

## **ABSTRACT**

JOHNSON, DIANE WYNN. "I'm Not a Statistic": Identities of African American Males in Advanced Science Courses. (Under the direction of Margaret R. Blanchard).

The United States Bureau of Labor Statistics (2010) expects new industries to generate approximately 2.7 million jobs in science and technology by the year 2018, and there is concern as to whether there will be enough trained individuals to fill these positions. A tremendous resource remains untapped, African American students, especially African American males (National Science Foundation, 2009). Historically, African American males have been omitted from the so called science pipeline. Fewer African American males pursue a science discipline due, in part; to limiting factors they experience in school and at home (Ogbu, 2004). The percentage of African American high school students enrolled in advanced science courses is substantially lower than that of White and Asian students. African American males enroll at much lower rates than do females in advanced science courses. Yet, there are African American males who excel despite the obstacles they face and who stand out among their peers in scientific and other science, technology, engineering, and mathematics (STEM) careers. These individuals probably benefit from supportive and creative learning environments, various levels of motivation, peer support, teacher encouragement, and positive familial influences (Eccles, 2009; Eccles et al., 1983). Research indicates that African American students who are enrolled in advanced science courses tend to have high self-efficacy, a high level of motivation, and have familial support. To date, no study has investigated the science identities of African American males in advanced science courses.

This is a case study of African American males who are enrolled in advanced science courses at a predominantly African American (84%) urban high school. Guided by expectancy-value theory (EVT) of achievement related results (Eccles, 2009; Eccles et al., 1983), twelve African American male students in two advanced science courses were observed in their science classrooms weekly, participated in an in-depth interview, developed a presentation to share with students enrolled in a tenth grade science course, responded to an open-ended identity questionnaire, and were surveyed about their perceptions of school. Additionally, the students' teachers were interviewed, and seven of the students' parents. These research questions were assessed: 1) Who are the African American males in advanced science courses?, 2) How do African American males in advanced science courses identify with science?, 3) How do African American male students in advanced science courses describe the relative cost and value/benefits of this choice?, and 4) What social factors do African American male students perceive as influencing their academic course choices and future goals?

Case studies were compiled for each of the twelve students, based on classroom observations and interview data from them, their teacher(s) and for seven, their parents. All twelve of the students described the benefits of being in the advanced science courses (interests/enjoyment, attainment value, utility for their futures) and downplayed the costs (hard work). Seven of the twelve students strongly identified with science and intend to pursue science careers. Two of these students were concurrently enrolled in two advanced science courses. These students tended to see themselves as excited about science, having shared characteristics with scientists, and had experiences such as past camps, museum visits,

and strong interest and aptitude in science. Of these students, three of them had parents with professional science careers. Two of the students identified moderately with science, did not have parents in science fields, and may or may not major in science in college or pursue a science career. Three of the students had low or no identification with science. One student was uncertain about his goals and may enlist into the military or pursue computer engineering; the other two aspire to careers as a sports agent and a lawyer. All of the students were certain they would attend and graduate from college, and almost all had lists of specific colleges to attend.

The interview data analyses highlighted the important role of supportive parents (key socializers) who had high expectations for their sons and who pushed them academically. The students clearly attributed their enrollment in advanced science courses to their high regard for their science teachers, which included positive relationships, hands-on learning in class, and an inviting and encouraging learning environment. Additionally, other family members and coaches played important roles in these young men's lives. Although students acknowledged the difficulty of the courses, it was not a focus for the students, especially those who most identified with science. That is, students underplayed the costs of the courses (hard work, difficulty level) and highlighted the value of the courses, such as their interest in the subjects (interest/enjoyment), positive views of the teacher(s), what the course would do for them (utility value; increase GPA, help prepare them for their college major), and the importance of the course(s) to them (attainment value). Seven of the twelve males lived in a two parent household, and seven of the students had a least one professional parent.

