for these young men due to these factors and that social cognitive career theory was an appropriate framework from which to test these questions.
Chapter 1: Statement of the Problem

If America is to maintain our high standard of living, we must continue to innovate. We are competing with nations many times our size. We don't have a single brain to waste. Math and science are the engines of innovation. With these engines we can lead the world. We must demystify math and science so that all students feel the joy that follows understanding. – Dr. Michael Brown; Nobel Laureate for Medicine

In 2007, the National Academies’ report *Rising above the Gathering Storm* was a call to action for improved science, technology, engineering, and mathematics (STEM) in the United States. In 2008, newly elected President Obama in a weekly radio address said “Today, more than ever before, science holds the key to our survival as a planet and our security and prosperity as a nation. It’s time we once again put science at the top of our agenda and worked to restore America’s place as the world leader in science and technology.” (12/20/08) In 2010 there were the National Science Board’s report *Science and Engineering Indicators* and the National Academies’ report *Expanding Underrepresented Minority Participation: America's Science and Technology Talent at the Crossroads*. These reports, along with numerous others, continued to detail longitudinal data on the participation rates and success of minorities not only entering the so-called “STEM pipeline” but also on those students successfully matriculating through it. In his 2011 State of the Union Address, President Obama said “We need to out-innovate, out-educate, and out-build the rest of the world.” As part of his larger initiative to improve our K–16 education system, President Obama issued another call to action to
improve our students’ abilities and our workforce efforts in STEM. Echoing the Presidents call, Governor McDonnell and the Virginia legislature proclaimed that it is necessary,

“To enhance personal opportunity and earning power for individual Virginians by increasing college degree attainment in the Commonwealth, especially in high-demand, high-income fields such as science, technology, engineering, mathematics, and health care . . . . To support the national effort to enhance the security and economic competiveness of the United States of America, and to secure a leading economic position for the Commonwealth of Virginia, through increased research and instruction in science, technology, engineering, mathematics . . . .” (2011)

Researchers have collected data that can be used to establish the significance and relationship that exists between the global economy and the numbers of students earning degrees in STEM. Figure 1 offers a comparison of the global population of international college students showing how the percentage of US students earning STEM degrees has been a relatively flat line, especially when compared to those students from the Asia and the Far East (National Research Council, 2011). Additional international statistics seen in Figure 2 offer insight into the growth of STEM in countries such as Brazil, India and Germany that reinforce the concern many have with the state of the US STEM pipeline. The total number of STEM graduates from the top three emerging economic countries (Brazil, China, India) is greater than the total number of STEM graduates three of the
world’s largest developed countries (United States, United Kingdom, Japan) (Craig, Thomas, Hou, and Mathur, 2012)

Figure 1. STEM degrees earned internationally in selected countries. From National Science Board, 2012, Science and Engineering Indicators, p. O-8.
Figure 2. STEM degrees earned internationally as part of total percentage of degrees earned. From Accenture, 2011, No shortage of talent: How the global market is producing STEM skills need for growth.

Within this United States college population and post college workforce, the matriculation and participation rates of underrepresented minorities (African American, Hispanic, American Indian, Alaskan Natives, and Native Pacific Islanders) in STEM is less than White students when examining the overall statistics as shown in Figure 3 (Daire, LaMothe, & Fuller, 2007; National Science Board 2012; Oztürk, 2007). Figure 4
provides perspective to the overall racial demographics within the United States (United States Census 2010, 2012).

Figure 3. Breakdown by race of STEM degrees in the United States. From U.S. Department of Education, National Center for Education Statistics (NCES); Integrated Postsecondary Education Data System (IPEDS) Completions, 1995-2009

*In this data set, STEM fields include other Life Sciences as well, such as environmental science, nursing, etc.
To put these data in context, the National Research Council (2011) reported that underrepresented minorities comprise approximately 28% of the college population, 17% of the STEM degrees conferred (National Science Foundation, 2011), yet they make up only 9% of the STEM workforce. Enrollment figures of the intent to study STEM in college for African American males show levels around 33% (White males 40%). As a contrast, there were over a half million more African American females enrolled in college, with approximately the same level of intent to study STEM (32.3%) However, graduation rates for African American males in STEM are around 14% (White males 69%, African American Women 12%). Even after six years of college, the graduation rate is approximately 29% for underrepresented minorities versus 42% for White students.
(Byars-Winston, Estrada, Howard, Davis, and Zalapa, 2010). At Dansby State University (a pseudonym; DSU), the number of minority STEM graduates made up 12.9% of the degrees conferred (96) in 2010-11 out of 747 STEM degrees, compared to the conferral rates of Asian Americans 26.0% (194) and whites at 42.3% (316). As a subset of all of these numbers, both at Dansby State and within the United States, African American male college students in STEM face an even larger participation and graduation gap. At Dansby State, only 3.21% of the STEM graduates (24) in 2011 were African American males in compared to 16.2% (121) and 30.1% (225) for Asian and White males respectively. The numbers were not better for African American women with 11 graduates accounting for 1.47% of the STEM graduates (Dansby State University, 2012). Comparing these numbers to national data, the rates are not better. In the U.S. in 2009, African American males earned 3.07% of the STEM degrees, juxtaposed against rates of 4.99% and 33.9% for Asian and White males respectively. African American females earned more than 11,000 more STEM undergraduate degrees awarded than did African American males and earned 5.48% of the STEM degrees conferred (National Science Foundation, 2011).

It is projected by the U.S. Census Bureau “that underrepresented minorities will account for about 45 percent of the U.S. population by the year 2050” (National Research Council, 2011, p. 24). So what this means, if the trends hold, is that the number of eligible minority students who could enter college will be increasing. However, using the current trend of STEM enrollment and matriculation as a baseline (see Figures 5 & 6) (National Science Board, 2012), the rate at which the number of minorities (specifically
African American males) matriculate into and graduate from college can’t match the overall population profile, which can only further the gaps. It is worth noting that in Figure 6, the percentage of White students earning degrees is declining. Factors for this could be the decreasing ratio of white students in relation to the increasing total underrepresented minority population as well as lessening interest in STEM versus other career pathways. Palmer (2010) suggests that unless the disparity of STEM minority student graduation rates is addressed, the participation gap will inevitably increase.
From 1990 to 2009, Whites had the largest gain and highest rate of students entering college increasing from 32 to 46%. The number of African Americans entering college over this same period had a smaller increase going from 23 to 35% and has not
moved more than 4% over 12 years (1997-2008). Within this, African American males are still disproportionately enrolling in college at a lower rate compared to both Whites and to African American females. In 1990, 26.1% of African American males (24.8% African American females) were enrolled in college. In 2009, 29.6% were enrolled as compared to 41.2% for African American females (Kim, 2011). So in 19 years, the rate of African American males enrolling in college hasn’t changed 4%. As stated earlier, with the intent to study STEM roughly the same, it is easy to see why there are more than 11,000 more female STEM graduates than there are male (National Research Council, 2011). The specific experiences of African American male freshmen in college who have declared themselves STEM majors is an area of significant concern where few studies have been directed at the causes for the low graduation and retention rates. While compared to White students African American females still trail significantly in producing STEM graduates, it is with African American male students where this study will concentrate.
Underlying Issues

These issues and concerns surrounding a “pipeline” problem for minority students within STEM are not new. There is a range of factors that are believed to impact minority students from K–16 that influence their interest, persistence, retention, and matriculation as STEM graduates (National Research Council, 2011). Research suggests that familial, financial, academic, and social issues are just a small sampling of the areas where minority students could face influences that affect their not pursuing a STEM degree or worse yet not graduating (Moore III, 2006, National Research Council, 2011, Palmer, 2011). While intervention to support these students spans a wide area, it has also been less than clear how and when exactly students should be identified to help them stay in the pipeline. The National Research Council (2011) suggests it is a combination of four segments that can be identified as to when to propose intervention: pre-elementary, elementary, middle, and high school. Additionally, they submit that it isn’t a single pipeline that feeds the STEM workforce pool, rather it is a myriad of intertwined segments that converge and diverge fed by various factors that pull minority students into and also push them out of STEM curricula. Focusing more specifically within the U.S. underrepresented student population, African American males continue to enter college at disproportionate rates, among other racial and ethnic groups. Once in college, there is significant research investigating the many aspects that influence these students’
struggles (Harper, 2012). Research has looked at the connections to the African American male dynamic, facets of their college life, and how various factors both during and prior to college impact their success (Anglin & Wade, 2007; Basu & Barton, 2007; Jackson & Moore III, 2006; McCullough, Crull, & Thomas, 1994; Moore III, 2006; National Research Council, 2011; Palmer, Maramba, & Elon Dancy II, 2011; Palmer, Davis, Moore, & Hilton, 2010). These strands of web that intertwine the students’ lives in and out of college are complicated. It is clear that there are numerous issues all of which hold some validity and can to varying degrees influence these young men. For some it is the transitional periods that are problematic (Anglin & Wade, 2007; Goldrick-Rab, Carter, & Wagner, 2007; Seidman, Aber, Allen, & French, 1996), whereas other data portray a more holistic problem evidenced by achievement gaps in STEM earlier in minority students’ academic careers (National Research Council, 2011). Harper (2012), Bonous-Hammardth (2000), the National Science Board (2012) offer the significance of earlier academic preparation, financial considerations, social interactions in school, and the opportunity to explore and experience programs encouraging life after high school.

For African American freshmen in college, studies on persistence, retention, well-being, and academic success have generated many initiatives, programs, and interventions to support their graduation (Awad, 2007; Bynum, Burton, & Best, 2007; Flowers, 2006; LaVant, Anderson, & Tiggs, 1997; Nealy, 2009; Schwartz & Washington, 2002). Few have investigated these young men who intend to pursue a STEM major, (Bonous-Hammardth, 2000; Hrabowski & Maton, 1995; Lewis & Collins, 2001; Post,
Recently, Byars-Winston et al. (2010) approached the influences of African American young men in STEM from a fresh perspective. Basing their work on Lent, Brown, and Hackett’s (1994) social cognitive career theory (SCCT), Byars-Winston et al. investigated factors and connections influencing young minorities and their interest and goal setting in college as related to their science and engineering majors, and found that the self-efficacy belief, defined as “confidence in one’s ability to successfully perform a given task” that these young people hold, influenced their interests and goal setting as they related to their STEM major (p. 207). Their work with 223 undergraduate minority students who were STEM majors demonstrated that these students’ self-efficacy beliefs as it relates to their academic achievement impacted their expectations and goal settings. Byars-Winston et al. modified Lent, Brown, and Larkin’s Self-Efficacy for Academic Milestones Scale (1986) for use with science and engineering students to gather their data. Proposing possibilities for future research from their study, they note the lack of investigations of this type where academic and career experiences are investigated which would include the interactions among the students’ career aspirations, academic expectations, and decision-making processes and responses to freshman STEM courses.
Theoretical Framework

Social cognitive career theory (SCCT) (Lent et al., 1994) encompasses the inputs, experiences, and influences on goal setting, interests, behavior, self-efficacy, and outcomes for students. Building on Bandura’s social learning theory (1977) including his ideas around self-efficacy, which he defined as "people's judgments of their capabilities to organize and execute courses of action required to attain designated types of performances" (1986, p. 391), several others (Byars-Winston et al., 2010; Fouad and Smith, 1996; Lent et al., 1994) have developed SCCT and applied it across many subjects like literature and mathematics, including students and the processes they encounter to make decisions related to the careers. Their work investigates how students’ background and beliefs affect the decisions they make regarding their education. SCCT also incorporates how students think they will do based on, among other things, their experiences, prior preparation, and the probable outcome for the learning. All of this has an impact on their goals and their sustained interest in the learning.

While relatively new in relation to the work Bandura has done, Pajares and Miller (1994, 1995) and Pajares (2003) tested SCCT in many subjects including mathematics and language arts worked with primarily majority populations: Fouad (1996) reported on middle school math with an ethnically diverse population; and Navarro (2007) examined science and mathematics with middle school Mexican Americans. Across these
researchers they investigated the influences the students’ belief systems on their education. More recently and more closely aligned to this research study, Byars-Winston et al. (2010) tested SCCT for how well it explained the behavior of underrepresented minorities in science and mathematics at the undergraduate level.

Following on the work of Byars-Winston et al. (2010) and Lent et al. (1994), this study seeks to understand the underlying reasons for the clogs, holes, or deviations in this pipeline at the more formative levels for male African American students. The paucity of previous research and the suggestions from the various national reports and research suggests that from grades six to twelve and the first year of transition into college is an area under-investigated and could offer insight into why a generation of black students aren’t interested in STEM as a career. Figure 7 is an adaptation of the SCCT framework presenting possible questions and variables to investigating this need and for generating questions appropriate for this study. Recognizing the undecided and inconsistent nature regarding the decision making of freshmen, the premise of this study is to gather data to investigate African American male freshmen in an introductory STEM course and their cognitive and affective responses to the quality of instruction, persistence as STEM majors, and their perspectives on career opportunities in STEM.
The small number of investigations involving freshman African American men in STEM and the self-efficacy beliefs they have as applied to their achievement has been noted in the literature by Byars-Winston et al. (2010). There is very little depth in the current research targeting STEM and the intersection with specific variables involving gender, ethnicity, and year in school. The socialization and academic experiences of young minorities during their formative education years has left a growing void in the production of students who have sustained and pursued an interest in STEM. This void could then translate into lower graduation rates in STEM, lower entrance in to graduate
programs in STEM, and lower entrance into the STEM workforce. Studies involving science, the formative development of African-American males who are freshmen, and the career choices they make are not extensive. Therefore, as a realistic extension, there seems to be an appropriate application of SCCT to a pool of students who have been understudied. There is growing recognition that the larger STEM workforce problem that exists in the global job market can only be addressed by improving the pool of potential candidates. The pool of candidates, as shown from indicator data in Figure 5 (National Science Board, 2012), could be enhanced through a boost in the participation rates of qualified African-American males. The challenge, however, is that minority males’ rates of interest and their college participation completion rates of in STEM has been inconsistent, and often stagnant or declining.
Purpose of the Study

The purpose of this study was to investigate how the self-efficacy beliefs of African American freshman males at a large, public, mid-Atlantic state university are affected by the initial first-year STEM course they take. When compared to other gender and ethnic specific data for this University, the number of African American males in STEM is very low (these numbers reflect the national data as well). This gap in participation and matriculation is significant because of the need to continue the diversification of the field and support the growing need for talented graduates in the workforce. Additionally, factors impacting these students could be addressed in order to improve campus climate and function for all students. Embracing social cognitive career theory as the foundation of this research, the intent of this study was to gather data from these young men to gain insight into how and if their self-efficacy beliefs throughout the semester are affected by their initial STEM course, and changing their outlook on a STEM career at this University and after graduation. A study of this type involving STEM and the formative transitional development of African-American males entering college and the career choices they make in STEM has not been investigated with any significant depth. There has been extensive work done researching programs to sustain African American students in college as well as programs to increase scientific research participation during their college career (Goldrick-Rab, 2007; Hrabowski and Maton,
Intervention programs such as the Louis Stokes Alliance for Minority Participation (LSAMP) work to sustain the students once in college they enroll and reports continue to focus on the graduation rates of minorities and their entrance into STEM graduate school programs (Clewell, de Cohen, Tsui, and Deterding, 2006; Virginia/North Carolina, 2012). There is a need to “look further upstream” from graduate school and into the earliest years of college to identify more clearly why it is that once African American male students enter as undergraduates in STEM fields that there is such a precipitous drop in their staying as declared STEM majors and eventually graduating in a STEM field. The relevance of a study could not only have clear implications on the successful graduation rates of these students but on the rates African American students pursue graduate degrees and their place within the global STEM workforce, and leads to the following research questions.
Research Questions

The theme for the questions for this study is focused on the critical transitional time period African American men go through in their first semester of college, and their self-efficacy beliefs and goal setting in regards to STEM. More specifically, this study is investigating African American male freshmen in an introductory STEM course and their cognitive and affective responses to the quality of their instruction, persistence as STEM majors and their perspectives on career opportunities in STEM.

1. How are the self-efficacy beliefs of African American freshman males majoring in a STEM field at a large, public, mid-Atlantic state university affected by their first STEM course?

2. What are factors affecting African American freshman males in STEM majors at a large, public, mid-Atlantic state university?

3. What are freshman African American male students’ perceptions of their ability to do STEM and how do these perceptions affect their achievement?

4. Does the perception of the quality of instruction in the first STEM course taken at a large, public, mid-Atlantic state university affect the self-efficacy beliefs of African American males?
Limitations

The challenge exists that I utilized a single institution from which to talk to students. Additionally, the sample from Dansby State University was for a study focusing only on freshman and the number of African American freshman males that are declared STEM majors was a moderating factor. A plausible option would have been to design the study for any African American freshman male or to adjust my questions to look at African American males in STEM at any level at this university. This would have presumably increased the available number of candidates to address the validity concern. Opening up the sample to additional universities would increase the pool of eligible candidates but in exchange would create additional threats to internal validity. It was difficult to identify pools of candidates that I could easily access to study, however, programs at this university such as their high school transition and tutorial program, the minority transition program for freshmen, and the Louis Stokes Alliances for Minority Participation (LSAMP) had regular meetings with participating students from which I was able to identify candidates to work with.

Some of the questions that were addressed with the group of participants were reflective in nature and looking to find commonalities among them from their formative secondary education. I was trying to determine whether there is some unifying thread that characterizes these successful students in STEM. This is intriguing in that I had a group
of students who have demonstrated that they are clearly interested in a STEM career pathway and have found a way to maneuver through all the hurdles that it took to choose their path. It was possible to incorporate questions regarding familial influences into questions about their self-efficacy beliefs. The challenge was that reflective studies could present validity questions with respect to the relevance of the types of memories that any surveys or interviews could bring out.

**Significance of the Study**

The data gathered through this study could be a foothold for identifying ways to improve intervention in supporting freshmen entering college. In 2011, Dansby State University documented the importance of student retention and graduation and produced a white paper charting trends of enrollment and retention and the efforts that have been made and those that are needed to support freshmen (Dansby State University, 2011). To ensure the successful matriculation of freshmen, this white paper lists a series of efforts and interventions that could be introduced that align with the foundation of this research. Recognizing that African American male students at Dansby State University aren’t achieving the desired results both in STEM matriculation rates and in their retention as STEM majors, this study could allow for identification of other factors that influence this outcome.
Chapter 2: Review of Literature

The purpose of this study was to investigate how the self-efficacy beliefs of African American freshmen males at a large, public, mid-Atlantic state university are affected by the initial first-year science course they take. Embracing social cognitive career theory as the foundation of this research, the intent of this study was to gather data from these young men to develop insight into how and if their self-efficacy beliefs throughout the semester was influenced by their STEM courses, thereby changing their outlooks on their STEM career after graduation at Dansby State University.

Social Cognitive Career Theory

In 1994, Lent, Brown and Hackett proposed a conceptual framework that attempted to “explain central, dynamic processes and mechanisms though [sic] which (a) career and academic interests develop, (b) career-related choices are forged and enacted, and (c) performance outcomes are explained” (p. 80). Their social cognitive career theory (SCCT) was a way to try to unravel the web of connections that is instrumental in student learning and the impact on their decision-making and choice of career. Recognizing the interwoven factors that affect the nature of adolescents’ lives, the work by Lent et al. (1994) put together a “segmental model” (p. 81) that helped to investigate the steps that lead to decisions on careers being made. The complexity of adolescent development is addressed in SCCT by building on work from social cognitive theory (Bandura, 1997). A
key to the theory is that the factors identified are not so static, rigid, and easily identifiable that they would cause them to be considered boilerplate. Rather, the factors dynamic and contextual and are heavily reliant on the adolescents and how their personal control guides their lives. Work by Bandura (1986) is critical to the framework of SCCT with three mechanisms paving the foundation: self-efficacy beliefs, outcome expectations, and goal representations. (Lent, Brown, & Hackett, 1994, p. 83).

As described by Lent, Brown, & Hackett (1994, p. 84), in the context of social cognitive theory, “self-efficacy is not a passive, static trait, but rather is seen as a dynamic set of self-beliefs that are specific to particular performance domains and that interact complexly with other persons, behavior, and contextual factors.” Self-efficacy is like clay, it is moldable and dynamic in the hands and influence of different people. Young students certainly bear the brunt of social, familial and educational influences and the delicate ties between them all are numerous. How these influences connect to the second mechanism, outcome expectations, is summarized succinctly by Byars-Winston et al. (2010, p. 207). They relate self-efficacy with outcome expectation by saying that “self-efficacy relates to the question “Can I do this?” and that outcome expectations address the question “If I do this, what will happen?” Adolescents are full of doubt, and their level of confidence changes with every peer interaction, school assessment, and parental influence among many other factors. How they perceive their abilities and how these talents will change their lives lead to what a student decides is an achievable goal and if that goal is worth attempting. In many senses it creates a self-sustaining paradoxical loop that is constantly adapting, adjusting and backtracking as the student
matriculates. The outcome expectations that students also have, be they the anticipation of physical, social, or self-evaluative outcomes create various routes that these young people may have (Lent, et al., 1994). Student outcome expectations, which can be developed from their earliest school and personal interactions, could clearly impact the choice to pursue or avoid those careers that are stereotypically difficult such as those in STEM.