Students' PowerPoint© presentations to younger high school students on why they

should take advanced science courses highlighted these African American males' interest, motivation, and enjoyment for science. They also focused on the personal importance they placed on doing well on a task (attainment value), or how useful the students believe the course relates to their current or future goals (utility value). The next most important theme was the impact of past experiences (science programs, good grades, past successes) and the role of key socializers, which encompassed cultural stereotypes and the beliefs and behaviors of their parents, teachers, siblings, peers, and the media. Thirdly, students focused their presentations on their abilities and future goals.

Analyses of the Twenty-Statement Questionnaire highlighted the students' expectations of success in their science courses(s) and highlighted their positive experiences with the courses(s), as well as the value of these advanced science courses for their futures. The students who strongly or moderately identified with science more often wrote statements about their expectations of success. Results of the School Perceptions Questionnaire indicated that students were most likely to positively identify with academics. Students' level of identification (strong, moderate, weak/no) with science was not linked to the results of this survey, but rather was linked to the academic strength of the individuals (range: 3.5-5.0, mean 4.3). Similarly, students' results on the subscales for valuing school (range: 2.7-5.0, mean 3.8) and a sense of belonging (range 2.8-4.6, mean 3.8) was not linked to students' level of identification with science.

Of the nine students who were either strongly or moderately identified with science, only three of the students had a parent in a science field. Therefore, with these students, it was not necessary to have a parent in science in order to have strong identification with

science. Seven of the twelve (58%) students had at least one parent who attended college; eight of the twelve (67%) lived with both parents. However, it was not essential to have a college educated parent in order to enroll in advanced science courses, or aspire to a science career. Students who strongly identified with science, enjoyed science experiences outside of school and the in class science activities, and identified their positive characteristics (e.g. inquisitive, imaginative, knowledgeable) as similar to those of scientists. Students with low or no identification with science also enjoyed the courses, particularly as a result of the excellent relationships with the teacher(s). They saw themselves as successful students, but they did not see themselves in science or as sharing the characteristics of scientists.

Students who strongly or moderately identified with science were more likely to stress the value of the advanced science course(s), in terms of enjoyment, utility for their futures, and personal importance, and to downplay the work involved. Students who had low or no identification with science were more likely to stress the social enjoyment of the course they were enrolled in, relating to the other students, the fun activities, the teacher, and more likely to address the difficulty of the course. However, all of the students stressed the value of the course for their future as college students.

Regardless of the level of identification with science, students were effusive in their respect for and praise of their science teacher(s) and the role he and/or she played in their interest in the subject matter, providing interesting and engaging work in class. The teacher as a role model, especially the Black male teacher, was critical to the learning of science for these students. Parents of all of these African American males conveyed the importance of academic achievement, and participated in school events as well as monitored their students'

activities outside of school. All of the parents of the students in this study were supportive of their sons and had high expectations for academic success, regardless of whether they had attended college or completed a degree. In contrast to the literature on African American males, these students had a sense of academic excellence, high self-esteem, and their families and science teachers had high academic expectations for them. Rather than focus on negative stereotypes, the males in this current research work acknowledged and chose to work against these stereotypes, excelling in school with future plans to pursue college degrees, and for most, science careers. The majority of the students in this study were from two parent professional homes, were well dressed, and they did not describe lacking any of the necessities for school. Factors of the expectancy-value theory of achievement related choices; (Eccles, 2009; Eccles et al., 1983) was applied as a qualitative tool to understand these African American males in advanced science courses. The EVT, proved a useful tool in illuminating key motivational factors of the students' for enrollment in the advanced science courses, and highlighted their relative levels of identification with science.

This study addresses a group often missing from the literature: successful African American male high school students. The study highlights the critical role of knowledgeable, well prepared teachers who connected with students and provided high quality, stimulating science experiences and role models, especially the Black male science teacher. Additionally, the high expectations and involvement of parents was key to driving the success of these males, as well as their socially-fueled desire not to become "a statistic." Ever mindful of their role as successful Black males, these students were achieving for more than themselves, but as role models for Black males in society. This was a major factor underlying their

motivation to succeed, and seemed to trump the hard work involved in the challenging academic choices they made. These Black males were beating the stereotypes by being well dressed, successful scholar athletes.

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“I am Not a Statistic”: Identities of African American Males in Advanced Science Courses

by  
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## **DEDICATION**

This dissertation has been completed in honor of my parents.

Their memories will live on forever.

## **BIOGRAPHY**

Diane W. Johnson was born and reared in a rural community in northeastern North Carolina. While in high school, she was inspired to pursue her studies in science, eventually majoring in Biology in college. After obtaining her Bachelor's and Master's degree in Biology from North Carolina Central University, she began her teaching career at a high school in Northampton County. Diane taught Biology and Chemistry there for three years before moving to Durham, North Carolina.

Diane has been a secondary science teacher for twenty-eight years and spent twenty-four of those years teaching chemistry, and the last four years as an instructional facilitator, working primarily with classroom teachers. During each summer of her career, she was involved in a summer science research program either being a participant or providing the instruction to others. She has coordinated science summer programs, advised science clubs, and led Saturday academies, all in science.

Having a passion for sharing her science knowledge with others, she chose to return to school and pursue her Doctorate in science education.

## **ACKNOWLEDGMENTS**

I would like to thank my family and colleagues who have stood with me and provided their support throughout the writing of this dissertation.

I must thank Dr. Margaret Blanchard, my committee chair, for her support and guidance throughout this process. The countless meetings and hours of work have been priceless; without her none of this would have been possible. I must also thank my committee members; Dr. Miriam Ferzli, Dr. Sarah Carrier, Dr. DeLeon Gray, and Dr. Eric Wiebe for the guidance and support they all have given to me. Knowing that I could count on them for ideas and feedback were incentives to complete what seemed like an insurmountable task. I am inspired by you.

Finally, I must express my gratitude to my children, for their encouragement, inspiration, support and love.

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## **CHAPTER ONE**

### **INTRODUCTION**

The United States Bureau of Labor Statistics (2010) expects new industries to generate approximately 2.7 million jobs in science and technology by the year 2018, and there is concern as to whether there will be enough trained individuals to fill these positions. A tremendous untapped resource remains untapped, African American students, especially African American males (National Science Foundation, 2009). Historically, African American males have been omitted from the so called science pipeline. Fewer African American males pursue a science discipline due, in part; to limiting factors they experience in school and at home (Ogbu, 2004). Yet, there are African American males who excel despite the obstacles they face and who stand out among their peers in scientific and other science, technology, engineering, and mathematics (STEM) careers. These individuals probably benefit from supportive and creative learning environments, various levels of motivation, peer support, teacher encouragement and positive familial influences (Eccles, 2009; Eccles (Parsons), J., Adler, T.F., Futterman, R., Goff, S.B., Kaczala, C.M., Meece, J.L., et al., 1983).

The educational status of African American males in the United States (US) has historically been characterized by low academic achievement, a sense of academic inferiority to their peers, low self-esteem, and low teacher expectations (Ogbu, 2004; Archer-Banks & Behar-Horenstein, 2012). Rascoe and Atwater (2005) reported how little attention has been

given to the sociocultural context of these learners regarding how their learning is shaped in the teaching of science. Toldson and Lewis (2012) and Toldson (2008) reported that African American males are often enrolled in low-level academic courses with sub-par instruction, thus lacking the opportunity to participate in engaging science coursework. In the face of these obstacles, some African American males successfully ‘beat the odds’ and enter into the science pipeline that can eventually lead to prosperous STEM related careers (Toldson & Lewis, 2012; Maton & Hrabowski III, 2004).

To be successful in science courses, students must be capable of understanding scientific knowledge, identifying important scientific questions, drawing conclusions based on evidence, and making decisions as to how the natural world is affected by human activity (NSF, 2012). The learning environment can be instrumental in activating the student’s desire to learn and increasing his motivation and interest, potentially bolstering the number of African American male students aspiring to become the scientists, engineers, technologists, and mathematicians of the future (Organization for Economic Cooperation and Development (OECD), 2007). According to the OECD, a creative learning environment is essential for student and teacher academic engagement.