The impact on adolescents and how they then set goals based on these mechanisms is critical, but it isn’t simply the recall of events that play a role in future decisions, it is also the anticipation and proactive decision making that is undertaken to put value onto what choices could be made and the benefit of the path that could be taken. Social cognitive career theory allows for decisions to be made that are not fixed, permanent choices, but fluid, malleable pathways that are dynamic. As Navarro, Flores, & Worthington (2007, p. 320) put forth,

SCCT explains how the bidirectional interaction of cognitive-personal variables (e.g., self-efficacy, outcome expectations, and goals), external environmental factors (e.g., oppression and socialization), and overt behaviors (e.g., career decision) via feedback loops can either promote or impede career development processes (i.e., interests, choice, and performance).

It is important to note that they also highlight their need and the prior call for targeted application of SCCT (Navarro, Flores, & Worthington, 2007, p. 322), “Lent and colleagues argued that there is a need to examine the validity of SCCT with culturally diverse groups (Lent et al., 2000) and to examine potential gender differences in the
relations among SCCT constructs (Lent et al., 2005).” They pursued, as did Fouad and Smith (1996), studies involving middle school students in STEM. Their intent was to look at the impact of self-efficacy and SCCT on adolescent decision-making and career choices.

Although investigating older students, Byars-Winston et al. (2010, p. 207), support that call to action, “More SCCT research is needed with ALANA (African Americans, Latino/as, South East Asians, and Native Americans) STEM students in other college contexts, such as predominantly White institutions, to examine the influence of proximal contextual factors such as perceptions of campus climate on their academic goals.” The purpose of their study was to investigate STEM retention efforts that are theory-driven that could help because “identifying influences on retention-related variables for ALANA (African Americans, Latino/as, South East Asians, and Native Americans) students in STEM majors would help career counselors, higher education staff, and faculty to better focus their retention efforts on factors that have a significant impact on students’ persistence” (p. 206). Byars-Winston et al., classified research literature studying retention factors into three categories: contextual, cultural, and cognitive. Identifying numerous salient aspects of these categories could impact minorities in college such as different types of microaggression, perceived racism, campus climate, isolation, and ethnic self-identity, Byars-Winston et al. present research that suggests separate relationships to efficacy, goal-setting, and achievement. It is their contention that no research has presented evidence that examines all of these in a theory grounded study and the use of social cognitive career theory could be used to address
this. Byars-Winston et al. used as a foundation Lent, Brown, and Hackett’s (1994) social cognitive career theory (SCCT) and investigated factors and connections influencing young minorities and their interest and goal setting in college as related to their science and engineering majors. Byars-Winston et al. modified Lent, Brown, and Larkin’s Self-Efficacy for Academic Milestones Scale (1986) and Lent et al.’s Outcome Expectation Measure (2001) for use with science and engineering students to gather their data. The questions utilized in two of the instruments by Byars-Winston et al. were chosen because of the validity shown in previous studies by Lent et al. The adaptations made by Byars-Winston were made to incorporate a broader STEM audience because the original instrument was designed for only engineering students to isolate only questions designed for undergraduates, and to address social interactions and outcomes. The confidence ratings used in the Self-Efficacy for Academic Milestones Scale were on a 10-point Likert-like scale measuring confidence in completing academic indicators. The expectation measure used a 5-point Likert-like scale evaluating STEM expectations resulting from the degree. The modifications Byars-Winston et al. made to the original scales appear to hold up under scrutiny as shown by the Milestone Scale reliability coefficient of .85, Cronbach’s alpha of .92, and consistent validity as compared to the original scale utilized by Lent et al. The expectation measure also shows consistent validity to the original Lent et al. scales and had a coefficient alpha of .85 which can be compared to the original Lent et al. alpha of .89.

The data for their study, collected from 223 undergraduate underrepresented minority STEM majors at a majority White college, indicated that these students’
academic achievement, mediated by their self-efficacy beliefs, affected their expectations and goals are in line with what is put forth thorough social cognitive career theory. Those students who had initial high self-efficacy beliefs were found to expect positive rewards such as high academic achievement for STEM expressed the goals and interest to complete a STEM degree. Additionally, positive efficacy effects were seen with students’ setting of STEM goals and belief in the benefit of the path toward the STEM degree as well as the rewards afterwards. For students in the biological sciences, it was found to be direct the path for academic self-efficacy beliefs to academic goals for these undergraduates, whereas in engineering, it was found to be indirect and mediated through outcome expectations and interest. It is suggested that the high number of support and student organizations within the engineering school (>50; biological science ~10) influenced other factors that are not addressed in their study and could perhaps account for the indirect relationship. Byars-Winston et al. found in this study partial support for the association between ethnic identity with perceived campus climate, self-efficacy or outcome expectations. They put forth that there may be direct association with how students process efficacy information and ethnic identity that in turn affects a rise in self-efficacy and outcome expectation. Additionally, Byars-Winston et al. suggests that the “cultural context of the university sampled” (p. 215) where underrepresented minorities are clearly evident in the STEM college classrooms could factor into the lack of significance found. By that they suggest, that being a minority on a majority White college campus in a STEM class where there are few other minorities, causes the students self-efficacy beliefs to be impacted by the low numbers of other minorities. What this
study doesn’t isolate and report are any differences in gender as identified by ethnicity. The data provided only investigates students through the college they are enrolled in and doesn’t disaggregate the results.

Hence, since the investigations involving the application of SCCT and African American males entering college is still very low, it seems appropriate to utilize SCCT to explore this phenomenon further to understand the lived experiences of a group of African American male freshmen and the degree to which their initial experiences in a college-level STEM class affects their career decisions.

**Self-Efficacy**

In the early 1900’s a children’s story called The Little Engine that Could introduced the world to the phrase “I think I can, I think I can”. This phrase, now treated almost as a cliché, has some significant underlying truth to it. Changes in behavior and successful performances on tasks are linked to a person’s belief that she/he has the ability to be productive and can meet her/his goals. As discussed by Bandura (1993), few if any mechanisms are more critical than this personal agency. He states “none is more central or persuasive than people’s beliefs about their capabilities to exercise control over their own level of functioning and over events that affect their lives” (p. 118). He continues that this self-belief, this self-confidence, influences “how people feel, think, motivate themselves, and behave” (p. 118). Bandura (1977) explains the idea of self-efficacy in a social context as people choosing or avoiding situations they either believe or don’t believe they can cope with based on their skills. This self-reflection often dictates how seriously an individual undertakes a task and how much effort she/he will put forth to be
successful. In academia, this often translates to students not performing well if they don’t believe they have the skills. This self-perception of whether they do or don’t have these expected skills regulates their performances in a negative fashion.

From a large, public, southern university, Pajares and Miller (1994) sampled 350 undergraduates (137 education majors; 229 women, 121 men) testing factors that could correlate to predicting mathematics problem-solving ability. They utilized six measures targeting math self-efficacy beliefs, math anxiety, math self-concept, perception of the usefulness of mathematics, prior experience, and mathematics performance. Pajares and Miller reported that of these six variables, math self-efficacy beliefs had the strongest direct effects on math problem-solving ability. They did find that many of the students (57%), overestimated their math performance capability. Overestimation was defined as choosing 4 or 5 on the mathematics self-efficacy Likert scale and then incorrectly answering the question. This overestimation of ability is aligned with predictions generated from social cognitive theory through the mediation of effort given and persistence in reaching goals. 20% of the students underestimated their performance. This underestimation of performance is troublesome for students in STEM, as “students who lack confidence in skills they possess are not likely to engage in tasks in which those skills are required, and they will exert less effort and persistence in the face of difficulty” (p. 201). Additionally, they found that the gender and prior experiences of the students affected performance in part because of the influence on mathematics self-efficacy beliefs. Pajares and Miller’s results also suggested that men had less anxiety and higher self-efficacy beliefs than did women. The gender findings from this study also indicated
that females had a lower perception of their capabilities than males and that factor was correlated to their lower self-concept and performance.

Similar to their 1994 study, Pajares and Miller (1995) sampled 391 undergraduates (247 women, 144 men) from three large public universities (two located in the south, one in the southwest). This study investigated any correlation that existed between mathematics problem self-efficacy beliefs and mathematics problem-solving performance. The results from the three instruments (mathematics self-efficacy scale, mathematics outcome measure, mathematics performance) confirmed that mathematics problem-solving performance had a strong relationship to math problem self-efficacy beliefs. They found that students’ self-efficacy beliefs that they could solve math problems were more significant than the confidence to earn a good grade or to complete a math-related task. These results were consistent with those from Pajares and Miller (1994).

Schunk (1990) presents research that documents the relationship between how students perceive their abilities and how well they improve their learning. He summarizes theories that suggest students demonstrate that as they gain skills their self-efficacy is improved and that can reflect on their academic performance. This “efficacy appraisal” (p. 75) that students performed, let them “take into account such factors as perceived ability, expanded effort, task difficulty, teacher assistance, other situational factors, and patterns of successes and failures” (p. 75). Schunk continues that it is through achievable proximal goal setting combined with rewards that promoted the highest instructional performance. In other words, when students perceive that the difficulty of a task is
reasonable, that there are ways to measure and monitor their progress when compared to their peers, that they have specific targets that match their desires, and are given feedback supporting progress towards the desired outcomes they are the most successful. What is also clear to maximize achievement is that these students have to be taught to set realistic goals so that as they begin to self-regulate they can set goals that make sense and build their skills and knowledge while at the same time improving their self-efficacy.

Investigating minority students in high school, Zimmerman et al. (1992) reported on the relationships among the students’ self-efficacy beliefs, their ability to regulate their efforts on academic pursuits in the face of other alternatives (social, etc.), and to seek help when needed. Additionally, the familial impact on these students’ self-efficacy beliefs, goal setting, and academic achievement was measured. Through the analysis of the students’ prior grades, these researchers found that parents affected the students’ academic goal setting, but it wasn’t clear how they influenced it. Additionally, parents “efforts to foster academic achievement need to do more than simply set demanding standards for students. They need to structure academic experiences in a way that enhances students' sense of academic efficacy as well” (p. 673).

Betz and Hackett (1981; 1983) found that there was an impact of career-related and mathematics self-efficacy beliefs on students choice of majors and career choice. Utilizing an initial pilot sample of 114 undergraduate students (50 male, 64 female) to refine a mathematics self-efficacy instrument, Betz and Hackett then sampled 262 students (109 male, 153 female) to investigate relationships of career choice, attitude, and personality factors to scores on the mathematics instrument. Starting with a 75-question
instrument with the pilot group, the instrument was revised to 52-questions for the second group. The instrument consisted of questions investigating student confidence completing requirements for specific college courses, and questions on students’ perceptions on their ability to finish a mathematics task or problem. Their results suggest that mathematics self-efficacy expectations are correlated to student choices of being a science or non-science major. Betz and Hackett also document results that show lower self-efficacy expectations for females than males. Results from the three instrument subscales (math tasks, college courses, and math problems) as well as the total instrument scale showed that males had higher self-efficacy expectations in mathematics. They propose that these results could contribute to the low numbers of women in STEM occupations. This work was a foundation for similar work by Post-Kammer and Smith (1986) & Post et al. (1991) using underrepresented students and the choice of STEM type careers. While this study proposed investigating the effect of the first college course on students’ persistence and self-efficacy, the studies by Post-Kammer and Smith examined the influence of gender on 131 students (from a total group of 357) ranging in age from 16 to 24 who were participating in a precollege program for promising students in mathematics and science. There was a mix of high school students and high school graduates, with 41% of the participants being African American. The outreach was “designed to facilitate the completion of high school and graduation from college of [sic] disadvantaged students who show academic potential in mathematics and science” (p. 91). This study was monitored through the students taking daily classes over seven weeks during the summer and data were obtained using a survey instrument requiring students to assess a range of...
potential careers. Post-Kammer and Smith presented findings that suggested minimal influence of gender differences on students’ self-efficacy beliefs in selecting non-math/non-science careers. They argued that there are a significant number of factors influencing career choice. For example, they found that confidence was a much larger influence for women than men while interest was more of a factor for men. The reasons behind this aren’t explicitly clear, but they propose that a confidence factor is present for a female that isn’t for male, which is relevant to influencing a female’s ability to meet the education requirements for a mathematics career. The complexity of factors influencing female confidence and the influence on this decision making process arise from multiple sources including socialization and achievement expectations. So it could be plausible that coming into college, males have a higher self-efficacy beliefs entering STEM, but once enrolled, various factors then affect the level of confidence they have and their matriculation. Additionally, the “perception of opportunity” (Post-Kammer and Smith, 1986, p. 99) that students could feel in their first STEM classes is important and could be a significant factor of students remaining in the pipeline. If students believe that pursuing a STEM degree is a realistic and achievable goal, and that staying in the pipeline could afford them opportunities they wouldn’t have in other majors, then this could be an important variable in determining the number of students who finish with STEM degrees. However, if the perception is that a STEM degree doesn’t allow for increased job opportunities and financial benefits, this could then negatively influence a student’s self-efficacy beliefs and their progress at finishing a STEM degree. Post-Kammer and Smith proposed proactively addressing efficacy with students through group discussions in
college. They suggest that the collection of variables that intertwine a student’s STEM career decision-making process crosses gender lines and gender in and of itself isn’t related to a student’s interest and confidence. Rather it is the relationships between the variables that influence STEM interest and confidence.

Post-Kammer and Smith’s research suggests further studies that incorporate some ideas that this study puts forth especially when exploring African American students. They point to the need to address sex differences in self-efficacy and STEM careers. One question that was put forth for participants in this researcher’s study considers whether student participation in pre-college or college support programs influence their self-efficacy beliefs. Germene to the present study, it is reasonable to speculate on whether, African American male STEM majors at Dansby State University, who participate in any minority support programs that are either STEM or non-STEM specific, experience changes in their self-efficacy beliefs over the semester versus those who do not? These programs, some of which have regular meetings and support mechanisms embedded in their structure, could certainly influence a student’s academic success.

A study by Lent, Brown, and Larkin (1986) suggested the significance self-efficacy beliefs have for students by linking past academic success and the prediction of grades, persistence, and perceived career options in the future. This investigation sampled 105 college undergraduates (75 men) who were enrolled in a career education course for perspective STEM majors. Utilizing their Self-Efficacy for Academic Milestones Scale, these students completed the scale during the first and last session of the course to assess changes over the length of the semester in “self-efficacy, career indecision, self-esteem,
expressed vocational interests, and range of perceived vocational options” (p. 266). They reported that students’ self-efficacy beliefs helped in predicting their retention and what they believed could be viable career options for them. They also found “that self-efficacy expectations are related to indices of academic performance behavior (Hackett & Betz, 1984b; Lent et al., 1984) as well as vocational interests and range of perceived career options” (p. 268) is the area that is lacking, and the dearth of research like this is evident particularly when focusing on young African American college students at majority white institutions.

These studies are consistent with the theoretical perspective of Lent, Pajares, Bandura and others that the perception of ability, the realistic attainment of goals, and possible career implications could be affected by what a student encounters in their very first STEM course in college.

**Freshman Transition to College**

Persistence also remains perhaps one of the most important topics to be studied within the issue of underrepresentation in STEM fields: “You can’t play if you don’t stay, and leaving science or premed for education or history usually means leaving science or premed forever” (Elliott et al., 1996, p. 700). Extensive research has investigated the factors influencing their transition experiences when students enter college, and what factors influence their matriculation. A meta-analysis by Goldrick-Rab, Carter, & Wagner (2007) expressed fundamental concerns with some of the literature on the transition to college. They submit that

Higher education research on the transition to postsecondary education
is dominated by two specific foci: college entry and college completion. The first body of literature is primarily concerned with examining inequities in college participation, and addresses questions regarding the relative importance of ascriptive characteristics, high school preparation, and financial aid in predicting enrollment. The second area of research focuses on correlates of student persistence to the bachelor’s degree, with a strong emphasis on theories of student retention. (p. 2445)

Additionally, they characterized the state of transition research to be similar to the problems seen in some K-12 teaching in higher education: the silo effect where there is minimal interaction across areas of study. That is to say, they were of the opinion that educating students in discipline-based isolation, within “silos,” is similar to the type of research being done on the transition a student could encounter going from high school into higher education. Goldrick-Rab et al. (2007) stated that the time “between college entry and exit-is understudied partly due to a lack of conceptual clarity regarding what constitutes a college pathway” (p. 2445). They also put forth that transition research should move “towards a more critical approach that raises questions about race, gender, and class inequalities…” (p. 2445). They supported the idea that additional data are still needed to clarify information on the “formation of degree expectations…” (p. 2448) for students entering college which aligns nicely with this study’s intent to use social cognitive career theory as a lens to study students.

Anglin and Wade (2007) recognized the wide variety of factors that influence students’ transition into college and that it “encompasses different domains of
functioning, including academic, social, and emotional adjustment.” (p. 209). They support the need for investigations that look at African American students in college and the factors that impact their initial adjustments. They continue with the idea that the formation of a healthy racial identity for these students is related to their self-esteem and could then be associated with how a student makes decisions on career choice and goal setting. Anglin and Wade sampled 141 minority students found at a large majority white private university (83) and at a smaller more diverse public college (58) with a “significant proportion of Black students” (p. 209). The majority of these students were freshmen and sophomores (66%), 39% were male, and 56 students self-identified as being Black or African American. Using a racial socialization scale, an identity scale, and an adaptation to college questionnaire, Anglin and Wade found that how these young people internalized their identity directly affected how they socialized themselves into their college experience and how they adjusted both academically and socially. This adaptation is then critical to a student being able to stay in school. Isolating for gender, Anglin and Wade found that despite significant differences with the composition of students ethnicity, there were no significant differences between students’ adjustment to college at the large majority white university to those at the smaller college. Students who had a strong sense of self were better able to racially socialize and adjust to a college environment than those who did not have strong self-identity.

Identifying the limited research focusing on gaps between White and African American college students and the career choices they make, their income expectations, and perceived status Daire, LaMothe, and Fuller (2007) examined how societal status
(perception of future job importance and status, level of future income, and making a difference in society) influences what African American students choose as their career path, their college attendance, and completion of high school. Using a demographic questionnaire with 155 college students from a large southeastern metropolitan university (both African American (56.8%) and White (43.2%) students; 99 women, 56 men), these students were all recruited from entry-level general elective classes and African-American student organizations. They found that students’ perceived future status influenced what major the students chose, and this was more the case for African Americans than Whites. From their data, they suggested that early intervention done with students on career choices could allow for better alignment of the majors they choose to their future expectations of income and job. With a better understanding of what their future options are and the requirements needed to succeed when choosing that major, there is a chance that the drop in retention rates in college over four years that is seen in some majors could be slowed. They did not identify any gender differences in data collected or majors of the students.

In working with African American middle school students who are making the transition into high school, Gutman (2005) investigated how setting high mastery targets in mathematics impacted their self-efficacy beliefs and achievement in contrast to just setting performance goals. Just as an increase in size of student population happens from middle school to high school, the move to college also usually comes with a transition with a larger population, and also with increased freedom and more academic responsibility. Gutman’s longitudinal survey study of initially 901 participants at the end
of elementary school culminated in a final group of 507 as freshmen in high school. Analyzing data across eighth and ninth grade, Gutman found that goals set for classroom mastery correlated to student mastery goal orientation. She also found that mathematics self-efficacy beliefs positively correlated to students’ classroom performance goal structures. The students who “had more mastery goals in 9th grade experienced more positive changes in mathematics self-efficacy from 8th to 9th grade” (p. 54) and experienced more positive GPA changes in mathematics. She did not see that change in GPA when correlating to student performance goals from 8th to 9th grade.

Gutman suggests that supporting a larger number of mastery goals in mathematics translates into more positive changes in self-efficacy of students. Additionally, her study suggests that the familial support of students and their also sharing their students’ mastery goals was also correlated with improved self-efficacy and grades in mathematics. She concluded that it is possible that the setting of these mastery goals during the transition into high school could be helping to ameliorate the drop in academic performance that affects some African American students who are in lower socioeconomic situations. When a student enters a new academic environment, it is clear there are significant factors that can be associated with how a student performs and the level of mastery of content that they expect. Gutman goes on to identify the further need for studies targeting African American students, their performance goal orientation in a content area (in her case, mathematics) and the student’s achievement.