Factors such as supportive parents, peers, teachers, counselors and environments contribute to the success of students in scientific fields, and have been examined in the education literature. Bryan, Glynn, & Kittleson (2011) studied 288 suburban high school students (80.2% White and 6.8% African American) enrolled in high school biology (freshmen) and physical science (sophomores). These students responded to a questionnaire

on intrinsic motivation, self-efficacy, and self-determination. They also participated in interviews and wrote essays on motivation. The authors found relationships between students' intrinsic motivation, self-efficacy, self-determination, and achievement: consistent with the social cognitive theory, motivation was most related to achievement. The students' essays identified career interests, inspiring teachers, and collaborative-learning activities as strong motivating factors for their success. Student motivation in studying science in advanced high school classes is a related, yet understudied, issue (Eccles, 2009; Eccles et al., 1983; Palmer, Davis, & Hilton, 2009). Given that these high school science courses have been identified as gateways, for some students, to scientific careers (Updegraff, Eccles, Barber, & O'Brien, 2001; Aschbacher, Li, & Roth, 2010; Toldston & Lewis, 2012), learning more about these students' motivation to enroll is vital.

Researchers, policymakers, and national leaders have expressed the importance of the United States increasing its production of skilled workers in STEM fields to be competitive in the global marketplace (Palmer, Maramba, & Dancy, 2011a). According to the National Science Foundation (NSF, 2010) undergraduate degree attainment has decreased among United States students in physical science, engineering, mathematics, and computer science. The NSF asserts that students of color continue to experience problems accessing higher education and persisting to graduation, especially in STEM fields, and that the United States must focus on increasing under-represented groups in pursuit of STEM degrees. Although some progress was made between 1995 and 2007 (the proportion of science and engineering degrees awarded to African Americans increased from 6% to 8%), these increases still are

disproportionate to the number of African Americans in society (about 13.2%) (US Census Bureau, 2014).

Additionally, research findings on African American students' strengths in high school suggest that successful students have strong interest, are motivated, goal-oriented, and experience positive influences on their academic performance (Gibbons, 2011; Palmer et al., 2011). High performance directly influences the students' relationships with their peers as well as the community (Stewart, 2007; 2008). Identifying these factors for African American youth could serve to assist educational stakeholders, teachers, school administrators, and parents to better understand promoting resilience among these students and sustaining their social identity through achievement (Whiting, 2009).

Researchers, policymakers, educators, and parents have highlighted the disproportionate underachievement of African American males (Joe & Davis, 2008; Mickelson & Greene, 2006). This negative press is linked to future decreased social and educational opportunities for African American males. Research suggests that the differences in academic achievement among students are significantly influenced by the parents' level of education, ethnicity, poverty status, and the student's environment (Joe & Davis, 2008). Joe and Davis stressed the influence of family characteristics on a student's academic outcome and highlighted the role the parent plays, especially for African American males, and Brooks-Gunn and Markman (2005) highlighted the roles parents play in preparing their children for success in school.

During high school, some students choose not to take advanced science and mathematics courses, which directly affects their paths towards careers in STEM fields. Only 56% of US students take Chemistry, 29% take Physics, and 12% take Calculus (National Science Board, 2006). High school course choices have significant implications for academic and career choice (Simpkins, Davis-Kean, & Eccles, 2006) and it is essential to use potential resources to motivate students to enroll in courses that will help prepare them for futures in STEM related careers (Harackiewicz, Rozek, Hullerman, & Hyde, 2012). Parents can also play a critical role in motivating students in their preparation and aspiration for STEM careers, although they may lack the necessary skills to do so (Hill & Tyson, 2009).

This study builds off of pilot work conducted with African American students at an urban high school (Johnson, 2013). In her study, Johnson found high levels of self-efficacy among honors students, but it was student interviews that highlighted more important factors, such as the students' experiences in the classroom and their engagement in school. Johnson's focus group interviews with African American students highlighted the social nature of academics, and how taking an advanced course is often a decision to *not* have friends in the class.

### *Science identity*

Identity is a model of practice theory that sees learning as taking place through students' daily social interactions within "communities of practice," such as those occurring at school, home, and the larger world (Aschbacher, et al., 2010). Exploration of students' identities allows for a greater understanding of the world of science as perceived by students,

explains how an individual participates in the world, and how that participation is viewed by others (Brickhouse, Lowery & Shultz, 2000; Brickhouse & Potter, 2001).

Carlone and Johnson (2007) focused on science identity as an interface between competence, performance, and recognition in science. By working with undergraduate females, they characterized a student with a strong science identity as an individual who understands the nature of science, has strong beliefs in what they are capable of, is capable of participating in the social norms of science, knows what they want to do with regards to science, and is capable of using the tools of science. Carlone and Johnson also emphasized the significance of how female students view themselves and believe others view them as they participate in scientific endeavors.

Carlone and Johnson (2007) state that nurturing a students' short-term knowledge and interest are not enough to develop a continued interest in science; there needs to be further examination beyond achievement and interest in an attempt to understand why some students persist in science while others opt out of the field. There needs to be a better understanding of how students develop science identities (Aschbacher, et al., 2010).

Researchers recommended examining students' science identities and the meanings they make of science by identifying what engages them and how this relates to who they think they are in regards to science. Science is a social construct shaped by human endeavor and prone to the biases of human activity (Brickhouse, et al., 2000). Science identity involves how one sees oneself in relation to this culturally based and biased science, which is generally accepted and reproduced in schools and society (Barton & Yang, 2000; Barton,

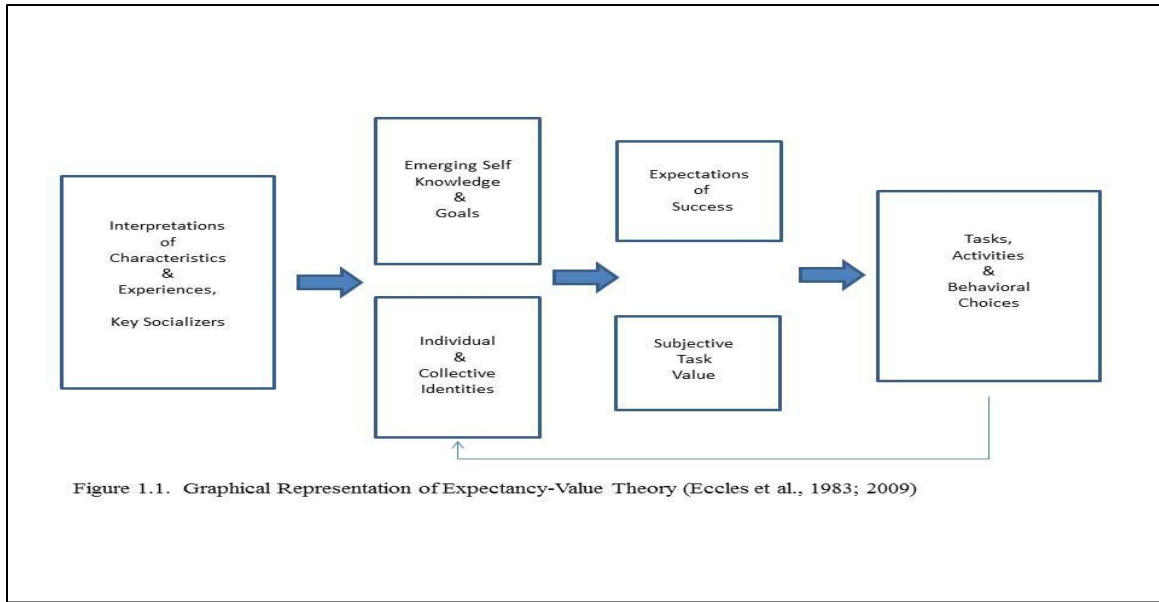
2001). According to Witz (2000), when students can make connections between science and their daily lives, they can make meaning of science, thus allowing them to better understand who they are and who they want to be in relation to science. There needs to be discourse among students that allow connections to be made between the relevancy of science and potential personal benefits for students (Kozoll & Osborne, 2004). Because learning is shaped by environmental influences on individuals, these socio-cultural perspectives are lenses through which individuals have been analyzed by others, including those under-represented in science (Brown, Reveles & Kelly, 2005; Carlone & Johnson, 2007; Gilbert & Yerrick, 2001; Tonso, 2006). Centering on science identities allows considerations of how science participation and aspirations can support or impede students and are influenced by students' gender, ethnicity, and economic background (Aschbacher, et al., 2010; Carlone & Johnson, 2007; Carlone, Cook, Wong, Sandoval, Barton, Tan, & Brickhouse, 2008).