In 2000, Reyes, Gillock, Kobus and Sanchez reported on their longitudinal study of 137 students (92% of whom were minority) in eighth grade and their examination of
the perception of support these students believe they received during the transition into high school until the twelfth grade. They characterized the transition as described by Eccles et al., (1993) and Midgley, Eccles, & Feldlaufer, (1991) by saying,

In this new context, students must gain the acceptance of new teachers, learn and adapt to a variety of instructional styles, and conform to a different set of rules and expectations in each of their classrooms. The development of close relationships with teachers may be inhibited by the greater number and mix of the student body. (p. 521)

Their study found that as these students passed from eighth grade and on through high school and underwent various transitions, they experienced grade changes. What they concluded is that those students who do graduate were able to mediate the transition into and through high school much more successfully than do those who don’t graduate from high school. Reyes et al. used a collection of different psychological, social and academic measures and instruments; a 45-item self-perception measure that was a self-reporting instrument that assessed a student’s reflective beliefs; an 83-item self-reporting school perception measure that investigated perceptions of school; a 55-item social support assessment that measured social services a student receives; school grades, GPA changes over time, and enrollment status data. They then calculated an index of change between eight and ninth grade from these different instruments. From the original 137 students, 42% (57 students) had graduated or were still enrolled during last data collection at the end of their study. The other 80 students were considered either inactive or lost due to various reasons including non-attendance, employment, enlistment, or
disciplinary reasons. Reyes et al. report that these 57 successful students didn’t create additional stress in their academic lives because they were able to adjust to new demands, increased rigor, and had higher self-perception. As a result, these students who adapted more easily, didn’t have to do extra work their classmates did to make up an academic deficit which was caused by their failure to adapt. They did note an unexpected result, the students who graduated perceived less support from their teachers. It was proposed by Reyes et al., that this could be due to an increased sensitivity felt by these students who were traditionally successful and they had personalized the lack of success. However, the students who did graduate began their high school career with a “positive sense of scholastic competence” (p. 537), and this could be one factor influencing why they were successful.

As students transition from high school into colleges and universities, their social network expands and the significance of day-to-day interactions increases. Student relationships with individuals on campus in social and academic arenas can sometimes involve less than enjoyable interactions. Sue, Capodilupo, Torino, Bucceri, Holder, Nadal, and Esquilin (2007) explain that microaggressive behavior and interactions are those comments and insults pointed at minorities, with or without conscious intent, that are only done because that person is a minority. These slights come in three forms, microassault, microinsult, and microinvalidation. Microassaults are those actions that explicitly attack someone verbally or nonverbally utilizing derogatory racial characterizations. A microinsult is an interpersonal insensitivity or rudeness that seeks to lessen someone’s racial identity. Again this could be verbal or nonverbal. Lastly,
microinvalidation is the minimization or nullification of the reality of a person of color. That is, to ignore the fact that a person is of color, is an attempt to minimize or nullify her/his reality. What is key to this form of microaggression is that many times it occurs without the recipient knowing it happened to them, the aggressor not being aware she/he did it or both. As freshmen new to a college campus, the wide variety of interactions with new people can lead to unpredictable and dynamic situations where performance could be impacted and an inequity produced.

The transition continues as students begin their first weeks and months in college, and some hurdles they encounter academically seem to persist. Powell (1990) presents a conceptual framework where she investigates African American students’ who avoid math and science careers. In this meta-analysis, Powell suggests that it is the repeated failures in an academic area that breeds an acceptance of poor achievement in a student and as a consequence of that, an inability to address it. So early academic failure in mathematics can grow into a “mathematics phobia” (p. 294) that persists into college. This “helplessness syndrome” (p. 294), she believes is internalized by African American students, which could result in a failure to perform even when their poor content mastery could be due to other factors. These factors, such as exposure to uncontrollable noise like in schools around metropolitan airports and also growing up and learning in a “high density environments” (p. 296) in overcrowded classrooms or at home where students could have less control over their academic outcomes.

Li, Shavelson, Kupermintz, and Ruiz-Primo (2002) were also concerned with the relationship between mathematics and science achievement. Through an analysis of 1999
Trends in International Math and Science Study (TIMSS) assessment data on United States students, this team analyzed math and science results for 10,973 middle school students and found a high correlation (.74) between these two measures regardless of gender. To address the factors that cause differences in student performance across the country such as pedagogical methods, opportunities to learn science and math, and selectivity of the student population, Li et al. also calculated the averaged within-classroom correlation, and found the correlation fell to .55 all students. For boys this correlation was .55 with girls just below at .53. This points Li et al. to call attention to the distinct differences in math and science classrooms across the country but to also recognize that it is certainly reasonable to predict achievement scores in science from mathematics achievement scores.

Through the analysis of literature, this chapter examined how SCCT can be presented as a framework to explain how learning influences the goals, expectations, and career choices a student makes. The relevance of self-efficacy beliefs in concert with SCCT are influenced by the background of a student and presents pathways that connect with the interests, actions and goals that a student possesses. As students progress through school, this chapter analyzed factors influencing her/his persistence and transition into college in the STEM field and how these factors become more intertwined. Additionally, the significance of mathematics achievement to the self-efficacy beliefs of a student and the relationship to achievement in science were analyzed.
Chapter 3: Methods

The purpose of this study was to investigate how the self-efficacy beliefs of African American freshman males at a large, public, mid-Atlantic state university are impacted by the initial first-year science course they take. This study employed a multiple-case study method to sample five DSU African American male freshmen who have self-identified as STEM majors upon entering their freshman year at Dansby State University. I modified the questions originated by Lent, Brown and Larkin in their Self-Efficacy for Academic Milestones Scale (1986) in a similar fashion to the work done by Byars-Winston (2010) who adapted the scale to use with science and engineering students, to use as the basis for my interview questions (see Appendix A). As described by Merriam (2009, p. 41), my selection of this group of young men to investigate, this “one particular classroom of learners (a bounded system)” is appropriate to investigate this “contemporary phenomenon” and identify any interactions between the factors I’ve chosen. (p. 40) Classroom in this sense is broader than the typical four walled classroom, rather it’s the unifying situation of being one of a comparatively small number of young African American males on a large majority white college campus. Additional incorporation of data from interviews along with the first semester academic performance and background academic information were examined.
The rationale for a case study is analogous to the work that Jett (2010) presents when studying African American males and mathematics. Jett explains how Merriam characterizes the factors of case study as applied to his study through the three features presented as critical to case studies; particularistic, descriptive, and heuristic. As interpreted through my dissertation, the particularistic significance is important as the question of minorities participating and navigating the STEM pipeline continue to persist. There is minimal research on possible connections between initial STEM coursework and the self-efficacy of African American males to do STEM coursework. The value that can be found in hearing the voices of young men who are navigating their first year of college is critical to understanding the processes they undertake to pursue their degrees. There has been an increasing light shown on a generation of young African American males and the struggles they have personally, socially, and academically (National Research Council, 2011; Nealy, 2009; Palmer et al., 2010; Palmer, Maramba, Elon Darcy, 2011). So as a heuristic tool, this dissertation suggests offering insight into how these young people adjusted to their first semester as an undergraduate and any connections to their STEM pathway.

Participants

To develop insight into these young men, I conducted interviews with five African American freshmen students at Dansby State University who have declared themselves STEM majors. Over the past three school years, (2009-2012), there have been 22, 21, and 28 first-time freshman African American students who declared a STEM field as their academic major at this university, respectively. As a result, the total population of
African American freshmen male candidates that can be utilized was a limiting factor so the realistic pool from which to choose qualifying STEM majors from those potential candidates that enroll at the university was small. I was open to working with as many as fifteen freshmen, but in the fall of 2011, there were only 6 total of African American male STEM students who entered the College of Science at the university (23 entered the College of Engineering). Because this study was exploratory in nature, interviewing up to fifteen students I believe was an appropriate sample size to investigate the research questions (Glesne, 2006; Merriam, 2009; Yin, 2009). While no qualitative researcher has a formula for ideal sample selection size, in an unknown study such as this, Merriam details the need to maximize evidence but not be redundant with the data collected. Both Maxwell (2005) and Glesne (2006) encouraged purposeful selection of participants and avoiding those candidates of convenience. It must be stated that a certain amount of convenience was unavoidable for this study because the students were volunteering to participate and had control over the depth of data they provided. The number of candidates who participated in this exploratory study could have presented a sampling of stories and evidence that could have easily aligned, or differed radically, yet all could offer rich detail of their initial transition experiences that provides evidence not yet in the literature. While some sort of systemic or random sampling could have offered a broader and perhaps deeper collection of evidence, the population availability at the university mitigated that. It is not the intent of this research to generalize the findings; rather it is an attempt to provide insight into the lives of these young men as they pursue college STEM degrees, and to generate some new understanding of their experience. I selected
participants by working with the Dansby State University Office of Diversity Programs and Services, the Dansby State University Louis Stokes Alliances for Minority Participation (LSAMP), and the Dansby State University Early Identification Program (EIP) to contact potential candidates. The Director of the Office of Diversity Programs forwarded my recruiting information to all minorities on their email database. This database included all incoming freshmen which included the subset of students I was interested in recruiting. From this, I secured two candidates who were willing to participate. I also contacted the faculty advisors of the local chapter of the National Society of Black Engineers (NSBE) and LSAMP and they invited me to attend the first meeting of the school year. I secured the other three participants through these meetings. The young men who participated had self-selected as STEM majors, and in the fall of 2012 entered their first semester of coursework. Each student received informed consent documentation providing information on the data collection protocols that were used. Participants were contacted by email, and in the case of three students, we met through a face-to-face meeting with the assistance of officials in the aforementioned offices. All students who expressed interest in the study and agreed to participate were used.

**Interviews and Survey Instruments**

I interviewed each participant individually three times, around the beginning of the semester, the middle of the term, and again at the end of the semester (September-December). This schedule allowed for digestion and interpretation of the previously collected data and adequate planning for the next meeting. Additionally, three interviews spaced in this fashion put one interview just as classes started, one just around the mid-
term, and the last interview prior to final exams. The timeline was designed to not be intrusive to the participant’s schedules and not spaced too far apart so that any continuity developed from session to session could be lost. A goal of this study was to collect approximately 2 hours of interview data per participant. I interviewed each person from 50 to 75 minutes initially at a location and time of their choosing. Follow up interviews were capped with a maximum time between 30 to 45 minutes. I recorded the interviews electronically. I provided participants with my contact information should there have been additional conversations they would have liked to have in between sessions. Participants’ names were not used in the reporting of data. Each student was assigned a pseudonym to protect confidentiality and to provide anonymity. The survey instruments were scrubbed of any names and only the pseudonym assigned to that participant allows for alignment with the interview data.

Each interview focused on the experiences and expectations the participant had in regards to their STEM course work. The experiences that each young man had as he went through his very first college STEM course allowed for a tapestry of their collective understandings about their preparation, their abilities, and their expectations. While the primary source of questions focused on the present, it was expected that some discussion would revolve around precollege preparation and experiences as they related to STEM (see Appendix A). As emphasized by Glesne (2006) and Merriam (2009), the questions I developed avoided beginning with why and focused more on probing the experiences, values, and feelings the participants had about certain situations as they pertained to their first semester at Dansby State. My interest in the quality of teaching that the participant
interprets from his first science class stems from both personal experience and anecdotal conversations I have had with peers over my career. How a student perceives instruction doesn’t always align with goals and outcomes set forth by instructors. Couple this with other social and academic factors, and our young people could find themselves struggling. As explained by Maxwell (2005), I tried to anticipate how the questions I would use, could be interpreted by the participants, and what my resulting responses would be. The prepared questions were a template for me to establish a comfort level with the participants and what I was investigating. While they were important for me to return to in order to gather evidence, I recognized that additional data would come from the responses the participants gave that weren’t expected. The questions were written using the academic milestones and math/science utility as a foundation, then expanding upon them all the while maintaining my research questions as the goal for which I was trying to gather evidence. The questions for subsequent interviews after the first were much more fluid based on the results from the first interview and situations that arose in between the interview sessions.

As an additional source of evidence, I utilized the Math/Science Utility and Academic Milestones Inventory developed by Byars-Winston et al. (2010) (see Appendices B and C). These instruments focused on the students’ self-efficacy beliefs and their perceptions of their abilities and opportunities to finish with a degree in STEM and the outcomes related to that. Yin (2009) reports on the importance of having multiple methods of collecting the evidence that converge on the facts versus those that address facts separately. The inventory and the utility were used twice. At the initial interview
session, the instruments were used after introductions but prior to any of the formal interview questions. The instruments were used again during the last interview session also at the beginning of the meeting.

**Data Analysis**

The interpretation of the interviews was done through the coding of data. Initial coding was developed along common themes that evolved from the interviews. As described by Glesne (2006), coding is a “progressive process” (p. 152) where I would find interweaving experiences some of which could be similar, while others would be quite divergent. It would have been difficult and perhaps inappropriate prior to any data collection to set up expectations of how the data could be integrated into any themes that could develop. It was important that I established a hierarchy of codes where the major codes would adequately subsume any smaller subunit codes. In the process of note-taking, it was critical that I began my development of my codes soon after data collection so that as ideas and themes emerged, I could digest them based on the work that had been completed.

The coding strategy began by developing organizational categories (Maxwell, 2005) that I developed prior to interviews with participants that allowed me to further sort evidence as I proceeded with the interviews. It was important to note that once data collection began, I was able to clarify and incorporate substantive categories that helped to express the participants and their thoughts as well as my interpretation of the evidence from the interviews. NVIVO software was utilized to support organization and analysis
of themes developed through data analysis. My initial consideration for themes (Byars- 
Winston et al., 2010) included the following:

- perception of racism
- background education influences
- microaggression
- campus climate
- familial support
- classroom social structure
- goal setting
- self-identity

These initial thoughts on categorization for this study were not exhaustive and 
only served to build around evidence in the foundational literature while allowing for 
flexibility to develop new categories as data were collected.

As the interviews began, I took the time to try to digest not only what the students 
were saying, but also what they were doing. I found if I did too much writing at one point 
it was easy to miss any fleeting changes in their body language, with the intensity and 
inflection of their voice, and the consistency of their eye contact. I found by arranging 
how I sit, along with the position of the recorder, I could maximize my ability to jot down 
notes effectively and still remain conversational with the students. After completing each 
of the initial interviews, I created memos to help me process my thoughts and retain as 
much detail as possible. Additionally, this processing along with my notes helped me to 
generate additional themes that were significant to that student. I found that by following
this process after each interview, I was able to better detect patterns in their thinking and themes that were sprouting from our conversations. From the interviews, the following additional threads emerged:

- Personal Social Structure (Interactions with Friends & Teachers)
- Perception of race
- Mathematics concerns
- Expectations (of Self & Teacher)
- Confidence
- Help-seeking
- Balance (Academic & Social)
- Disinterest
- Boredom
- Response to Academic Achievement
- Frustration

As I analyzed each of the subsequent interviews, the intricacies of the connections between themes became more and more lucid and also allowed me to identify trends shared between students. In identifying themes, it was important to me that the intensity of the students’ voices reflected the vivid thoughts they had.

The targets of the milestones instrument was to complement the stories that the participants shared and to have additional information on any ideas that participants had on their ability to complete coursework, remain STEM majors, and excel in their coursework over the next one to three semesters. The utility instrument investigates
feelings of efficacy in STEM and how the participants’ goal setting relates to their thoughts on STEM coursework. An interpretation of these two instruments in the same vein as a pre/posttest could demonstrate how these students’ thoughts changed over the course of a semester and identify concerns about retention as both a STEM major and as a student.

Validity Concerns

Validity threats in qualitative research as described by Maxwell (2005) often revolve around two main issues, researcher bias and reactivity. As an African American male with multiple STEM degrees, my pursuing a study where I have a vested interest in the data that I collect creates reasonable concerns of which I must be aware. Glesne (2006) and Maxwell discuss the ramifications of having preconceptions prior to data collection. Merriam (2009) suggests that with case studies we “do not attempt to eliminate what cannot be discounted. They do not attempt to simplify what cannot be simplified. Thus, it is precisely because case study includes paradoxes and acknowledges that there are no simple answers, …” (p. 52). I have been explicit with the fact that my background certainly was an impetus to many of the questions I have. It was important, however, not to impose my interpretation of what is going on in these students’ lives into the things that they were doing during the semester. As Maxwell argues, I needed to be aware of how my “values and expectations influence the conduct and conclusions of the study (which may be either positive or negative) and avoiding the negative consequences” (p. 108). This was addressed through careful use of my interview protocol and the use of questions that target the goals of the study. As Maxwell suggests, I needed
to gather evidence through the interview method in such a way that my background is not
creating a validity threat. It was important to probe the participants to gather as much
meaning to their answers as possible while trying to avoid any tangential follow-up
queries based on experiences I may have had. It became increasingly challenging as the
semester progressed to not change my role from interviewer of these students, to
someone trying to conduct an intervention in order to adjust what I considered to be poor
decision making by some.

While the participants could see me as someone who has walked the same path
that they hope to walk, I had no way to control how this could influence their behavior.
The young men I interviewed were under no obligation to answer my questions
completely and honestly based on the experiences they had over the semester simply
because of who I was and my appeal to them to be a part of my research. I couldn’t hide
the fact that I’m an African American male interested in science, nor should I have. My
motives for the research were made clear to the participants, but I was aware of not trying
to influence the potential decisions that these students would be making over the course
of the semester. Also, as I collected data, I needed to write rich descriptions on the
students themselves and their behavior as the interviews proceeded to allow for as much
transparency in what the students were thinking rather than forcing the reader to have to
interpret my interpretations of the students’ thoughts. The sharing of my data
interpretation with the participants, member-checking, was one-way to ensure more
accurate interpretation of the interview and as a way to reduce misunderstanding as much
as possible. This respondent validation, which was also addressed by scheduling multiple
interview sessions allowed for additional evidence that responses given in earlier interviews were not affected by my biases. Additionally, as Maxwell (2005) offers to address reactivity, “what is important is to understand how you are influencing what the informant says, and how this affects the validity of the inferences you can draw from the interview” (p.109).

A significant threat for this study was the consideration of the triangulation aspect of validity. An opportunity to address the need for multiple sources of evidence was to utilize the Math/Science Utility and Academic Milestones as developed and used by Byars-Winston et al. (2010). These two tools, a survey and an inventory are designed to assess student self-efficacy and career aspirations. Merriam (2009) presents triangulation as “comparing and cross-checking data collected through observations at different times or in different places, or interview data collected from people with different perspectives or from follow-up interviews with the same people” (p. 216). Utilizing these tools and multiple interviews with the participants, I have attempted to address the need to present evidence from multiple perspectives to support the facts.

This study was done with a small sample size of students from a large, public, mid-Atlantic university. Phenomenologically, the number of students participating doesn’t invalidate the value of this study and the suggestion of simply increasing the number in the sample doesn’t automatically increase the reliability of the data collected.

Lastly, stereotype threat is a concern where a racial or social groups perception and anxiety regarding an existing stereotype is confirmed through their resulting poor performance on a task. This study is not addressing this threat in part because the
difficulty in assessing stereotype threat through interviews is significant. Additionally, because my participants are volunteering, I am not addressing this concern as they could not be aware of the threat.

Summary

As a result of the work, it is my hope that a more complete picture can be developed of these young men’s experiences as freshmen and the impact of their coursework on their college matriculation. Therefore, it was necessary to conduct a study on how the initial science courses these African American male students took in their freshman year of college influence their interest in and perspectives on careers as STEM majors as well as the relationship of the students’ self-efficacy beliefs and the degree to which it affects their participation and retention in these classes, and what their cognitive and affective responses are to the quality of their instruction, would be a valuable addition to the current body of work.
Chapter Four: Results

The purpose of this study was to investigate how the self-efficacy beliefs of African American freshman males at a large, public, mid-Atlantic state university are affected by the initial first-year science course they take. The goals and expectations that these students have, many of which could be shared by their families, were being constantly tested and adjusted in concert with the student’s sense of efficacy over the semester and provided an interesting opportunity to gather data. It was to be expected that the choices these students made as the semester progressed would help to validate or alter their pathway towards graduation. This study is interested in adding valuable information for expanded studies of underrepresented groups to support efforts to bolster enrollment and expand graduation rates in STEM fields.

Over the course of one semester (approximately three and a half months), five African American freshman males who had declared their majors to be science, technology, engineering, or mathematics participated in the study. These students who were all in their first semester of college, were interviewed three times each for a total of approximately two hours each. Interviews lasted anywhere from 30 to 60 minutes in length. Questions presented to the participants were approved by Dansby State’s Institutional Review Board (IRB) with some follow up questions intended to expand on topics as they emerged. All conversations took place in common areas of the student
center on campus so as to allow for comfortable interaction in a nontthreatening environment.

Developed using a multiple-case study method with a phenomenological lens, the following research questions are addressed:

1. How are the self-efficacy beliefs of African American Freshman males majoring in a STEM field at a large, public, mid-Atlantic state university affected by their first STEM course?

2. What are factors affecting African American freshman males in STEM majors at a large, public, mid-Atlantic state university?

3. What are freshman African American male students’ perceptions of their ability to do STEM and how do these perceptions affect their achievement?

4. Does the perception of the quality of instruction in the first STEM course taken at a large, public, mid-Atlantic state university affect the self-efficacy beliefs of African American males?

In this chapter, the five young men are introduced followed by themes that developed individually for each student in support of these research questions. From here, I discuss holistic themes that impacted all participants in their pursuit of a STEM degree. After summary of the data collected is presented, I discuss what my role in the research was, and concluding thoughts on the data.

**Participants**
In order to protect the students and allow them unimpeded freedom of expression during our interviews, pseudonyms were assigned to each young man. The names assigned were chosen at random for no other reason than alphabetical organization.

Table 1

Participants’ statistics

<table>
<thead>
<tr>
<th>Name</th>
<th>Age at first interview</th>
<th>First STEM Course</th>
<th>Declared major</th>
</tr>
</thead>
<tbody>
<tr>
<td>Alex</td>
<td>18</td>
<td>Intro. to Engineering</td>
<td>Biomedical Engineering</td>
</tr>
<tr>
<td>Brent</td>
<td>17</td>
<td>Intro. to Information Technology</td>
<td>Applied Information Technology</td>
</tr>
<tr>
<td>Charles</td>
<td>18</td>
<td>Intro. to Engineering</td>
<td>Computer Engineering</td>
</tr>
<tr>
<td>Dion</td>
<td>18</td>
<td>Intro. to Engineering</td>
<td>Biomedical Engineering</td>
</tr>
<tr>
<td>Elijah</td>
<td>18</td>
<td>Intro. to Information Technology</td>
<td>Applied Information Technology</td>
</tr>
</tbody>
</table>

**Alex.** On outward appearance, Alex was very introspective and made very little if any eye contact with me throughout all three interviews. Meeting him each time in a small conference room in the student center, it seemed hard for him to be comfortable as he was constantly fidgeting in his chair and repeatedly rubbing his hands together and looking at his feet. Standing roughly 6 feet tall, he’s lanky, but not gaunt. The interactions I had with Alex generally went smoothly, although on two of the three occasions, he was late for one, he overslept; and for the other, he forgot what time we had scheduled, despite previous confirmations. It was only because I saw him in the student
center did he remember our meeting and allowed me to continue with data collection. Generally an amicable young man, Alex occasionally seemed preoccupied with other thoughts. To be clear, at no time did this preoccupation cause him to behave in a disrespectful way; rather, it was just an appearance to this researcher that he was engaged in deeper thought.

**Brent.** A gregarious young man, Brent had an impressive list of various computer certification credentials that he earned in high school. Self-describing himself as a student who prefers a tactile, physical learning environment, Brent also holds emergency medical technician (EMT) certification. Self-confident in demeanor, Brent answers thoughtfully and without hesitation. He seemed very self-aware and the things he did or didn’t like to do. A young man of many interests, he showed little doubt to this researcher that he would do well in college and be successful at whatever he chose to do. Brent repeatedly put forth that staying busy for him was the means to being academically successful and “out of trouble”.

**Charles.** An American of African birth, Charles is majoring in computer engineering and is a Louis Stokes Alliances for Minority Participation (LSAMP) Scholar. This program is funded by the National Science Foundation and is designed to increase the number of underrepresented minorities in the STEM fields. He portrayed an outward confidence but evoked in me a peculiar sense of uncertainty with many of his statements. I was at many times left wondering if the confidence he portrays was masking some deeper concern that reflects itself in the inconsistency of his decision making processes. Charles has a background that demonstrated early interest in STEM, his father works in
the science field and he proclaims passion for IT and software engineering. He came across in our initial meeting as very modest and he seemed in some respects to be a stereotypical freshman. That is to say, naïve in some senses (such as knowing his schedule, assignments, etc…) but was extremely polite. It is unclear to this researcher through his first weeks of school whether he has an accurate grasp of the work that is needed to be truly successful in his classes. Throughout many of our conversations, his body language appeared to reinforce that he is insecure about the work that he will be asked to do in his classes.

**Dion.** For almost the entire first interview, Dion didn’t make eye contact with me. Appearing bashful, Dion seemed to be feeling out the transition into college. As a magnet school student and also a LSAMP scholar, Dion took several STEM courses in high school including an Introduction to Organic Chemistry, an Introduction to Environmental Science and an Introduction to Engineering course. His achievement in these preparatory science courses was average and he spoke often of the difficulty with those classes. While he summed up the college workload as not too bad, he seemed less than certain about the future of the STEM courses he had to take.

**Elijah.** An aspiring collegiate athlete from the mid-Atlantic majoring in IT, Elijah was involved in the International Baccalaureate (IB) program in high school, which is a rigorous worldwide program that offers a wide variety of classes for students. The IB program can be for students in grades K – 12 and its mission and various curricula center on holistic, culturally aware courses where students, teachers, and schools are externally assessed and monitored. Developing lifelong learners is a key tenet of the academic
program that features one or two-year high school science courses in Biology, Chemistry, Physics, Environmental Systems, and Design Technology. Elijah has an older brother who is also in the information technology field and a sister in the medical field. Elijah was a focused, cordial young man who consistently maintained eye contact and seemed genuinely interested in the topics we spoke about. He is attempting to walk onto the college baseball team, which caused his schedule to be busy and many times preplanned with games and practice. He was the easiest of the young men to talk to and seemed quite comfortable in all of his classes regardless of size, and felt that the workload has been manageable. He spoke of how it was important for him to finish work early because of his schedule with athletics. He shared that his family was very supportive of his work and that he has set high expectations for his work.
Findings

The development of themes from the conversations that I had with these young men emerged from the overarching research question revolving around their efficacy and their responses to the schoolwork that they encountered as the semester progressed. Intertwining throughout the semester were concerns about help-seeking, mathematics achievement, confidence, and a variety of classroom and social dynamics which have influenced how these students are progressing as STEM majors. Underlying many of the themes is the foundational work that each young man had from high school and how both in high school and college they responded to their classroom achievement. The intensity of the stories that the students shared allowed for individualization of many subsets of themes that helped me clarify many of the findings. I also sought to build a profile of each student to share their depth and breadth of character as they went through their first semester in college.

Using the research questions as the overarching umbrella from which to develop themes and sub themes, the conversations with each of the participants were driven by an interest in their thoughts and processes to make decisions in their STEM courses. These decisions had ramifications on their academic trajectories and their social interactions and I concentrated on what their expectations were for their courses as the semester progressed and their responses to the challenges encountered in class. After each
interview as I reviewed the transcripts and coded, the themes detailed in this chapter emerged and allowed me to pull relevant statements and thoughts to align with the research questions.

**Self-Efficacy**

Schunk (1990) spoke of students taking a personal evaluation of their efficacy to “take into account such factors as perceived ability, expanded effort, task difficulty, teacher assistance, other situational factors, and patterns of successes and failures” (p. 75) when making academic decisions. Based on the background that the participants had entering the semester, the confidence in the coursework that students enrolled in during the first semester could vary greatly. The young men openly discussed their thoughts as class began on their expectations of the rigor of work they expected, what it would take to seek help to ensure academic success, and how they believed they would excel in class.

**Confidence and background.** Perhaps it is not unexpected that most of the young men involved in this study came into their first semester in college outwardly showing confidence and with minimal significant concerns about the work that was to be expected from them. It was clear from the initial introductions that I made, that they had high expectations for themselves and for their college careers. However, it was also not unexpected that for a few, there was some trepidation on the solidity of their STEM foundation based on their backgrounds.

Beginning with our first interview and threaded throughout all three, I spent a bit of time inquiring into the participants’ feelings about how confident they were in
different classes when they began the semester (specifically focusing on his STEM courses) and then how those thoughts progressed as the weeks elapsed. Through not only their words but also their body language I found that their spoken confidence didn’t always match their projected body language. I found eye contact hard to maintain with some of the young men, and where possible and relevant, I tried to document moments where it appeared to me that there was a disconnection between with what they were saying and the way they were behaving. Transitioning from high school, Alex had mixed thoughts on what he thought he was capable of:

INTERVIEWER: Do you generally consider yourself a good student in STEM?

ALEX: When I was in high school I did consider myself to be a good student in STEM, until I got to the magnet school specialty program where I felt like I wasn’t prepared.

INTERVIEWER: How so?

ALEX: I guess from the amount that I was able to contribute in class; I wasn’t confident in answering, things like that. But being at the actual campus, it’s definitely changed. I study by myself. I feel pretty confident about my answers. In Calculus I’m doing well the second time around. But still the fact that I did so poorly the first time around did make me a little weary [sic] about my ability to succeed in that subject. (September 6, 2012)

As he stated, Alex had concerns about his ability to do well in math based on prior experiences. His concerns with his engineering course were not as pronounced:
INTERVIEWER: What are your concerns about your first course, the Intro to Engineering course? What are your thoughts? You’ve now gone to two classes, but coming in before the first class what were your thoughts or expectations?

ALEX: I guess with any course I want to succeed. Will I be able to? My real concern was with Calculus instead of this technical course because many people, even outside the engineering major, take Intro to Engineering because it’s a basis for ethics and things like that. But really it’s seeming more like a liberal kind of class; we’re talking about ethics, we’re talking about what we can do, how ideas are formed. We’re not even actually making anything or doing anything science yet. (September 6, 2012)

From outset of the semester, Alex initially expressed disappointment in the rigor in his Introduction to Engineering class. He initially spoke on the ease of the work and the lack of “engineering” in the class as he saw it:

Honestly, I don’t consider the Intro to Engineering course to be something that scares me at all because like I spoke about the nature of the course where it probably will consist of papers, writing about ethics and things like that. (September 6, 2012)

Additionally, Dion, supplementing what Alex said, and in what could be interpreted as a bit of naiveté, offered: “…Intro to Engineering, so far it doesn’t look like that much…there’s only like five assignments the whole semester” (September 14, 2012). Brent expressed reservations and anxious feelings not necessarily because of the rigor (or lack there of) of the STEM courses, rather it was the newness of the semester that
worried him: “Yes, I'm three weeks in and I'm still a little anxious because I haven’t been exposed to everything.” (Brent, September 11, 2012). Charles added his concern about meeting the expectations of his professors: “I’m worried about what kind of grade I’ll get if I’m following his format or if I’m meeting his expectations” (September 7, 2012). Elijah, summarizing succinctly what the other participants expressed in many different ways, said that he had few doubts about being successful in his first semester:

INTERVIEWER: Yeah. And it’s not like these are easy math courses, necessarily, that you’re taking. So how confident are you that you’ll pass the IT and the math courses?

ELIJAH: Oh, real confident. I know I’ll pass it in the end.

INTERVIEWER: What grades are you expecting, A’s?

ELIJAH: A’s. Nothing less. (September 16, 2012)

All the young men came into the semester with similar statements of confidence and expectations of high achievement that they considered realistic and grounded and was based on work they had done in high school. Elijah continued that:

ELIJAH: I was actually expecting it to be a little bit more harder, more difficult, more challenging.

INTERVIEWER: Okay.

ELIJAH: But the stuff that we’re talking about, as of now, I already know. So I feel like I’m ahead of the game.
INTERVIEWER: Is it just that you expected it to be more difficult just from the assumption that college is just going to be ramped up; the normal expectations of rigor?

ELIJAH: Yeah. (September 16, 2012)

As the semester progressed, there was a divergence of the participants’ feelings in how confident they felt as assignments began to be returned and demands on their time increased. The young men had to experience the realization that there isn’t a direct relationship between the number of assignments given and how hard the work is that is demanded from the professors. Alex became a bit less cavalier in his pronouncement that his engineering course was not rigorous. Perhaps there was a bit of naiveté on his part, but Alex changed his tone after a few additional classes and the assigning of a project:

ALEX: It’s definitely changed, because at first I thought the class was about ethics, and I’m finding out that it’s actually about physics. I would have wanted to have like, physics done before I took this class.

INTERVIEWER: You didn’t take it in high school, right?

ALEX: No.

INTERVIEWER: Okay.

ALEX: And it’s a two-credit course, so that’s why I’m really angry about it because it’s actually requiring a lot of work outside of class. Things like that.

(October 28, 2012)

The softening of Alex’s bravado and his loss of confidence as the semester went along continued to spiral downward to the point where he abandoned some study habits and had
a D in mathematics as the end of the semester approached. Brent also showed inconsistent success. Initially, he found that his confidence strengthened as the semester went on and he participated in classes and established routines. However, poor study choices eventually led to him failing a mathematics exam and carrying a grade of C into the final weeks of the semester. Interestingly, both Alex and Brent admitted to skipping classes more than most, although they volunteered that they were not any of their STEM courses. However, an inconsistency came up for Brent as during our third interview he said he skipped a STEM class that day: “I just didn’t go to class. I slept through.” (November 27, 2012). Brent, in our final interview expressed his thoughts about changing from an IT major to a business major. He seemed pretty certain that he would and when asked after our last interview, he had changed majors out of STEM into a business major.

Dion found that his initial interpretation of the difficulty of the five assignments in Introduction to Engineering was incorrect and he struggled at the midterm with a C. Charles and Elijah both avoided developing breaks in their confidence and maintained A’s and B’s in their STEM coursework with Elijah showing the strongest academic success in all his classes earning all A’s and a B as he went into his finals.

INTERVIEWER: What about your dad, did he have anything to say about sort of your confidence with what you were doing or academic performance?

ALEX: I guess because of experience he’s not academically… I mean I just really don’t consider much of what he tells me. He just always says you got to go for that B or something. But I mean honestly I’m really not listening because I know
the situation I’m in, I know what I’m doing. Definitely in high school I wasn’t
going to any parties or doing anything like that, so when he told me that, it was
just in one ear and out the other, like you don’t need someone to tell you to get a
B. It was just irrelevant. (Alex, September 6, 2012)

INTERVIEWER: What were your parents’ thoughts on sort of your struggles in
both the academics and your confidence? Did you express concerns to them?
ALEX: I didn’t. I guess they knew or my mom knew what struggles I had based
on what I told her. Of course I can be extremely biased, I can say, “Mom, these
are the smartest kids, they’re all from our county, I can’t do it.” I was going to
quit the magnet school program like a friend of mine did —her second year there
because it is a two-year program— I was going to quit but I went to one day of
the classes come the second year, and I said I got this kind of good feeling like
you do on the first day because every question is meant for you to be able to
answer the first day. Of course it goes down from there. (September 6, 2012)

Charles had a distinctly different take on the role of his dad’s influence on his
schoolwork and STEM. With both a father and uncle involved in STEM, Charles looked
to dampen his dad’s interaction:

INTERVIEWER: Did they sit with you and do homework and stuff like that or
talk math and science to you a lot?
CHARLES: No, my dad did offer but I didn’t really want his help though.

INTERVIEWER: Why not?
CHARLES: I might regret it later but it was like he was too passionate about it.

One question, he will probably take 20 minutes on and I was like, “I have other
stuff to do.” So I don’t always want to… (September 7, 2012)

Elijah, the most academically solid of the participants, had an easy-going relationship
with his parents with whom he talked often. An otherwise innocuous exchange Elijah and
I shared that shows a small bit of insight into the respect he has for his parents:

INTERVIEWER: Skipped any classes?

ELIJAH: No, I haven’t yet.

INTERVIEWER: Yet?

ELIJAH: I don’t plan to, but …

INTERVIEWER: Why not, just out of curiosity? Not that you’re supposed to, I'm
just curious as to-

ELIJAH: Yeah, it’s just not my character to skip classes.

INTERVIEWER: Really.

ELIJAH: The nice thing about it is that my parents paid for the class, so I might as
well go, get their money’s worth. (November 28, 2012)

The theme familial influence came from some of the participants clear
expressions of affinity and importance in their lives. While parents weren’t sitting next to
these students as they went about their daily undergraduate lives, it appeared some of the
students have a clearer interpretation of their parents’ expectations.

Evolved from the first research question and interwoven with the efficacy that
these students had, positive and negative subthemes presented themselves that impact the
confidence these young men had in the classroom and that had connections to their academic success. These various factors had relationships with each other to various depths and as one shifts based on positive or negative performances, the others realign themselves in sometimes unpredictable ways.

Factors Impacting African American Freshman Males

As a result of the 15 interviews with these five students, I began to interpret clear themes regarding factors, concerns, challenges, and support issues that potentially could interrupt their navigation of the STEM pipeline taking them from first semester freshmen to graduating seniors. Powell (1990) spoke of the connections of self-concept and mathematical concerns as part of the underlying problems with the underrepresentation of African American scientists and mathematicians. Additionally, Gutman (2005) investigated how setting high mastery targets in mathematics could positively impact self-efficacy and achievement versus just setting performance goals.

Mathematics concerns. As a requirement at Dansby State University, all entering freshmen are required to take a mathematics assessment to place them in an appropriate level class. Li et al. (2002) examined the Trends in International Mathematics and Science Study (TIMSS) data and showed a clear and important relationship to mathematics and science achievement which could certainly forecast success in other STEM courses because of the prerequisite requirements in those classes. These five young men had varying outcomes on the mathematics assessment. Alex and Brent struggled on the test resulting in placement into Calculus and a course analogous to Pre-Calculus, respectively, which are both courses these young men took in high school.
Charles took the test late and was placed into a Calculus class that was spread out over two semesters. He also took Calculus in high school. Dion successfully exempted out of Calculus into Calculus II second semester and Elijah opted to utilize a free math tutor offered by Dansby State University to study through the semester and was able to pass the test and opt into Business Calculus second semester while taking his Statistics elective this semester.

Alex’s effort in math over the course of the semester proved to be problematic and issues quickly developed in class after his first few weeks:

INTERVIEWER: Okay, and what about your Mathematics class?

ALEX: Math is going terribly. I got my second exam back today, which was a 64, two points above my previous first exam, which was a 62.

INTERVIEWER: Is this out of 100?

ALEX: Yes.

It became increasingly apparent that Alex was struggling with the course and actively preparing in advance:

INTERVIEWER: All right. And what about the assignments in between these exams?

ALEX: The assignments are in my Math lab. We have one quiz per week, which was in the recitation section, and previously, those were going well. I thought I was doing fine, but when it came to the exam, I felt like it didn’t correspond to the easiness of the weekly test, and eventually the weekly tests started getting more difficult, so I started doing badly on those.
INTERVIEWER: Okay. And so how many points are the quizzes out of? Like ten or fifty?

ALEX: No, quizzes are out of ten. Tests are 100.

INTERVIEWER: Okay, and so, when you say you’re doing poorly, what are—you said you did well on the quizzes. What are you getting on the quizzes?

ALEX: Well was when I was getting 9 out of 10, 9 out of 10. Then, I started say, getting 7 out of 10, and now I’m starting to get a 5 out of 10. No lower than a 50 so far. But we have like we're on the ninth quiz now. So, the midterm evaluation for that was a D, and I would have gone to other people to see what kind of grades they're re getting, some people are just doing well. Like the only other female I talked to in my class, she got a 68, yeah and I think I got a 67 or something for the semester.

INTERVIEWER: For the midterm? So, the midterm grade was a D, and the midterm exam grade was also a D?

ALEX: Yeah, a 62, yeah, uh-huh.

INTERVIEWER: So, it’s on a ten point scale then right, so a 60 to a 70 is a D?

ALEX: Right. (October 28, 2012)

Following up on Alex’s struggles in mathematics during our third meeting, it appeared that he began to equate his effort completing homework and understanding of concepts. However, that understanding didn’t mean that he was actually doing it in a timely fashion:
INTERVIEWER: And then before, what about the homework? How’s that going? You were sort of up and down with doing some of the work you’re doing there.

ALEX: Right. I mean, it was just a matter of doing it. It’s time consuming. Like I understand the concepts, but I don’t know. Just getting and doing it at the specified, deadline is what was difficult. (November 26, 2012)

Even a friend of his offered his take on his why Alex is struggling:

INTERVIEWER: Really? Any reasons you’ve thought about why?

ALEX: Because math is weird to study for. I mean, I guess, you never know how to study for math, but, I mean, I know what I need to do, which is, I don't know, like a friend said, “All you got to do to get an A or really, in any course should be to go to office hours, pay attention during the lectures, and actually spend a few hours on that class per night, and someday though I’ll do that.

INTERVIEWER: What are you doing?

ALEX: I don’t know. I’m not managing my time well.

INTERVIEWER: You doing an extracurricular, any sports or anything like that?

ALEX: No, just school really. Hanging out, like, not all the time, but like sometimes. (November 1, 2012)

This disconnection Alex shows in understanding that his effort in doing the work on time, the feedback he seeks out, and how well he achieves, extends to his other classes. He found it challenging to turn in all his assignments in engineering, citing everything from computer compatibility issues, adjunct status of the instructor, poor interactions and
expectations from office hours, to his unclear expectations in understanding Microsoft Excel.

INTERVIEWER: Have you been doing well on the assignments though, as far as the feedback or …?