Science identities of urban minority students have been scrutinized in a number of studies (Furman & Barton, 2006; Barton, 2001). Gender, ethnicity, and socio-economic status (SES) have been examined to understand the role they play in students' science identity development (Brickhouse, et al., 2000; Carlone & Johnson, 2007). It is likely that a student's science identity changes and evolves over time (Aschbacher et al., 2010). Russell and Atwater (2009; 2005) found that under-represented groups can be marginalized in the science classroom, often feeling inferior to their teachers and White students because of their gender, ethnicity and social class. Other studies found that non-White students feel they have to change their social identities in order to succeed in science, often at the cost of being

berated by their own peer groups (Fordham, 1997; Seiler, 2001; Ogbu, 2004; Elmensky & Selier, 2007).

### **Theoretical Framework**

The *expectancy-value theory of achievement related choices* (Eccles, 2009; Eccles et al., 1983) describes the links made between students' educational choices, their individual expectations for success, and the values these individuals attach to these options they perceive as attainable (see Figure 1.1). This model emphasizes the role of "socializers," such as peers, teachers, and parents, in shaping how students access, interpret, and evaluate their lived experiences, which influence their long and short term goals, attitudes, priorities, and values. During these daily social interactions with their peers, teachers and counselors, parents and extended family members, beliefs about the meaning of science, its values, and the capability of students in engaging in science are conveyed to students. Students are influenced by these social interactions and judge the viability of their science identities and aspirations to that of others; their self-efficacy is also affected by their pursuit of their goals (Eccles, 2009; Eccles et al., 1983; Wigfield & Eccles, 2000), and the degree to which they are successful influences in their science identities.



### Research Questions

This study will provide rich interview data from African American high school male students in a predominately minority high school (84% African American), their parents and their teachers. By focusing on African American males who are enrolled in advanced science courses, this study strives to make sense of these students’ science identities, and the factors that are most important in developing these identities. Students were asked to identify the most essential factors that influenced their enrollment in advanced level high school science courses and examining how they navigate through their science courses.

Therefore, the research questions addressed in this study are:

1. Who are the African American males in advanced science courses?
2. How do African American males in advanced science courses identify with science?

3. How do African American male students in advanced science courses describe the relative cost and value/benefits of their choices?
4. What social factors do African American students perceive as influencing their academic course choices and future goals?

### Summary

In Chapter One, I highlighted the need for STEM candidates from a largely untapped source; African American males. If the United States is to remain competitive with other countries and meet the future demand for STEM career professionals, potential prospects must be sought to fill these positions. To encourage these potential individuals, educators must serve as and find additional role models who can inspire these students to pursue STEM related fields in college by adequately preparing them while in high school. The expectancy-value theory of achievement related choice (Eccles 2009; Eccles et al., 1983) is a theory that has been employed to gain an understanding of the role of social factors, identity, and subjective task values on African American male students' selection of advanced science courses. To date, little information is known about the science identities of African American high school males who are enrolled in advanced level science classes.