ALEX: First one, I didn’t turn in. Second one, I did and I didn’t do well. The third one, I’m about to turn in today. But like I said, I didn’t do well, but the rest of the class didn’t do well either, so there was a big curve on that. I don’t know how the grade was calculated, but all I know was I got a B plus in the end and I know that’s largely because the class is doing terribly so he’s curving the grades a lot.

INTERVIEWER: Why didn’t you turn in the first?

ALEX: First one, I was sick and there’s no excuse or whatever, because I could have gone on Blackboard and found out that week—because we only have the class once a week. So, if I miss it once, at that next time I have class, we just have all this-

INTERVIEWER: Stuff due?

ALEX: Yeah, and I was just totally confused, because I haven’t talked to anybody in the class yet. (October 28, 2012)

Brent overcame early semester math jitters and rediscovered his confidence: ”I’m pretty confident. I’m not second-guessing myself anymore. It’s like it’s either right or it’s wrong” (October 24, 2012). However, that confidence was short lived after the midterm as his grade dropped to a C as finals approached:
INTERVIEWER: Okay. All right, we'll come back to sort of talking about what you’re doing in the course. With math, you—before you had had a B+ in the class, I guess at the midterm, and you had a test also I guess, right after we had talked the last time. Do you remember what you got on that?

BRENT: Yeah. That’s the grade it was bad. And that was because my teacher was out…

INTERVIEWER: What did you end up getting?

BRENT: A 59.

The struggles that Alex and Brent showed in math were aligned with the achievement they showed from the onset with their placement tests. Certainly for Dion and Elijah, the positive scores they got on their exams allowed them some flexibility with their schedules. Charles, while disappointed with his placement into split Calculus, found that the slower pace worked to his benefit to grasp material more easily. Research has been done correlating achievement in mathematics with the sciences (Li et al., 2002) and appears to be relevant for these young men, which could potentially be a factor in their academic success, positive or otherwise. As Powell (1990) explained, it is possible with some students that this “self-perception of incompetence in mathematics” could fester and cause these young men to struggle.

**Perceptions of race.** For most of these young men, the idea of being young, Black, and male on a majority White college campus just isn’t an issue that is at the forefront of their thinking. Some, like Brent though noticed early on in high school how unique he was:
INTERVIEWER: Did you find yourself being the only black male in class a lot of times?

BRENT: Definitely. That was just actually (another) black period. There were no girls...

INTERVIEWER: Okay, male or female.

BRENT: Yes, male or female. I found myself in a lot of those situations but with that said, I always wanted to be my best because I know as a black male that you have to do that and then a little bit more too...

INTERVIEWER: Is that something your parents stress to you or is just something you picked up growing up?

BRENT: It was both. I noticed that my parents have always told me that and it became evident in my life. That was one thing that I picked up and I noticed. We just have to go that extra further mile which isn’t bad. It always kept me on top of my game.

INTERVIEWER: Is it a pressure, you think?

BRENT: No. It's just the way I live my life. (September 11, 2012)

Dion expressed how he paid a little bit of attention in reflecting on his being a minority in STEM: “I think it’s because of my mom, like she’s always telling me that you should be proud, I guess, because not many Black people actually want to do this kind of thing” (September 14, 2012). When pressed, all the young men identified that they were one of a small number of African Americans in their STEM courses, but that it wasn’t necessarily a pressing concern for them. Elijah noted: “It just motivates me to work
harder” (September 16, 2012). Charles offered his thoughts on why there could be a small number of minorities in STEM: “Well maybe it's from like the environment we're raised in maybe. It doesn’t focus as much as math and science because they're really difficult, I guess” (September 7, 2012).

**Balance.** The expectations that a university has for freshmen to manage their schedules in such a way as to balance their academic and social components vary broadly. Many schools, such as at this University, have programs and courses that offer its students opportunities to be exposed to various offices (e.g. multicultural affairs), services (e.g. tutorial services), and outreach (e.g. counseling programs) that are available. Elijah, the student-athlete and arguably the busiest of the participants, Alex, and Brent all participated in this type of course. All three also got jobs on or around campus. Elijah suggested that the variety in his schedule helped him stay balanced:

ELIJAH: I like to stay on top of my work, get it done early and out of the way so I’m not rushing. I like doing things early.

INTERVIEWER: Do you find that part of that is because of your involvement in athletics or just you’ve always been like that?

ELIJAH: Yeah, I’ve just always been like that.

INTERVIEWER: Do you find your athletics—I don’t want to say interferes because that’s not the right word—but do you find that it causes you to pay a bit more attention to your scheduling of your class work and things like that.

ELIJAH: Actually I think it helps me balance it a little more. (September 16, 2012)
Alex, in contrast, reported that finding balance in his first semester was more difficult and he looked to the upperclassmen in his major as exemplars of how he needed to be:

ALEX: Mostly just seeing their discipline that they have there —and once again I’m talking about the students that have already been through the course work—they’re very disciplined and that’s just something I don’t have right now.

INTERVIEWER: Disciplined in terms of?

ALEX: I think giving up their social life, they’re always studying and they actually have found joy in studying and teaching others. So that’s something that’s amazing. I hope I get that one day and I get this balance of social activity and academic activity but I just don’t see it right now.

INTERVIEWER: You think you’re imbalanced?

ALEX: Yes.

INTERVIEWER: Towards what, the social?

ALEX: Towards the social aspect, yes. I mean I’m new here, I’m a freshman, but most of my friends so far have been upper classmen that have introduced me to a lot of stuff. (September 6, 2012)

This didn’t improve as the semester went on as socialization with friends took priority:

INTERVIEWER: Are you just socializing? I mean what’s taking up, sort of, in your words, what’s imbalanced? You're just hanging out with friends?

ALEX: I guess I’ll be studying, when I really know that there’s maybe a problem is when I’m studying and then I’ll get a text, and then I just leave studying and go somewhere else and be with friends or something like that. (November 1, 2012)
Brent suggested that his issue came not from the prioritization of his academics versus his social interests; rather he feels that he was too aggressive in finishing his work and therefore wasn’t as conscientious about its accuracy and mastering the content. Regardless, the lack of balance he has as a student needed to maintain academic success appears to be impacting some of the quality of work. He goes on to say:

BRENT: The work is pretty spread out. I wish it was closer because with the work being spread out it’s a little rough because you want to—you kind of foster procrastination a little bit. Like I said the work is spread out and you’re like okay, well I have time to do it. The reason why I think my grade—one thing I think why my grade can improve is that when the teacher posts the assignment online because I don’t like to let it sit and the things that I need to do on Blackboard, I just go ahead and do it. I may not know all the information, and that’s one of my problems. I’ll see it on there and it bothers me.

INTERVIEWER: Are you being too aggressive to finish the work?

BRENT: Yeah, I just want to finish it and get it out of the way. I guess it’s like when you get an email you see the inbox and it has the number and you just want to go through and knock out the numbers. That’s just, I guess, at least my generation. I don’t like seeing the little envelope—

INTERVIEWER: Inbox full.

BRENT: Yeah, the inbox full or the little notification number next to the mail or the messages or the—I don’t like that. So, that’s one thing I just go ahead and just try to knock it out and just finish it and get the grade. (October 24, 2012)
While it seems apparent there are resources out to inform and assist students in recognizing the challenges of college as well as the strategies to model for success; like many things, the decisions to use them have to be made by the individual.

**Isolation.** The theme of student isolation and a resistance to work collaboratively presented itself multiple times with our participants along with a reluctance for help-seeking (which is presented as a subtheme later in this chapter). This tendency to approach academic requirements in isolation as if it is a badge of honor came up in conversations with all the participants. These young men in advanced STEM courses are often the single minority face in a room of Caucasian classmates, will sometimes carry a perceived torch of responsibility for their demographic. Their decision to be isolated in class is often a result of teacher pedagogical style, old habits, and/or new conscious choices. “I never compared it to as if I study with a group, but I think if I do study with a group I might get more distracted” (Charles, September 11, 2012). Alex reported a similar perspective on working alone:

> Of course I don’t really like being in isolation, I think it’s just the way it was given to me. Studying in isolation I know for engineering majors or for engineers in general they do need to collaborate abundantly with other engineers, but I guess it’s just going to be like a learning curve once I get to that point. (September 6, 2012).

Dion suggested isolation was his usual strategy:

> DION: I’m more of a person that studies by themself but if I need to I can also do study groups.
INTERVIEWER: Yeah. Have you found them effective generally if you’ve worked in groups like that?

DION: With my friends, not really. (September 14, 2012)

The linkages between the various factors that could affect these young men and the majors they intend to pursue are vast. Pulling on one connection could lead to a host of other factors and challenges that are manifested in students’ lives. Self-doubt and questions regarding the preparation a student has could cause instances where they no longer trust the education they have received and the academic foundation they’ve built. The third research question connects with the previous questions in that as factors evolve that are impacting student confidence, the willingness of a student to reflect and seek help when needed could be changed.

**Perceptions of Ability**

When trying to find a balance between the social and academic components of their college lives, these young men spoke of how they thought they would excel in college and what it takes to do so. Zimmerman et al. (1992) reported on the relationships among students’ self-efficacy, their ability to regulate their efforts on academic pursuits in the face of other alternatives (social, etc…), and to seek help when needed.

**Help-seeking.** During conversations about the academic expectations these men have for their first semester, our discussions turned to evaluating how and when they would be aware of a need to seek assistance with their work. Overwhelmingly, it appeared to be a reactive response rather than a proactive one. The extent to which some of them were willing to struggle prior to seeking help varied, but there was a perceptible
reluctance from some of them. They spoke of various situations that would trigger help-seeking, yet they didn’t adhere to what they established. As Alex stated,

I seek help when I need it. I mean I’m pretty confident in my ability to recognize when I need to do something, when I need to get up in the morning, whenever I need to do anything. So what I need from a teacher really is just really no interaction at all. Maybe in office hours like when I specifically want to seek further assistance or attention I guess. But for me to recognize that I’m doing poorly, like I said all I’d have to do is get something below B, not do an assignment or something like that. (September 6, 2012).

Brent was asked what it would take to recognize the need to seek help. He spoke of it taking him having a feeling of not being prepared.

INTERVIEWER: What does it take? You said your expectation is A's in class, so what do you think it would take for you to go seek some help?

BRENT: Well I guess that point where I just feel like the class is spinning around me and I feel I'm just like “Whoa, I'm not prepared.”

INTERVIEWER: Do you think it's a certain grade level or is it just a general feeling?

BRENT: Yes, probably once I hit that first bad grade.

INTERVIEWER: What's bad for you? It's like saying, "I did good," that could be a B. You said you are good if it was an A.

BRENT: A is what I'm achieving for, so once I get that low B then that's when I would probably start. Because it's different; in high school people are like, "I don't
want to fail." I've always hated that. I was like, "Fail, that's such a low standard." But then somebody may say it as, "I don't want to fail to my personal standards." I don't want to fail my goals or things like that. I want to make the dean's list, so everything for me would need to be above an A. (September 11, 2012)

Dion allowed himself a bit more latitude before he became worried about his academic status.

INTERVIEWER: Yeah. You said to do well for you is A’s and B’s. So when do you get worried? What kind of grade does it take for you to say, “Okay, I’ve got some concerns?”

DION: If I start getting a lot of C’s and stuff. (September 14, 2012)

When asked what was the impetus for him to seek help, Elijah had given himself even more latitude than Dion.

INTERVIEWER: What about any particular grade? Let’s say this first six-page paper comes up. What’s it take for you to go, “Okay, wait, I’m in over my head,” or, “I’m not in over my head, I’m neck deep.”

ELIJAH: Right.

INTERVIEWER: What’s it take for you to say, “I got to go,” as far as a grade? You say you’re an A-B guy. What’s it take for you to go?

ELIJAH: If my grade just isn’t passing at all; if it’s below…

INTERVIEWER: Below what? What do you think of?

ELIJAH: Like it’s just straight bad; below 50%.

INTERVIEWER: That’s failing isn’t it?
ELIJAH: Yeah. Then I need to go to TA. (September 16, 2012)

Charles was more explicit in that he would rather see the results of the assessments he took before he initially sought out additional help.

INTERVIEWER: Okay. What about your math? You said you had a quiz coming up, what do you think you're going to do to prep for that so you can get your A or B like you want?

CHARLES: Tutoring as well as find a quieter place to study.

INTERVIEWER: Where do you study now?

CHARLES: I usually study in my room and sometimes my roommate, Joe, sometimes they're doing stuff or--

INTERVIEWER: So moving to another place could certainly change that. What about your other classes? You talked about math, you talked about engineering and seeking help, are you talking about going before the assignment’s due or after? Like you're talking about the paper, going to a writing center, are you going to go now since it’s on your mind about meeting expectations or are you going to wait to see how you do without the tutoring center help?

CHARLES: I was going to see how I did without the tutoring center. (September 7, 2012)

While I certainly wouldn’t label any of these young men indifferent in their attitude towards their education, there was a particular arrogance among some, specifically Alex and Brent, which almost seemed to border on defiance. It could certainly be a bit of freshman year hubris that they have, but they appeared to be set on
proving that they can do the schoolwork and don’t need others to support them. Alex in particular, noted that there were not a large number of African American males in his engineering course, but doesn’t think it’s affecting his attitude. When I mentioned how he stated he doesn’t want feedback on work he does poorly on, Alex described how when he did poorly on math assessments in high school, he didn’t look at the work and threw it away. He didn’t want to see papers that were marked up. “I don’t even review those papers, those goes straight in the trash before I even look at them” (September 6, 2012). Brent seemed to respond best with professors that were straightforward and outgoing and willing to directly answer questions: “She just helps us out with—she’s really good with answering questions and things like that and not beat around the bush or like you know run around the question” (October 24, 2012).

As the semester progressed, there were mixed amounts of participation in seeking academic help. The student-athlete, Elijah, had a mandatory study hall built into his schedule as a requirement of his team participation. This time allowed him to seek out professors if needed or attend group cooperative learning meetings. Alex and Brent had spotty participation at best when queried about seeking help after their initial struggles and about looking for feedback on assignments. Charles and Dion also had less than consistent help-seeking as they felt their performance in courses didn’t require more than periodic visits to help solve targeted difficulties.

The concerns and hesitation these students had over if, when, and how to seek help was mediated by their interpretation of the effectiveness of the instructor and their ability to assess their mastery of classroom content. Each of five participants found that
because of the various challenges and growth producing opportunities from their instructors in their STEM courses that their willingness to seek help was impacted.

**Quality of Instruction**

In 2000, Reyes, Gillock, Kobus and Sanchez characterize the transition students undergo and their interaction with professors by saying,

In this new context, students must gain the acceptance of new teachers, learn and adapt to a variety of instructional styles, and conform to a different set of rules and expectations in each of their classrooms. The development of close relationships with teachers may be inhibited by the greater number and mix of the student body (Eccles et al., 1993; Midgley, Eccles, & Feldlaufer, 1991). (p. 521)

The young men in this study interpreted the variety of instructional strategies very differently, but each had an opinion of the strengths and challenges that their STEM teachers presented.

**Boredom, disinterest, and disappointment.** The significance of appropriate instructional strategies aligned with student learning styles, cultural sensitivity and active inquiry based methodology revealed themselves as factors underlying a theme revolving around classroom experiences. Student boredom, disinterest, and disappointment in the classroom all were revealed as part of these students’ experiences during the semester.

ALEX: Since this was my first Engineering course, to learn something new that I hadn’t, just to describe the first day of class; we’ve only had two classes but we started out talking about what engineering meant and how ideas are formed. I mean before you even read a book or need a book for anything you can say,
“Okay, it starts off with a problem,” and then someone using their math or science courses they come up with a solution. I guess he was talking about the financial toll that any invention can have, the risk and how businesses and corporations go about assessing whether an invention or innovation would be beneficial to implement. All these are just ideas that you don’t need a class to take. So my expectation was that I’d learn something and even from the second class today, I didn’t learn anything.

INTERVIEWER: Are you disappointed?

ALEX: Yes. (September 6, 2012)

Subsequently Alex said that his engineering course improved as it progressed and more “science” was being taught. He was, however, disappointed with the fact that he felt underprepared for the depth of physics required to successfully complete the course without it being a prerequisite since he did not take physics in high school. However, Alex questioned the qualifications of the instructor: “Like I said, I personally don’t think he knows anything. So, I scheduled one appointment with him, and he was just of no help at all” (November 1, 2012).

Some like Dion and Brent acquiesced to the long PowerPoint lecture-based STEM courses as the norm and welcomed small respites given during class.

INTERVIEWER: Does that bother you sitting in there for that long?

DION: Yeah. I mean he gives us like a 15-minute break but it can get a little boring. (September 14, 2012)

While Brent said:
BRENT: Not that it’s not beneficial, but I felt like it’s just a waste of time sometimes because they’ll talk about the chapter in class, and then they’ll say, okay, go home and read the same chapters that they just went over.

INTERVIEWER: Okay.

BRENT: And because there’s no way that you can cover all the things that you just mentioned in class.

INTERVIEWER: All right.

BRENT: And it’s kind of death by PowerPoint. He teaches by PowerPoint.

(November 27, 2012)

Elijah simply resigned himself to the fact that although he preferred hands-on learning in his instructional technology class, he was stuck with dealing with long lectures for as long as three hours and he should expect future classes to be designed like that.

ELIJAH: It does take a transition, yeah, because honestly sometimes I might lose focus or I might start getting sleepy because you’re just sitting there for the whole time listening to the professor talk.

INTERVIEWER: You said you like hands on. This doesn’t sound hands on.

ELIJAH: It doesn’t. I mean it’s what’s needed in a college class. It’s what I expected. I knew it was going to happen. (September 16, 2012)

Concerns Alex shared weren’t limited to STEM courses. He had also displayed a disinterest and a disregard for English and consciously chose to not attend class and became annoyed that participation could be a part of his grade:
ALEX: I just don’t feel like Liberal Arts degrees will get you anywhere. Being an English major; I actually have a friend that’s an English major and I just don’t know what she’s going to get out of it when you know how to speak English, if you want to write you can write, you don’t need a degree to write whatever is on your mind. I need to learn something from college; college has to bring me something that I don’t already have just by living. (September 6, 2012)

And when I pursued his work in English later on during our second interview:

INTERVIEWER: And then what about English?

ALEX: English. That was surprising. I got a C-.

INTERVIEWER: As the midterm grade?

ALEX: Yes. The thing was I did really well on my first paper, better than the majority of the class and apparently, it was because of participation and I went to her because I had missed a few classes, but the thing was like, even though I missed a few classes, I’d try really hard on the papers and things like that. So, she was like, “I still need to come to class,” and stuff like that. So-

INTERVIEWER: Why’d you miss classes? Just missing classes…

ALEX: No good reason for it. (October 28, 2012)

It was during his third interview that Alex offered another example of his thought processes when reflecting on what he had accomplished during the semester. Even though he had struggled with large portions of the coursework taken over the semester, struggled with the teaching strategies utilized by some professors, and seemed to have concerns about the relevance of some classes, Alex said: “I honestly need to take more
challenging classes next semester. I should have taken physics. And I should have taken a higher math, but I think I’m going to start working something next semester”
(November 26, 2012).

In college, not only does the teacher impact a student’s mastery of content, but interactions with students both inside and outside the classroom do as well. The significance of these dynamics for the five participants was broad enough that it allowed for the development of a theme in this study.

**Classroom and social dynamics.** The learning atmosphere and social dynamics that these young men encounter both within and outside the classroom are factors in their academic development. Collaborative, hands-on, and active learning opportunities are inconsistently utilized and supported, and university instructors don’t always consider students’ individual learning preferences and needs.

Alex was clear that he wanted to step back from the spotlight in college when in class and only wanted to participate on the periphery of any discussions. He rationalized his thoughts like this:

ALEX: Not on campus but the classroom environment; I’m in a group with 90 others. I don’t know if someone’s learning the concept quicker, which is a great thing; I don’t want to know if I’m the only one that’s confused. Actually when I’m confused in class I’ve been more adamant about just raising my hand and asking whatever my question is. But in high school, like what I said before, you would see how quickly other people were understanding the concepts and that just made me want to…
INTERVIEWER: Because of the smaller number?

ALEX: Right. It drew me back from understanding because if a teacher asks a question and someone’s so proud of themselves for knowing, then they’re going to want to raise their hand quickly, before you even have the time to think, and you’ve just given up without even fully attempting the problem. (September 9, 2012)

Dion had various interpretations on the effectiveness of two of his STEM teachers.

DION: Well the engineering teacher, just so far he seems kind of like his mind tracks off or he loses his thought process easily, gets kind of distracted.

INTERVIEWER: Okay. Does that bother you in class?

DION: A little bit.

INTERVIEWER: Yeah. Everybody has different styles they appreciate. What about your computer programming? You are working well in that one.

DION: I like that. The teacher actually explains it very well, goes over examples. If you have a question you can always answer it or raise your hand and he’ll answer anything like that. (November 27, 2012)

For Brent, there appears to be a disconnection with his understanding the possible relationships between expectations that his professors established regarding attendance and his achievement. He repeatedly didn’t go to class and seemed not to value any connection between his attending class, the conversations that occur in class to help master material, and achievement on assignments. Brent says:
INTERVIEWER: Because you were talking about you skipping History, but that's the one class that you have a C in. Do you think there's a connection or do you think it's just with the demands of what they're asking for in the rubric for your papers?

BRENT: I notice that as well. I don’t feel like there’s a connection because, like I said, it’s based off my own reading. She teaches out of the book. (October 24, 2012)

Brent goes onto say that of all his teachers, this history teacher is the one he found the most frustrating because of the style of instruction and how demanding she is rather than one of his STEM teachers. However, he clearly was unhappy with his IT teacher whom he said “talks around himself, so it seems like he doesn’t know what he’s talking about” (October 24, 2012) He continues with:

He knows his information. He just really doesn’t … like he’s talking as if he’s talking to someone who’s already informed about it. Like if he’s teaching something new, like, well just do this. It’s like, I don’t understand what the problem is? But it’s like, we’re new to this. He’s not teaching us as if we don’t know anything.

Brent identified how he best felt he should learn: “Definitely. I'm definitely more of a physical learner. I can go with all of them but if I had to choose or if I had a preference, it would definitely be hands-on” (September 11, 2102). He goes on to discuss his preference for STEM class size that would facilitate his learning most effectively.
BRENT: I would prefer it to be more of a smaller class like my English class, there's only 19 and that's all for English classes. No teachers are allowed to force add. So that's 19 people and you do have a more personal relationship with the teacher and that you can talk to other classmates and things like that. In my IT class, none of us really talk.

INTERVIEWER: Do you find you learn better in the smaller environments?
BRENT: Yes, because we can do a little more group interaction. You can definitely learn better. You learn better by other people.

Charles, Dion, and Elijah found that for them the size of the class didn’t dictate the effectiveness of the teacher, rather, it was the pedagogical choices the teacher made. Elijah found that despite the large Instructional Technology class size (over 100), that the back and forth nature within the course allowed for active participation and input from students. Dion found that he would ask questions in large or small classrooms, but he also had a preference: “Yeah, I kind of prefer the more hands on type of professor but I’m also fine with the lecture hall. That really depends on the content. Unless it’s one of those dry, boring type of classes” (September 14, 2012). Charles suggested his curiosity could be addressed more easily in smaller classes: “I find that I talk more in smaller classes but in my bigger classes, if I have a question or if I have any issue, I just write it down and then go do the research on my own” (September 7, 2012).

As the semester progressed, Alex found himself comparing his struggles and successes to his peers:
INTERVIEWER: So you think most freshmen are going smoothly; why do you think that? You don’t think there are people that come here and struggle?

ALEX: At least because I show if I’m struggling, if I’m stressed or something like that, I care. I’ll talk about grades, or I bring them up. If you don’t bring up your grades, if I see you most of the time and you’re chilling and you’re just out like hanging out, it doesn’t look like you’re stressed; you’re stressed from your grades or your coursework isn’t really showing. So, that’s why I made the general assumption that most people, or whatever, I guess if I look at my floor, most people—or where I live, they’re just chilling all the time. (November 1, 2012)

Brent found that his mathematics teacher through her willingness to be available and approachable helped to ease some of his academic concerns. It didn’t, however, seem to immediately cause him to achieve at a higher level as he did continue to struggle through the end of the semester. He also found that the lack of interaction in his instructional technology class wasn’t improving his depth of understanding of the material.

She just helps us out with—she’s really good with answering questions and things like that and not beat around the bush or like you know run around the question. But she does answer your questions and pretty much all of the resources that you need to be successful in the class are right there. So, you have online assignments, you have online textbook, you have your hard copy, you have email. You can always reach out to her. She’s really good with that. (October 24, 2012)
Brent also offered this about his IT course and the social interactions in class as a contrast to his mathematics course:

BRENT: The only class that we talk in all the time is the University class. In IT we don’t talk.

INTERVIEWER: Does that bother you or would you find it helpful if you actually talked in class?

BRENT: Sometimes, but at the same time, I’d much rather get in there and get out. (October 24, 2012)

**Microaggression.** Described by Sue et al. (2007), “racial microaggressions are brief and commonplace daily verbal, behavioral, or environmental indignities, whether intentional or unintentional, that communicate hostile, derogatory, or negative racial slights and insults toward people of color” (p. 271). While Alex’s and the others’ thoughts could be described as mentioned earlier as stereotypical freshman hubris, it perhaps underlies a larger problem affecting these young men. Alex suggested some interpretations that he made with regard to how professors interact with students in small classes. Because they were more often than not one of very few minorities in class (and often the only minority male), these interactions in the classroom could be interpreted as microaggressions. Alex initially described it this way:

INTERVIEWER: Okay, so now you’re one of 90 versus one of 25 maybe.

ALEX: Right.

INTERVIEWER: So what were your thoughts coming into that math class?

ALEX: It made me extremely happy.
INTERVIEWER: To be one in a smaller number or a larger number?

ALEX: One in a larger number. In high school, when I was taking Calculus before, a teacher could pick on you and say… it just gave them too much room for one-on-one--

INTERVIEWER: To identify you? You think in a smaller class they can identify you more readily?

ALEX: Right, and I really didn’t need any of that. I really just needed her to explain the concepts on the board and let me absorb myself without coming back to me to see if I understand. The thing was because it was such a small number she could ask a question and maybe the most confident person in the class could say, “Yes, I get it. It’s whatever, whatever.” Here you can’t do that; everyone has to learn by themselves. There’s no room for anyone to stick out or intimidate others academically because all I can do is just sit back, absorb the concepts and go to the math tutoring center if I feel like I need anything extra. In high school I think the teachers were trying to play both roles of teaching the concepts, making sure you understand, wondering if there’s anything going on with your life, a reason why you’re scoring so poorly on the test when I really didn’t need all that. I just needed, you know, let me do that job. (September 6, 2012)

He continues by describing the competition and perhaps intimidation that he felt from other students.

ALEX: Right. So you get kind of benefits both ways. Bu yes, if that does become the situation, hopefully at least 20 instead of 10. I’ll try to manage the best I can. I
just know what kind of aspects of a small class discourage me from wanting to contribute, learn or be a part of a class and that is other students and…

INTERVIEWER: The competition aspect?

ALEX: Yes, the competition and I guess kind of the favorability that professors gain once you have such small class.

INTERVIEWER: Favorability towards whom?

ALEX: Towards students that can perform to their idea of what a student should be able to perform to with the way that they can understand the concepts, whatever. Just their favorability that they gain that way; the one that does the best on the quizzes, always participating, things like that. (September 6, 2012)

As the semester progressed, Alex found himself still concerned with others achievement as compared to his own. Dion on the other hand found concern not with his peers, but with the friendliness of the professor and his interaction with students.

INTERVIEWER: Seems to still be manifesting itself. Like you still seem like you’re--there’s a concern there. With math, you said it was one of your smaller classes; that you can’t hide.

ALEX: Right. Right.

INTERVIEWER: Are you finding that that’s still the case? Do you think there’s any connection to sort of, the confidence or lack of confidence coming into the class?

ALEX: No, I actually do concern myself with how I’m doing in comparison with everyone else, but like that, not knowing the year’s gone by, I guess I have a few
people that sit around me that I’ll talk to about grades and things like that, but I can't concern myself with it too much then, I don’t know, I just probably won’t study at all because definitely, for one, when you tell me that you got a great grade, and then, you say that you didn’t study at all? That’ll just turn me away.

(November 1, 2012)

Dion suggested that his STEM professor made approaching him with questions was less than ideal.

INTERVIEWER: Have you gone to any of the office hours or anything like that for micro?

DION: I haven’t needed help from him, so no. And he doesn’t seem exactly friendly around students.

INTERVIEWER: Does that bother you?

DION: A little bit. He’s always like, if you say like the wrong thing, I guess he’ll like point it out and just like make fun of you a little bit.

INTERVIEWER: You’re talking about during class, like lectures and stuff?

DION: Yeah, like he doesn’t like people—if he says something he doesn’t really like you asking him the question again, he really hates repeating himself, pretty much. (November 27, 2012)

What was less than clear in this interaction between Dion and his instructor, was if this aggression perceived by Dion was intentional, targeted specifically at him, or if the discomfort he felt was felt by others in the class.
The concerns about microaggression, whether the incidents are identified or not, are significant as they can create potential disparities within a student's academic foundation. These interactions as Sue et al. (2007) put forth, with other students and instructors are meaningful as “microaggressions are detrimental to persons of color because they impair performance in a multitude of settings by sapping the psychic and spiritual energy of recipients and by creating inequities” (p. 273).
Academic Milestones and Math/Science Utility

The Academic Milestone instrument (see Appendix C) was completed by participants on two occasions during the semester to allow for points of comparison. This instrument focused on students’ perceptions on task completion as a STEM major. It was given during the first and last interview sessions prior to any questions being asked (see Tables 2 and 3).

Table 2

Results of Academic Milestone Instrument

<table>
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<th>Trial</th>
<th>Complete Task</th>
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<tbody>
<tr>
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<tr>
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<tr>
<td></td>
<td>Last</td>
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</tr>
<tr>
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</tr>
<tr>
<td></td>
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From this instrument I believe three significant items emerged.

Alex: His data showed the most widespread drop in the questions regarding the ability to remain a STEM major over the next one, two, or three semesters and the expectation of being able to excel in STEM over that time frame as well. Dropping four points on the question #9, Alex went from being completely sure of his ability to excel in STEM over the next semester (9) to being significantly less so (5). The additional questions (#10 and 11) concerning students’ Excelling in STEM the next two or three
semesters remained neutral for #10 and dropped one point in #11. Lastly, he dropped three points on question #6 in his thoughts on remaining a STEM major over the next semester (9 to 6) and one point drop in questions #7 and 8 (both from 9 to 8). Alex had the largest change in average (1.27) between the two instruments.

Brent: As the one participant who has decided to change his major from a STEM concentration to a non-STEM concentration, it was interesting that Brent felt more confident on questions #2 and 3 about being able to complete the requirements for a chemistry and biological sciences major (6 to 9). Yet at the same time, Brent felt slightly less confident that he could excel in a STEM major (questions #9-11) over each of the next three semesters (9 to 8). His pre and post means also showed that he felt the most confident through the end of the semester.

Elijah: As an academically solid student through the first semester, Elijah showed increases of two points (7 to 9) on questions #6-9, in his thoughts about remaining a STEM major over the next three semesters. Elijah also dropped by a single point (7 to 6) on question #5 his belief that he could complete a STEM degree. The means of his scores put him in the middle of the scores as compared to the other students. It is plausible that Elijah is underestimating his ability and is choosing to err on the side of caution in the completion of the instrument.

The Math/Science Utility (see Appendix B) also yielded interesting nuggets of information (see Tables 4 and 5) about the students that seem to align with the information gathered during our conversations and with the Academic Milestones instrument. Table 3 presents statistics on how over the course of the first semester, these
young men changed their interpretation of the importance and value of their first STEM courses and how it will influence future interactions as an adult and with their friends and family.

Table 4

*Statistics from Math/Science Utility*

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<thead>
<tr>
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<th>Post Mean</th>
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Table 5

*Results of Math/Science Utility*

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106
Alex: Question #5 regarding the relevance of mathematics in Alex’s life was originally disagreed with strongly (1). However, after a semester of mathematics, Alex agreed with (4) the statement. Additionally, concerning question #9, he became undecided about the use of after a semester of mathematics when he originally disagreed with the statement. Lastly, after a semester of classes, Alex now strongly agreed that his parents and friends would admire and be pleased with him with a STEM degree and it would pay off positively for him including in his salary (questions 13,16-18). Previously those questions were scored 4, 4, 3, and 4 respectively. Alex had the largest difference between the pre and post assessment scores as reflected in the means on the Academic Milestone Instrument.

Brent: His responses were exactly the same save for three responses regarding the importance of math out of school and as an adult (questions 9 and 10), and the question about friends admiring him if he had a STEM degree (question #16). There appears to be
some inconsistency with his interpretation on the importance of mathematics after graduation. He strengthened his conviction on disagreeing that he would have little use for math after school (question #9). However, on question 10, his stance changed to a position where he agrees that it isn’t important as an adult that he does well in mathematics. He had originally answered that he strongly disagreed with that statement. With regards to his friends admiring him if he were to earn a STEM degree, he originally answered as undecided, but answered strongly agree after his first semester at Dansby State University.

Charles and Dion: The importance of undergraduate academic success in mathematics as an adult (question #10) became an undecided issue for Charles and Dion after previously disagreeing and strongly disagreeing respectively. Charles had the smallest changes in average between the pre and post scores (.06) and Dion was tied for second smallest with a difference of .11.

Elijah: Continuing the consistency Elijah showed academically through the semester, none of the four answers that differed from the first responses to the second shifted more than one level. Questions #9, 12, 15, and 16 moved from 1 to 2, 2 to 1, 4 to 5 and 4 to 5 respectively. He had the smallest standard deviation on the pre assessment and the largest standard deviation on the last. This could speak to Elijah growing more comfortable academically and answering more questions with strongly affirmative or strongly disagreeing.

I presented in this chapter the themes that developed from the interviews with these five young men. These themes were used to gain a better understanding of the
experiences and factors influencing the academic pathways, goal setting, and decision making that these students made. The students’ self-efficacy beliefs that evolved over the course of a semester elaborated the connectivity between the learning that took place in the classroom and the relationship to social and academic factors. My involvement in these students’ lives was another factor that plausibly influenced their self-efficacy beliefs. My interpretation of this role is discussed in the next section.
Researcher Role

As an African American male who has two degrees in STEM, I was acutely aware of the part I played in the development, recording, and interpretation of the stories collected during this study. Throughout the collection of thoughts from the young men, I realized how important it was to have honest and straightforward conversations with them. I was clear in our initial meeting my vested interest in understanding the nuances of their decision-making and their thoughts on how they will try maximize their success as a STEM major. I was there with intentions of investigating ways to support the success of students when the data shows that there are challenges that can inhibit their progress. I was a student who successfully navigated this pipeline and was now an interested observer to this same process for others.

The conversations I had revolved around the four major research questions and the considerations these students had during their first STEM courses in college. The questions initially began with discussions on thoughts of confidence entering the first few weeks of their first STEM classes. Following that line of questions, I pursued factors that impact their achievement in their classes and the concerns that they have going through college to graduation. I followed this with questions on identity, expectations, and help-seeking. The final line of questions focused on interpreting what the student’s thought of their STEM classroom structure and teacher pedagogical choices. Throughout each of the
conversations I had with these young men, I internally empathized with each of their stories of success and challenge. Each of them was very forthright in the sharing of their unfiltered thoughts and feelings on the work they were doing over the semester. Even as some of them openly struggled with their academic work, they took time out of their day to spend time having conversations with me. I would like to think it was because of the relationship and value that they saw in participating in this study. I offered what I believe was sincere interest in there stories and was willing to talk to them as often as they would have liked to. They certainly allowed me to develop additional areas of interest to pursue and questions to investigate.
Conclusion

In this chapter I proposed themes that developed as a result of the conversations I had with these five young men. Those themes are: self-efficacy; confidence and background; family; factors impacting African American males; mathematics concerns; perceptions of race; balance; isolation; perception of ability; help-seeking; quality of instruction; boredom, disinterest, and disappointment; class and social dynamics; and microaggression. In the development of these themes and sub-themes, the findings were used to gain a better understanding of the breadth and depth of how the self-efficacy of these students were influenced by their first science course. The potential impact of uncovering factors that are unique to the demographics of these young men and how this University (or others) could interpret them could allow for a strengthening of programs and support systems to provide support for the STEM pipeline.

I will address conclusions from these interviews and the instruments utilizing the research questions to drive the discussion:

1. How are the self-efficacy beliefs of African American Freshman males majoring in a STEM field at a large, public mid-Atlantic state university affected by their first STEM course?

2. What are factors affecting African American freshman males in STEM majors at a large, public, mid-Atlantic state university?
3. What are freshman African American male students’ perceptions of their ability to do STEM and how do these perceptions affect their achievement?

4. Does the perception of the quality of instruction in the first STEM course taken at a large, public, mid-Atlantic state University affect the self-efficacy beliefs of African American males?

For these five young men undergoing their transition from high school to Dansby State University, opportunities and challenges were intertwined in each of their lives’ throughout their first semester. Their decision to major in a STEM field, and factors that affected that choice, were manifested in various ways in our interviews and through the two instruments completed over the term. As they took their first STEM classes in college, these students had interactions with their peers and their professors, they had successes and struggles academically, and they made decisions as a result of all of these that affected each of them and his self-efficacy differently.

The issue of being African-American on a diverse, but still a majority White and public university campus was an apparent non-issue for these students in class and in the impact it had on their academic goals and their self-identity. None of the students immediately took any significant notice to their uniqueness due to race and gender in their classes. Resigned to the fact that they are one of a small number or perhaps the only African American male in class, these students were comfortable in their own skin.

The coursework foundation in STEM that these students developed through high school and brought with them to Dansby State University established a baseline of
confidence that they had entering their first classes. The confidence of some of the five
students and their perception of their ability suffered coming out of high school due to
less than optimal achievement in their high school STEM courses. Additionally, various
deptths of familial interactions support some of the students’ additional impetus to
continue on their declared pathway and supplement that student’s belief in his ability.
Some of the young men, however, had parental input that was not as clearly identified,
which therefore had an unknown influence on their academic pursuits. The participants
attended class the first few weeks with certain thoughts and questions about what the
level of rigor in the class would be and on the nature of the professor’s content delivery.
They found that their early assignments and expectations resulted in them having various
responses that affected their efficacy. The end product for those who struggled
manifested itself in different ways. For some like Alex and Brent, there was the
commitment to try harder and study more. This responses to the transition didn’t appear
to identify adequately whether any underlying issues, e.g. if the bigger problem was a
misunderstanding of the content, or whether the issue was pedagogical in nature, or some
mixture of both. More specifically, the achievement some of these students experienced
in high school mathematics compared to the initial achievement shown on DSU’s
placement tests and within their first math class appear to have a relationship to each
other. The three students who struggled with the math placement test, Alex, Brent and
Charles had some concerns with high school advanced mathematics and as a result were
requested to take a course they already completed once. From that, Alex and Brent
continued to display below average performance in the first math course they took in
college. As Powell (1990) suggested, it isn’t unreasonable to ask whether these students are experiencing a feeling of helplessness with their performance in mathematics that had persisted from high school. Just as Bandura (1986) spoke of how repeated successes build efficacy that small instances of failure can’t weather, it follows that repeated failures could damage efficacy in such a way that infrequent successes would not supplement and raise efficacy easily. The significance of this mathematics concern with these young men could then be attributed to affecting their performance in their other STEM courses as expressed by Li et al (2002). The importance of the STEM courses these students took seems to have persisted from high school. The exposure to, and completion of, relevant STEM courses seems to show a relationship with STEM courses at DSU. Elijah for example, completed multiple STEM courses successfully in high school and that achievement has carried into his college coursework where he excelled. Alex and Dion, however, didn’t take physics in high school and as a result when they encountered their first STEM engineering course, they found they would have benefitted from having that background; as a result, they struggled with that content mastery.

In their first semester of college, each of these young men allowed some academic isolation and a reluctance to seek help to be a large part of how they identified the pathway to academic success and their fulfillment of their goals. Rarely showing proactive attempts to ensure content mastery, when pressed, many like Alex voiced a willingness to work collaboratively, but only on a few occasions did they. Brent spoke of the desire to get in and get out of class rather than work in small groups. And for those who did collaborate as Alex did, it was a reactive effort due to a concern about an
assignment, rather than an ongoing tool they used to support their learning. Additionally, some of the students like Dion and Charles voiced concerns about the effectiveness of collaborative work and its impact on their academic success as their rationale for not utilizing these opportunities. While some of the students were able to show promising achievement at DSU in STEM from the very beginning, not all of them excelled initially. Each one of them spoke of what it would take to get them to seek help in their classes, and for all of them, they had a hard time elaborating the internal mechanism that would “tell them” when they needed to get assistance. Some of the participants like Elijah, said that it was a low grade that would spur him to seek help, while others, like Charles, were less than certain about what it would take for him to seek help to ensure success. Additional academic segregation was self-generated by their lack of participation in classroom discussions. Some of this behavior was attributed to a personal choice, e.g. Brent; yet one student, Dion, said the instructor didn’t seem approachable and he therefore chose not to seek his instructor’s assistance.