Chapter Two is a literature review that highlights the need for STEM professionals and explores the issue of African American males in the workforce. Research findings on science students' identities and forming science connections to students' lives are explored. This chapter also includes relevant studies that have utilized the science identity theory and the expectancy-value theory of achievement related choices.

In Chapter Three, the methodology is described. Details on the research methods used with the high school science students, teachers, and parents are provided as well as a description of the data collected and the analyses undertaken for this case study. Chapter Four describes the findings of the study and Chapter Five is a discussion of the findings of this study. Chapter Six describes the Conclusion, implications, and significance of the study.

## **CHAPTER TWO**

### **LITERATURE REVIEW**

#### *Student success*

African American males are disproportionately represented in the pursuit of undergraduate degrees in science, and in attainment of science and technology careers. Males earn about 50% of the science undergraduate degrees awarded in the United States. The workforce in science and engineering is 75% male, yet African American males are still an under-represented group in the sciences (NSF, 2009).

College students' success in the sciences often results from students' prior success in science courses taken in high school (The College Board, 2010). High School students can enroll in Advanced Placement (AP) science courses that allow them to study science in courses that are more rigorous than the standard high school course offerings. The College Board administers the program and specifically prepares the high school teachers to implement the courses. Students can earn college credit while still in high school if they score well on the AP exams that are administered nationally. Doing well usually means scoring at least a level 3 out of a possible 5 on these exams. Although each college or university has its own policy in terms of credit awarded for such scores, students can earn college credits while in high school. In addition, according to the College Board, students who do well on the AP exams have better college admission rates, high eligibility for scholarships, and higher graduation rates. During the years from 2005-2010, the College Board reported there was a nearly 50% increase of the number of students taking AP courses,

up to 1.6 million, a sign that students have higher aspirations to earn college credit while still in high school. Concerns about the gender gap in science achievement, science course enrollment, and careers in science have been pervasive in the science education literature and varies by the area of science and level of educational and career attainment examined (Britner, 2008). While women dominate in Biology at the bachelor's and master's level, at the doctoral level males are in the majority. This is not the case for African American males.

#### *Course enrollment decisions*

Among the most influential self-regulatory behaviors students exercise in school are course enrollment decisions (Updegraff et al., 2001). These decisions have a direct effect on the opportunities that students have in learning new material. The failure of students to enroll in advanced science courses limits their eligibility for undergraduate majors in the university system. According to a study of female high school graduates in California, high school math courses are the critical filter courses that keep females out of math-related college majors and occupations (Chipman, Brush, & Wilson, 1985). A recent report by the NSF (2012) shows low levels of math proficiency at all grade levels in the US. The course enrollment decisions made by both male and female students to only take the minimal number of high school math courses, contributes significantly to the NSF's concern about the preparation of high school students as potential college science majors.

Robinson and Ocho (2008) surveyed 405 high school students to gain some insight into their decision to enroll in high school science courses. This study focused on teacher pedagogy and who influences the students' science class choice. The study also explored

how students could be motivated to continue science beyond the required ones for high school graduation and how to influence them to consider STEM majors in higher education.

The researchers found that students specifically requested more labs and hands-on activities to provide relevancy and potentially stimulate an increased interest in science for the students. The researchers surmised that science courses needed to be taught differently and that students needed good reasons for taking advanced science classes beyond the minimal science requirements.

Over 1700 rural, suburban and urban high school students participated in a survey soliciting factors that had the greatest influence on their decisions to enroll in physics and chemistry courses (Dalgerty & Coll, 2006a). The emerging factors were those of having college plans, intended college majors, enjoyment of science courses, college entrance requirements, and career goals. In a related study of 84 first year chemistry college students, the researchers found that learning experiences, attitudes toward chemistry, chemistry self-efficacy, prior high school science experiences, and chemistry as a program prerequisite all influenced a students' enrollment in future science courses (Dalgerty & Coll, 2006b).