The unwillingness of the students to seek feedback on classroom work added to the academic pressure that they placed on themselves and the decisions they made in regard to their academic interests and goals. Two students, Dion and Alex, spoke of their first STEM teacher as being an adjunct instructor rather than a tenure-track professor, who for them, seemed ill prepared, reluctant to answer questions, or provide assistance. With this as the backdrop as the first STEM experience for them, the full impact on their efficacy is unclear, but they did talk of being frustrated and disappointed. For example, Dion explicitly identified his Introduction to Engineering professor as being
disappointing, and Alex spoke at the end of the semester of the frustration he felt from his first STEM course. This type of judgment, made by students in the demographic category from which colleges are trying to improve participation and matriculation rates, is not encouraging in making STEM more appealing and accessible, thereby potentially keeping the pipeline flowing.

Not grasping that their freshman year in college would be a difficult year due to the dynamic between academic and social demands and the transition from high school, these young men each handled the balance differently. A schedule that was structured, with a fixed and regular study time seemed effective for Elijah, a student with multiple demands on his time outside of class. He appeared to handle the demands of being a student-athlete well, without any obvious negative impact on his academics and outlook. Those students with much less structure to their schedule outside of class, such as Brent and Dion, saw various effects on their achievement. Brent who repeatedly made decisions to let the social demands of college life influence and outweigh the significance of class attendance, participation, and assignments struggled academically and perhaps indirectly was a factor that influenced him to change his academic goals and choose an alternative major. Dion on the other hand, appeared to find balance when not in class, not allowing his social life and non-academic commitments interfere with his academic achievement.

First semester participation in University sponsored programs and organizations have yielded unclear effects on the students’ goal setting and academic pathways. The two young men, who are scholars in the LSAMP program, stated that the initial interactions in the program were more social than academic. A study room arranged
through the program was available, although neither of them had utilized it, nor had they had any LSAMP mentoring outside of initial class selection process. Faculty interaction at the initial semester meeting was minimal, and didn’t offer any academic counseling aside from showing them the study room. All five participating students also attended the initial meeting of the University’s National Society of Black Engineers (NSBE) chapter. At that meeting there was a voluntary sign-up tutorial list made available, but later in the semester, none of the students responded as having participated in any of their academic activities. The positive impact on the students’ efficacy from working with these organizations and programs are only important if they offer sustainable support and students seek them and find value in the resources they receive. If there is no follow-up to promises made and students don’t respond to the resources because they have academic challenges, then there is an attrition risk that these students could face.

In the next chapter, I will present a discussion on the implications are for the data collected in the support of African American male students in the STEM fields. Considerations of how these data could resonate with K – 12 as well as in post-graduate experiences will also be presented. The limitations to this study will be offered and potential areas for follow-up research.
Chapter 5: Discussion and Implications

By sharing the voices of these young African American men in college, this researcher investigated, the factors that impact the retention and ultimately the graduation of male students of color in science, technology, engineering, and mathematics. Specifically isolating the first STEM course these students took, the study identified these first semester African American male students entering college and the implications that these courses could have on their long-term success in the field. Conducting the sessions in a conversational arena where the candor of the participants was appreciated, the students offered over the course of a semester the successes and challenges that they encountered and any impact they had on their academic progress. With broadening resources at universities being committed towards outreach targeting transition, the stories shared by these young men were analyzed to identify any commonalities that were to be found to support their views of themselves, thereby suggesting an adjustment of university programing.

Research Questions

This study was driven by four main research questions:

1. How are the self-efficacy beliefs of African American Freshman males majoring in a STEM field at a large, public, mid-Atlantic state university affected by their first STEM course?
2. What are factors affecting African American freshman males in STEM majors at a large, public, mid-Atlantic state university?

3. What are freshman African American male students’ perceptions of their ability to do STEM and how does these perceptions affect their achievement?

4. Does the perception of the quality of instruction in the first STEM course taken at a large, public, mid-Atlantic state University affect the self-efficacy beliefs of African American males?

**Self-efficacy**

Research question number one was developed from the concern about African American freshman males successfully making the transition to the rigors of college coursework and the expectations demanded of a student majoring in science, technology, engineering, or mathematics. It also seeks to identify whether, over the course of a semester, the efficacy beliefs with which the students entered the program, will have changed based on the various circumstances that they encountered in their initial STEM class. The interviews yielded themes involving their background preparation in high school, the rigor of STEM coursework, and the level of family support they received.

As presented earlier, social cognitive career theory (SCCT) (Lent et al., 1994) encompasses the inputs, experiences, and influences on goal setting, interests, behavior, self-efficacy, and outcomes for students. Building on Bandura’s social learning theory (1977) including his ideas around self-efficacy, which he defined as "people's judgments of their capabilities to organize and execute courses of action required to attain designated types of performances" (1986, p. 391), several others (Byars-Winston et al.,
2010; Fouad and Smith, 1996; Lent et al.,1994) have developed SCCT and applied it across many subjects like literature and mathematics, including students and the processes they encounter to make decisions related to the careers. Their work investigates how students’ backgrounds and beliefs affect the decisions they make regarding their education. SCCT also incorporates how students think they will do based on, among other things, their experiences, prior preparation, and the probable outcome for the learning. All of this has an impact on the students’ goals and their sustained interest in the learning.

The self-efficacy that a young person has can strengthen or weaken due to various factors throughout their formative years. As described by Lent, Brown, & Hackett (1994, p. 84), in the context of social cognitive theory, “self-efficacy is not a passive, static trait, but rather is seen as a dynamic set of self-beliefs that are specific to particular performance domains and that interact complexly with other persons, behavior, and contextual factors.” So over the course of a semester, these five young men experienced various fluctuations in their efficacy as their academic and social lives developed. The initial highs experienced from being away from home, combined with the angst felt from becoming college students, along with the uncertainty these young men felt when entering college all affected how they felt about achieving their academic goals. From the simplest activities that had to be done like getting up on time to attend an early class, to making decisions that had possible academic ramifications like whether they should study or hangout with friends, influenced their efficacy. Alex, Brent, Charles, Dion, and Elijah were not immune from the highs and lows that are a part of the college experience.
and taking their very first classes. Each and every day they had choices to make that ranged from the complicated to the mundane and many were connected to a thread that impacted how they perceived themselves and their ability to achieve the goals they set for themselves. Whether it was Brent skipping class, Alex not doing homework assignments, or Dion completing a group project and presenting to a group of administrators, each of the decisions they made affected how they felt about their abilities. Schunk (1990) spoke of an “efficacy appraisal” (p. 75) that students perform, that lets them “take into account such factors as perceived ability, expanded effort, task difficulty, teacher assistance, other situational factors, and patterns of successes and failures.” (p. 75) The outcome expectations and goals that these five students had from high school as evidenced by their predictions of their GPA and their statements of confidence and poise regarding their academic ability carried into their first semester in college and were dynamically influenced by the experiences that they had in class. These experiences in turn, affected their goals and expectations through the end of the semester and possibly into their second semester, as course selection and academic goal setting was influenced by their first semester courses, as was the choice of remaining a STEM major for Alex. So as the semester progressed, these five students encountered and adjusted their efficacy beliefs to try to meet their adjusted academic goals. They did this by expressing the need to consider seeking help, through more concerted efforts to complete assignments, and evaluating activities that impacted the balancing of their schedule. The impact of family on their efficacy is not as transparent. Two of the students, Elijah and Alex, appeared to be on opposite ends of the continuum with regard to their relationship with each one’s...
parents respectively, and the influence on their academics, with the other three students falling in between. Elijah spoke of frequent conversations with both of his parents, his respect for their financial contributions, and their support of his academics. Conversely, Alex presented a small bit of information that was concerning when he spoke of not valuing his father’s opinion of his academic achievements. Brent, Charles, and Dion all expressed varying amounts of concern and input from their parents in support of their academic achievement. Gutman (2006), as stated earlier, suggested that the familial support of students and their sharing of their students’ mastery goals also relates to improved self-efficacy beliefs and grades in mathematics. These students’ families had varying interactions and input that could present as an underlying tertiary factors in the efficacy beliefs of the young men and perhaps their achievement in mathematics. There were three students Alex, Brent, and Charles, who stated they didn’t perform up to their expectations on the mathematics placement assessment and had to retake the same course they took in high school. From these three, only Alex shared any information that could suggest there was less than ideal support from both parents and who also struggled in his college mathematics class. Both Brent and Charles did not share enough depth on their relationships with their parents that would allow me to gauge parental support and impact on efficacy beliefs one way or another. Charles did offer that his father was passionate for STEM, but he rebuffed his help because of what he perceived as overzealousness about the subject. For Dion and Elijah, they performed well enough on the mathematics achievement assessment to be exempted out of their first semester requirements. Elijah provided insight that suggests his relationship with his parents is aligned with his goal
setting and has a positive impact on his efficacy beliefs. It appears the successes some of the students experienced over the semester have reinforced the decisions they made to pursue a STEM degree and their interest in remaining a STEM major has not changed. For example, Charles accepted the challenge of the major and resolved to continue the path he had chosen.

INTERVIEWER: Okay. What about thoughts on changing your major? Has anything—any thoughts on, “Okay, this is just not for me,” just based on what you’re doing in engineering class?

CHARLES: No thoughts like that, because I already knew it was going to be a tough major to follow, but other than that it’s going pretty good. (November 27, 2012)

Both Elijah and Dion succinctly answered any thoughts on changing their major with a simple “no” when asked if they were going to change majors. (Dion, November 27, 2012; Elijah, November 28, 2012) It theoretically follows that any sustained academic success they had over the semester fortified their efficacy beliefs and helped diffuse any poor performance that could potentially linger into the next semester(s) which could lead to changes in major or even dropping out, but there is no evidence in this study to support this speculation.

SCCT was an appropriate framework (see Figure 7) to employ and inform in the analysis of this study. The learning experiences these five students shared through this study align well in supporting pathways to efficacy beliefs and in establishing responses and outcome expectations from their academic experiences in STEM. Through their
STEM classroom experiences, Charles, Elijah, and Dion found reinforcement of their efficacy beliefs because of instructor interactions, results of assessments, and their self perceptions of their ability and confidence, whereas Alex and Brent saw some reduction because of academic challenges. SCCT was effective in mapping how these changes in expectations would and could affect their interests in STEM, their goals as STEM majors, and any actions they may take to remain or not remain within the discipline. Through our conversations, all five of the young men described their interests in coordination with their achievement in the STEM course he was taking, and how these interests were connected to the pathway towards achieving their goal of a STEM degree.

Factors affecting achievement

The second question pursued factors that could impact a student’s success as a STEM major. The focus of these discussions revolved around concerns about mathematics preparation, thoughts on race, the balance between academics and a social life, and isolation. The impact of pedagogical choices by the student and instructor was also initiated here and carried into the discussions of the final two research questions. Projecting from the work Gutman (2006) did, the transition to undergraduate work was accompanied by a larger student body, less social and academic structure, and more rigor and personal responsibility. The impact of different factors and decisions on the student in these initial STEM classes reasonably lays down a foundation of high or low confidence and efficacy beliefs as he continues on toward graduation. In regards to race, these young men did not interpret being African American as a significant factor affecting their participation in STEM and the role it may play in how they are perceived...
within class. Only when questioned, did they reflect on any demographics within their classes and the significance of their choosing a STEM field as their major. Alex suggested that because he thought African Americans may not come from high socioeconomic backgrounds that financial aid is a more significant factor for African Americans when going to college and therefore, business is a more likely choice of a major. Brent offered that coming from a majority white high school into a diverse, but majority white university, was an easy transition and he was comfortable in his own skin. Dion’s mother mentioned to him the relevance of color in discussions about his choice of major and how it was special because he was African American. He, however, didn’t relate the experience to this researcher as being significantly relevant to his daily thoughts.

As these young men found out, striking the right balance of academic and social components in their first semester can influence how viable their desired academic pathway will be. As Elliot et al. (1996) suggested, there aren’t a lot of chances to redo poor decisions made in the STEM pipeline in college. Once students leave the STEM field, either by their choice, or as determined through their academics, they tend not to return to the field. So it’s in the best interest of those vested in the success of the students to identify those factors impacting student progress in the pipeline. Students like Elijah, who because of his personal preference and his circumstances surrounding his athletic participation, preferred a schedule where his social and academic balance was mandated by the schedule he had to keep in order to remain eligible to play. Alex, however, struggled with the freedom his schedule allowed and said that his socializing was
consuming a larger part of his schedule than he would prefer and could be a factor in his academic achievement levels.

The significance of mathematics preparation from high school appeared to be a factor in a successful transition into first semester STEM achievement, as was the pedagogical choices these students’ were making to study and seek help. Isolation was a factor that repeatedly emerged as integrated into the academic preferences these young men had. There was reluctance by Alex, Brent, and Charles to proactively look for help until time had passed and their academic achievement suffered. Charles suggested that he wanted to see how he did without help before he would have considered seeking help while Alex was disappointed with the help that he did seek which led him to not pursue it again. It was this reluctance to seek help and collaboratively learn that provided a transition into the third research question.

**Perception of ability**

The third research question investigated each student’s perceptions of his abilities in STEM and the pathway that he takes to achieve academic success. Along this pathway the young men encountered the need to seek help. Alternatively, they could have chosen not to pursue help from their professors, so inquiry into the processes that these students used for that decision-making was made. As presented earlier, Zimmerman et al. (1992) reported on the relationships among minority high school students’ self-efficacy beliefs, their ability to regulate their efforts on academic pursuits in the face of other alternatives, e.g. socializing, etc. and to seek help when needed. It appeared that for these five freshmen, the need to understand why and how you seek help became a reactive process,
and when the efficacy beliefs of some of the students dropped because of academic performance issues, the impetus to seek help diminished. Interpreting this lack of impetus through Powell’s (1990) research, it seems the students had something analogous to a Pavlovian response. Their minds were being trained through repeated academic challenges to accept not being as successful as they had set out to be and as a result, that lack of success became self-reinforcing and cyclical. The students failed an assignment or didn’t do well, so they then didn’t expect to do well the next time, then they didn’t, and so they then failed again, and the process repeated itself. Alex expressed this behavior not only in regards to work he completed in his mathematics course during his first college semester, but he shared a story where he showed this behavior in high school. He had received bad marks on an assessment and in response he wouldn’t look at the feedback or corrections, and then he shared that he did not adequately prepare for the next assessment. These classroom and academic behaviors were in some instances perceived by the students to be exacerbated by the instructional choices made by their STEM instructors. Dion made a decision to not seek help from a professor because the professor appeared to him to be unapproachable and his teaching style left him disappointed by the end of the semester. Brent was critical of the instructor because of the repetitive, PowerPoint-based, teacher-centered lectures that were delivered. This instructional choice made him much more reluctant to seek out assistance when mastery of the material became challenging. To be clear, Brent didn’t aide his cause by his skipping class more often than the others. The perception by Alex, Dion, and Brent of reluctance to change or adapt classroom pedagogy by the professors, led them to question the
effectiveness of the STEM courses they were in. This opinion the young men had of the effectiveness of the instruction they received in their first STEM classes versus the type of instruction that they have said they prefer, is a viable reason to examine any impact the instructors’ choices may have on their decision to remain a STEM major and the effect on their self-efficacy beliefs. If a student has demonstrated and expressed that he learns most successfully and prefers, hands-on, tactile-based instruction in science, yet they continue to be exposed to teacher-centered instruction, it stands to reason that this too could be a factor in the persistence of a student group in the STEM pipeline.

**Interpretations of instruction**

The final research question was designed to investigate the students’ perceptions about the quality of the instruction that they had in their STEM coursework. These freshmen shared information about their preferred learning styles. Those perceptions were compared to what they encountered in their first STEM class. Additional input came from their perceptions of the social dynamics that they confronted on campus. Underlying the social dynamics in class were situations where some of the students reported that they found themselves unhappy, bored, and or disappointed with what was going on academically. Elijah shared that he felt the academic interactions among students in his IT course were minimal and instruction revolved around teacher lectures. Dion echoed these concerns in his Introduction to Engineering class, with Alex offering similar concerns about the pedagogical choices their instructors made and not feeling as if he learned something worthwhile during his STEM class. Some of these interactions, which could be perceived of as microaggression on the part a few classmates and some
instructors, were also addressed in our interviews because they influenced the students’ help-seeking and isolation. For example, as part of a group project, Alex felt that his contributions to the classroom conversations developing the work were minimized in part because he didn’t live on campus with the other group members and they met without him. Dion was concerned about seeking help from the instructor because he interpreted comments the instructor made in class to students as making him unapproachable after class. It was Sue et al. (2007) who suggested that microinvalidation is the denial of the reality of the individual, in this case the reality for these five young men is that they are African American male freshmen majoring in STEM at a majority White university where there are very few of them in the field as a whole. Alex’s perception of being overlooked in class because of favorability towards other students and Dion’s concerns about his relationship with his professor have been internalized by these students in a way that they were able to remark about the incidents. It is unclear if the intent of the interaction was due to race or gender, but the interactions were significant enough for the students to recall. As suggested by Harper (2012) and Reyes et al. (2000), the relationships that these five young men developed, or didn’t, with their teachers were important because strong positive interactions between teachers and students can build expectations for achievement and increased student self-efficacy beliefs. As previously mentioned in work by Midgley, Eccles, & Feldlaufer, and Eccles et al. (as cited in Reyes et al., 2000) they noted that for those students transitioning into a new academic environment, in their study high school, in the present case college, they said,
In this new context, students must gain the acceptance of new teachers, learn and adapt to a variety of instructional styles, and conform to a different set of rules and expectations in each of their classrooms. The development of close relationships with teachers may be inhibited by the greater number and mix of the student body. (p. 521)

What some of these five men found was an abundance of pedagogical strategies in their STEM classes that were not culturally responsive to what they needed to maximize their content mastery. As an example, Dion believed that his STEM instructor was not approachable because of the interactions he had in class with students; some, like Elijah and Brent, found that classroom time was consistently devoted to teacher-centered lecture-based instruction, where little to no student teacher interaction occurred. That lack of instructor interaction many times leaked over to the student’s social interaction in class where the participants found that very little cooperative learning took place aside from a few required group assignments. Interactions such as this do not support reducing the attrition rate that students of color encounter in the STEM field and don’t support improving their foundation of efficacy. On the other hand, Charles’ work in his STEM class caused him to have a positive efficacy boost when time was dedicated in class to allowing students to complete a group project and present to outside guests. Elijah found that in his advanced IT course having a long-term project provided some relief from the lectures as they were given classroom time to make corrections and adjustments based on lecture content from the instructor. Both of these young men expressed the value they
found in having hands-on experiential experiences in class to allow them to develop their conceptual understandings.
Summary of Major Findings

This study was not an attempt to generalize the experiences of all first semester freshmen African American male STEM majors. The research took place on a large, public, suburban, mid-Atlantic university that certainly mirrors the population and demographics of many schools across the United States. The experiences these young men had and the themes that developed from the interviews do intertwine with studies of similar populations. For example, work has been done on the transition, persistence, and matriculation of African American males into and through college by researchers such as Espinosa (2011), Harper (2012), Hrabowski and Maton (1995), and Palmer, Davis, Moore and Hilton (2010). Additionally, research such as that conducted by the National Research Council (2011), has been investigating intervention programs to expose African American students to research opportunities to support persistence studies. The data produced from this study showed that even the earliest interactions a student has socially and academically influence the choices he makes and its effects on his efficacy beliefs, goals, and interests that a student has. Therefore, there are areas that this research could logically progress to extend and deepen the work to support the strengthening of the STEM pipeline.
Implications for Practice

The challenge of increasing the number of students who successfully graduate in science, technology, engineering, and mathematics is not a new problem. Recognizing that there is an even more daunting problem with increasing the number of underrepresented minorities who graduate in science, technology, engineering, and mathematics is also not new. What did not have a clear answer was if and how the first STEM course an African American male student took in college could affect his efficacy beliefs and the trajectory of his academic goals in graduating with a STEM degree. It was this impact on efficacy using the lens of SCCT that I was interested in, as there was not comparable research looking at this. From this small initial investigation, I believe there is need to consider the first STEM classes as a fertile garden to cultivate the next generation of African American STEM graduates rather than it being simply a hurdle or filter that has to be crossed in order for a degree to be earned. The evidence in the present study suggests that treating first year STEM classes as a trial by fire where the strong survive may be contributing to the paucity of African American men a university sees in its graduation numbers. As universities such as Dansby State recognize that the first year of college is a vulnerable time for ensuring the persistence of African American STEM students, it is in the best interest of the schools to investigate factors that negatively affect this specific demographic of students. This is relevant because with the large size of the
University, the number of students in some classes and the small number of African American males who are STEM majors, effective sustainable interventions could be difficult to achieve.

It is reasonable to suggest that tiered interventions coordinated by local university administration and national organizations such as the National Science Foundation (NSF), can work in tandem to support these students (National Research Council, 2011). Interventions that are coordinated in transition programs for freshmen can more specifically target core foundational academic areas for STEM majors such as mathematics, physics, and engineering and mandate support prior to first semester. Additionally, reforming these transition and bridging programs for more proactive intervention with STEM students so they receive targeted academic support throughout the semester could also be a viable avenue for improvement. Many underrepresented minority campus programs offer these types of bridging components that seek to support students through the summer prior to fall enrollment. These programs offer a unique time to establish relationships with faculty as well as to ensure the expectations for the rigor of college work can be presented. These programs can also lay the foundation for pathways for proactive help-seeking habits for these young people as they enter their first semester. Two of the students, Charles and Dion participated in the Louis Stokes Alliances for Minority Participation bridging program (LSAMP), yet neither actively took advantage of the tutorial services available. The structure of these services were reactive in design, meaning students had to show up to have assistance provided, rather than having a mandatory time to meet to address any issues early on.
The expansion of collaborative programs between colleges and K-12 school divisions would also benefit the STEM pipeline. Early intervention programs at universities that offer middle and high schools students exposure to not only college life, but access to preparatory and exploratory classes that would supplement normal classwork and support efforts by universities with recruitment and retention. Programs at Dansby State that do this for students across content areas could be retasked for specific content areas such as STEM to address deficiencies addressed through pre-testing. None of the five participants of this study participated in any early intervention programs with the university. Partnerships with K-12 school divisions to address deficiencies seen at the university level early in the middle and high school pathways of students could also reduce the need for remediation once students graduate and begin their undergraduate work.

Work with the NSF can also direct efforts and funds to support university faculty professional development. It can’t be expected that professors are teaching to student’s pedagogical preferences and needs, if they themselves haven’t been trained in utilizing best classroom practices as explored and researched through education departments. The assumption and expectations of universities can’t be that their faculty are all equally trained and have a vested interest in learning differentiated teaching practices. It is however, in the universities interest to maximize the quality of the students who graduate, and this is one opportunity that could be effective.

The recruiting of students into campus programs and organizations, especially those designed to support underrepresented minority students’ academic achievement can
be more effective if their support is proactive. If students like Alex and Brent, who displayed some academic concerns in their first semester, are targets of organizations like the National Society of Black Engineers (NSBE), then it serves both the student, the organization, and the university well to ensure that they are taking advantage of the support offered and not just aware of it. Additionally, substantial faculty mentorship from not only the organization faculty advisors, but from the broader STEM professor pool as well is critical. As also suggested by Harper (2012), interactions with professors have to be more than just encountering them for class selection advising or when problems arise. Genuine proactive concern to address the problem has to be initiated from both the university and the student.

In the Dansby State University White Paper on Retention (2011), next steps were suggested that align with many of the implications for practice presented by this researcher. Specifically, in the 2010-11 school year, a retention committee was reformed to address the goals of reviewing and monitoring student retention data, identifying programs within the university that support persistence and retention, identifying barriers to student persistence and retention, and to develop a plan to improve retention. From this committee, numerous actions were taken including the monitoring of mid-semester grades, adding additional freshman transition course sections, and development and implementation of an early alert system for academics. The pilot of this early alert system occurred during the fall of 2012, so it is yet unclear if this effort has mediated the concerns about persistence and retention on campus. It was suggested that two full-time employees be hired and charged with the implementation and coordination of retention
efforts across campus, and the coordination of analysis and outcome research in all the individual academic departments on campus. Lastly, the committee was also tasked with the development and implementation of a proactive campus-wide philosophy that supports the idea of whole-campus responsibility for improving retention and graduation rates.
Implications for Research

Extending the work to look at gender effects on the experiences and efficacy of first semester freshmen and the themes developed with additional underrepresented populations is reasonable. The population of African American females in STEM both at Dansby State University and more broadly nationally, suffers similar growth problems as African American males. Expansion of this research to other traditionally underrepresented minorities, Hispanic/Latin Americans, Native Americans, and Asian/Pacific Islanders to investigate what, if any, parallel themes exist, is also a reasonable next step. Increasing the depth and breadth of work with African American males to investigate decision making, efficacy, and attrition from STEM over the length of the first year and persistence into year two would allow for a richer development of themes that stand the test of time. Additional broadening of the study examining more critically the intersection of efficacy, student expectations, teaching pedagogy, STEM persistence, and attrition rates of African American through the lens of SCCT could allow for the deeper development of what students’ perceptions are of the barriers in the STEM pipeline. Future studies incorporating analysis of stereotype threat in coordination with the perceptions, anxieties, and academic performance of specific racial, gender, or social groups is also an appropriate extension to this study.
Once in college, many of these students meet STEM mentors and tutors, but aren’t involved in an active mentoring, tutoring, and support network. The passive role and involvement that these students have chosen often require students to recognize when they are in trouble. Many times, that is too late. Letting students’ choose when they are struggling cannot be the deficit choice. Students like Alex and Brent made choices to not seek help when it appeared that assessment data early on in their mathematics class indicated that they were experiencing less than ideal content mastery. Dion wanted to wait until he struggled without assistance to seek additional support. Elijah, in spite of having dedicated study time, said were that not the case, he would have waited until he got a grade in the 50’s before he would have sought help. Research questions surrounding structured interventions could be introduced to study students who are in the pipeline to allow them to maintain their confidence and remain a viable candidate in STEM. Questions that investigate the factors which drive help-seeking in minority males and more broadly, in underrepresented minorities as a whole, could clarify the processes that are used to decide when assistance is needed and any resulting outcomes.

Research surrounding the teaching of minority males conducted by STEM faculty could search for relationships to the pedagogical choices made by the faculty within those classes and achievement by those students. A research question that incorporates students’ self-efficacy beliefs and any relationship to the pedagogical choices used in STEM classes could target additional persistence issues. Research in this area could be also used to develop professional development opportunities for faculty to better address the concerns about these students and the STEM pipeline issue.
Though small in number, these five young men shared their perceptions and experiences as seen through their lenses. I have attempted to interpret and adequately document their thoughts in a meaningful way expressing the depth of their stories. Just as these students are beginning their academic journey, the collection of research that supports the most vulnerable of our students in college at the earliest moment is still beginning.
Summary

African American males can play a part in addressing the leaky pipeline seen in US production of STEM graduates. To do so however, factors that have caused these young men to encounter difficulty in getting to and succeeding academically in STEM need to continue to be identified and opportunities to address these factors developed. Listening to the needs these young men express and the concerns that they identify as they complete STEM courses can help direct educators and researchers alike towards meaningful support. It is important that preconceptions about the experiences these young men encounter be dismissed and that their personal perspectives are considered.

This study is both personally, professionally, and academically relevant to what I interests me. As a African American male involved in education and STEM, a larger number of African American candidates provides not only a more diverse workforce pool, but could also creates a bigger mentoring pool for successful graduates to pay it forward to the next generation of minority STEM workers. Increasing the number of viable African American candidates for degrees in STEM can have benefits beyond just the local graduation rate. More graduates in STEM could impact the technological and economic demand in the field, which can trickle down to local education systems. Through business to school partnerships, student and teacher internship opportunities, financial donations, and mentorships, the development of a strong STEM community can
impact many beyond the walls of the lab. If universities could understand at the earliest possible moment how a student is adjusting to the transition they are making academically and socially, they can proactively assist the students who need it and positively affect their retention after the first semester.

The impact on the efficacy beliefs these young African American men had from STEM class was intertwined closely with the academic foundation and habits that they came to college with, the choices professors made in content delivery, and the goals they chose to set and adapt as the semester progressed. The continued study of the issues these students experience and how it contributes to their belief that they can achieve their goals in STEM could help to explain and gain insight into where there is a failure in the pathway that leads to graduation with a STEM degree.
Appendix A

Table A1

<table>
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<tr>
<th>Research/Interview Questions: Session 1</th>
<th>How are the self-efficacy beliefs of African American freshman males majoring in a STEM field at a large, public, mid-Atlantic state university affected by their first STEM course?</th>
<th>What factors are affecting African American freshman males in STEM majors at a large, public, mid-Atlantic state university?</th>
<th>What are freshman African American male students’ perceptions of their ability to do STEM and how do these perceptions affect their achievement?</th>
<th>Does the perception of the quality of instruction in the first science course taken at a large, public, mid-Atlantic state university affect the self-efficacy beliefs of African American freshman males?</th>
</tr>
</thead>
<tbody>
<tr>
<td>Can you tell me a small bit about your background?</td>
<td>How did you select your first STEM course?</td>
<td>What are you concerned about in regards to your first STEM science course? What about the first STEM math course?</td>
<td>Are you anxious about the workload expected in the class?</td>
<td>What are your expectations from your first professor?</td>
</tr>
<tr>
<td>Can you tell me about your background in STEM coursework your junior and senior year of</td>
<td>What are you expecting when you take your first STEM course?</td>
<td>Has your choice to be a STEM major changed any of your interactions with your</td>
<td>What are your expectations for the first major assignment/assessment?</td>
<td>What’s the ideal type of classroom instruction situation that your instructors can set up?</td>
</tr>
<tr>
<td>Question</td>
<td>Answer</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>-------------------------------------------------------------------------</td>
<td>--------------------------------------------------------------------------------------------------</td>
<td></td>
<td></td>
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</tr>
<tr>
<td>How are the self-efficacy beliefs of African American freshman males majoring in a STEM field at a large, public, mid-Atlantic state university affected by their first STEM course?</td>
<td>What factors are affecting African American freshman males in STEM majors at a large, public, mid-Atlantic state university?</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>What are freshman African American male students’ perceptions of their ability to do STEM and how do these perceptions affect their achievement?</td>
<td>Does the perception of the quality of instruction in the first science course taken at a large, public, mid-Atlantic state university affect the self-efficacy beliefs of African American freshman males?</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>When and how did you decide that you wanted to major in STEM in college?</td>
<td>Do you consider yourself a good student in STEM courses? What is your outlook on your options after graduation? Do you think you’ll seek tutorial help for the coursework? If not, what would it take for you to seek assistance?</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>How were any of your immediate family involved in your decision to pursue a STEM careers?</td>
<td>How confident are you that you will pass your first STEM course? Research suggests that African Americans aren’t graduating with STEM degrees at the same rate as other demographics, what are your thoughts? How confident are you that you will be able to complete the requirements for the degree you’ve declared?</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>How confident are you that you will pass the course with a How would you address getting below a B on an assignment?</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>How are the self-efficacy beliefs of African American freshman males majoring in a STEM field at a large, public, mid-Atlantic state university affected by their first STEM course?</td>
<td>What factors are affecting African American freshman males in STEM majors at a large, public, mid-Atlantic state university?</td>
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<td>Does the perception of the quality of instruction in the first science course taken at a large, public, mid-Atlantic state university affect the self-efficacy beliefs of African American freshman males?</td>
<td></td>
</tr>
<tr>
<td>---</td>
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<td>---</td>
<td>---</td>
<td></td>
</tr>
<tr>
<td>D? C? B? A?</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Table A2
Research/Interview Questions: Sessions 2 and 3 (2 is around mid-term, 3 is pre-finals at the end of the semester)

<table>
<thead>
<tr>
<th></th>
<th>How are the self-efficacy beliefs of African American freshman males majoring in a STEM field at a large, public, mid-Atlantic state university affected by their first STEM course?</th>
<th>What factors are affecting African American freshman males in STEM majors at a large, public, mid-Atlantic state university?</th>
<th>What are freshman African American male students’ perceptions of their ability to do STEM and how do these perceptions affect their achievement?</th>
<th>Does the perception of the quality of instruction in the first science course taken at a large, public, mid-Atlantic state university affect the self-efficacy beliefs of African American freshman males?</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>How has anything changed in the expectations of your first science class?</td>
<td>Has anything changed with your desire to be a STEM major?</td>
<td>How has the coursework expectations and workload met your expectations?</td>
<td>How has your professor met/or not met your expectations for course delivery?</td>
</tr>
<tr>
<td></td>
<td>What has been your level of achievement thus far in your STEM course?</td>
<td>Could you imagine any situation changing your desire to remain a STEM major?</td>
<td>Have you felt any need to seek additional help in your coursework?</td>
<td></td>
</tr>
<tr>
<td></td>
<td>How do you feel about this level of achievement? Has it met your expectation?</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Appendix B

Math/Science Utility

INSTRUCTIONS: Using the scale below, please indicate the extent to which you agree or disagree with each of the following statements.

<table>
<thead>
<tr>
<th>Statement</th>
<th>Strongly Disagree</th>
<th>Disagree</th>
<th>Undecided</th>
<th>Agree</th>
<th>Strongly Agree</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. I'll need mathematics for my future work.</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
<tr>
<td>2. Mathematics is a worthwhile and necessary subject.</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
<tr>
<td>3. In my adult life, I will use mathematics in many ways.</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
<tr>
<td>4. I study mathematics because I know how useful it is.</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
<tr>
<td>5. Mathematics is of no relevance to my life.</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
<tr>
<td>6. I only take math courses because they are required.</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
<tr>
<td>7. Mathematics will not be important to me in my life's work.</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
<tr>
<td>8. Taking mathematics is a waste of time.</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
<tr>
<td>9. I expect to have little use for mathematics when I get out of school.</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
<tr>
<td>10. In terms of my adult life, it is not important for me to do well in mathematics.</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
<tr>
<td>11. If I do well in science courses, then I will be better prepared for the work world.</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
<tr>
<td>12. I only take science classes</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
<tr>
<td></td>
<td>Strongly Disagree</td>
<td>Disagree</td>
<td>Undecided</td>
<td>Agree</td>
<td>Strongly Agree</td>
</tr>
<tr>
<td>---</td>
<td>-------------------</td>
<td>----------</td>
<td>-----------</td>
<td>-------</td>
<td>----------------</td>
</tr>
<tr>
<td>13. Getting a degree in a math or science-related field would allow me to earn a good salary.</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
<tr>
<td>14. I would feel good about myself if I were to earn a degree in a math or science-related field.</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
<tr>
<td>15. Earning a degree in a math or science-related field would lead to the kind of job I most want.</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
<tr>
<td>16. My friends would admire me if I were to earn a degree in a math or science-related field.</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
<tr>
<td>17. My parents would be pleased if I were to earn a degree in a math or science-related field.</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
<tr>
<td>18. Getting a degree in a math or science-related field would have lots of positive pay-offs for me.</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
</tbody>
</table>
Appendix C

Academic Milestones

For each task listed below, please indicate whether or not you feel you could successfully complete it - assuming you were motivated to make your best effort. For each YES, indicate how sure you are by circling one of the numbers on the scale.

<table>
<thead>
<tr>
<th>Task</th>
<th>Could you successfully complete the task?</th>
<th>If yes, how sure are you?</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Completely Unsure</td>
<td>Completely Sure</td>
</tr>
<tr>
<td>1. Complete the math requirements for most science, agriculture, or engineering majors</td>
<td>Yes</td>
<td>No</td>
</tr>
<tr>
<td>2. Complete the chemistry requirements for most science, agriculture, or engineering majors</td>
<td>Yes</td>
<td>No</td>
</tr>
<tr>
<td>3. Complete the biological science requirements for most science, agriculture, or engineering majors</td>
<td>Yes</td>
<td>No</td>
</tr>
<tr>
<td>4. Complete the physics requirements for most science, agriculture, or engineering majors</td>
<td>Yes</td>
<td>No</td>
</tr>
<tr>
<td>Task</td>
<td>Could you successfully</td>
<td>If yes, how sure are you?</td>
</tr>
<tr>
<td>---------------------------------------------------------------------</td>
<td>------------------------</td>
<td>---------------------------</td>
</tr>
<tr>
<td>5. Complete a science, agriculture, or engineering degree</td>
<td>Yes</td>
<td>No</td>
</tr>
<tr>
<td></td>
<td></td>
<td>0 1 2 3 4 5 6 7 8 9</td>
</tr>
<tr>
<td>6. Remain in science, agriculture, or engineering major over the</td>
<td>Yes</td>
<td>No</td>
</tr>
<tr>
<td>next semester</td>
<td></td>
<td>0 1 2 3 4 5 6 7 8 9</td>
</tr>
<tr>
<td>7. Remain in science, agriculture, or engineering major over the</td>
<td>Yes</td>
<td>No</td>
</tr>
<tr>
<td>two semesters</td>
<td></td>
<td>0 1 2 3 4 5 6 7 8 9</td>
</tr>
<tr>
<td>8. Remain in science, agriculture, or engineering major over the</td>
<td>Yes</td>
<td>No</td>
</tr>
<tr>
<td>three semesters</td>
<td></td>
<td>0 1 2 3 4 5 6 7 8 9</td>
</tr>
<tr>
<td>9. Excel in science, agriculture, or engineering major over the</td>
<td>Yes</td>
<td>No</td>
</tr>
<tr>
<td>next semester</td>
<td></td>
<td>0 1 2 3 4 5 6 7 8 9</td>
</tr>
<tr>
<td>10. Excel in science, agriculture, or engineering major over the</td>
<td>Yes</td>
<td>No</td>
</tr>
<tr>
<td>next two semesters</td>
<td></td>
<td>0 1 2 3 4 5 6 7 8 9</td>
</tr>
<tr>
<td>11. Excel in science, agriculture, or engineering major over the</td>
<td>Yes</td>
<td>No</td>
</tr>
<tr>
<td>next three semesters</td>
<td></td>
<td>0 1 2 3 4 5 6 7 8 9</td>
</tr>
</tbody>
</table>
INFORMED CONSENT FORM
An exploratory study on initial science classes and African American freshman males who are STEM majors at GMU: Factors affecting self-efficacy beliefs and persistence in the STEM pipeline

RESEARCH PROCEDURES
This research is being conducted to test how well social cognitive career theory explains the effects of an introductory freshman year science course on the career perspectives of African American males at a large, mid-Atlantic state university. If you agree to participate, you will be asked to complete two survey instruments twice and be interviewed three times over the course of a semester. Interviews will be audio recorded. The initial interview will last approximately 60-90 minutes. The follow up interviews will last approximately 30-45 minutes. Filling out the survey instruments should take approximately 10 minutes. The electronic files will be maintained by the researcher and only accessed by the researcher and transcriber. At the conclusion of the data collection, transcription, and analysis, the electronic files will be deleted.

RISKS
There are no foreseeable risks for participating in this research.

BENEFITS
There are no benefits to you as a participant other than to further research in analyzing factors that affect student self-efficacy at a large, mid-Atlantic state university.

CONFIDENTIALITY
The data in this study will be confidential. Audio recordings of interviews will be held in confidence and all personal names will be replaced using pseudonyms in the transcribed documents. In the survey instruments, names and other identifiers will not be placed on the documents and a pseudonym will be assigned to match the audio transcript.

PARTICIPATION
Your participation is voluntary, and you may withdraw from the study at any time and for any reason. If you decide not to participate or if you withdraw from the study, there is no penalty or loss of benefits to which you are otherwise entitled. There are no costs to you or any other party.

CONTACT
This research is being conducted by W. Jason Calhoun; College of Education and Human Development at George Mason University. He may be reached at XXX-XXX-XXXX; wcalhoun@masonlive.gmu.edu for questions or to report a research-related problem (Dissertation Chair Gary Galluzzo; XXX-XXX-XXXX; ggalluzz@gmu.edu). You may
contact the George Mason University Office of Research Integrity & Assurance at XXX-XXX-XXXX if you have questions or comments regarding your rights as a participant in the research.

This research has been reviewed according to George Mason University procedures governing your participation in this research.

**CONSENT**

I have read this form and agree to participate in this study.

____________________________
Name

____________________________
Date of Signature

_______ I **agree** to audio-taping.

_______ I **do not agree** to audio-taping.

Version date: July 30, 2012
Appendix E

Initial Contact/Recruiting Script

During the first contact with potential participants I will go over my background and interest in the study. I will also go over the informed consent form and the details of study.

Thank you for agreeing to speak to me. My name is Jason Calhoun and I’m a graduate student at George Mason University. I am conducting a study titled “An exploratory study on initial science classes and African American freshman males who are STEM majors at Dansby State University: Relationships between self-efficacy and achievement.” This study will attempt to develop an understanding about African American male STEM majors at DSU, the impact of their first science course on their self-efficacy, and any impact on their goal setting and staying in the “STEM pipeline”. There is a growing nationwide concern on the STEM pipeline issue and African American males but there is a limited amount of research on this topic, so this is why I have selected it for my dissertation study. As a new undergraduate student I recognize your time is precious. I am looking to have a few conversations over the semester to get your thoughts regarding your first science class here at DSU. I am attempting to gain a better understanding of factors that affect achievement in the sciences. If you are interested in participating we can arrange meeting times through email or phone.
References


College Record, 108(2), 267–286.


159


Powell, L. (1990). Factors associated with the underrepresentation of African Americans


Virginia/North Carolina Alliance for Minority Participation. Charlottesville, VA:


Curriculum Vitae

William Jason Calhoun graduated from Kennett High School, Kennett Square, Pennsylvania, in 1992. He received his Bachelor of Science from Morehouse College in 1996. He received his Master of Science from Cornell University in 1999. He has been employed as a teacher and science administrator in Prince William County, Virginia for 14 years.