The decision to enroll in an accelerated science program or major in education, rather than in law or engineering, are made within the context of a complex social reality that presents students with a wide variety of choices, each with immediate and long range consequences (Updegraff et al., 2001). These course choices are typically made in the context of other important decisions, such as deciding to take advanced English, whether to take a course with one's best friend, or not (Moore & Slate, 2008). The work of Eccles

(2009) and Updegraff et al., (2001) focuses on understanding the psychological meanings of the paths followed to understand both the men's and women's achievement-related choices.

Students' course decisions are often complex; deciding if the time required to take a course is too costly or whether they follow the advice they receive at home or from their school counselors (if they receive any advice). If the focus is on taking the math course selection, then its subjective value to the student increases (Eccles, 2009). If the subjective worth outweighs its subjective cost, then it is likely a student will take the course despite the cost in time and effort (Eccles, 2009; Wigfield & Eccles, 2000).

Course enrollment differences in fields and levels are evident at the high school level. From 1982 to 2000, females took more Biology and Chemistry courses than males, but males took more Physics, Engineering, and Earth Science classes. In 2003, females were taking more AP exams in Biology and Environmental Science than males (NCES, 2003).

Findings from the 1996 Advanced Science Study, which examined course taking and science knowledge and skills among students taking the NAEP (National Assessment of Educational Progress) exams, indicated gender differences among high school students taking advanced level science courses. There were over 2400 12<sup>th</sup> grade students in advanced science courses included in this study. The males did not take as much Chemistry as females in the general population, but among the advanced students more males (18%) reported taking more Chemistry courses than females (14%). Enrollment in Physics was lower overall, with males reporting 66% compared to females (34%). Physics appeared to be

a critical course; students who took Physics outperformed their peers who did not take Physics (NCES, 2001).

Although progress has been made in science, under-represented groups represent potential reserves of scientific talent. Adelman's (2006) in-depth analysis of the variables influencing college completion cites the intensity of the high school curriculum as being significant in predicting college completion. Researchers such as Adelman (2006), and Tyson, Lee, Borman, & Hanson (2007) have concluded that the more rigorous high school programs were significant in the students' attainment of college degrees. However, Tyson et al. (2007) found that females complete more advanced coursework than males, but not at the highest level (e.g. Physics), and significantly fewer Black and Hispanic students complete more advanced levels of coursework than their White and Asian peers. Tyson et al. (2007) stated that males' Physics enrollment in high school was positively associated with students choosing to major in college science. According to Maltese & Tai (2011), students taking advanced level mathematics and science courses in high school were more likely to earn STEM degrees; and the students who are interested in STEM and STEM careers are more likely to enroll in science courses based on their interest. This suggests that interest in science leads to course enrollment, which is then more likely to lead to a STEM major or career. Interest in science/STEM, therefore, is an important factor in the selection of science courses.

### *STEM success among African American males*

African American students have indicated their academic success in school is attributed to the two sources of strength they received, from both their parents and counselors (Gushue & Whitson, 2006). The parental support students received is positively related to their career decisions choices. While these career choices can vary, both the school's social class and school interactions can affect the diversity of students' course selection in the schools (Russell & Atwater, 2005; Spade, Columba, & Vanfossen, 1997). In the schools studied by Witherspoon, Speight and Thomas (1997), there was a broader selection of higher level courses offered in the higher social class districts than those in working class districts, which offered more courses at the basic level. Findings from Dalgerty & Coll (2006b) on 84 college chemistry students showed that students who have family friends or relatives in a science related field are more likely to enroll in a second-year college chemistry course.

### *Teacher support*

Teacher support was also cited as an influential factor to the African American males' student success. In their study of 104 African American ninth-grade students, it was reported that teachers support was positively related to their career decisions and career outcome expectations (Gushue & Whitson, 2006). Teachers and counselors provide more support and encouragement for high school males encouraging them to enroll in additional math courses. In contrast, females have been allowed to select themselves out of math, especially after their 11<sup>th</sup> grade year in high school, or midway through their 12<sup>th</sup> grade year, while males continued in math courses (Witherspoon et al., 1997).

Counselors meet with students, send course selection forms home to parents to indicate their approval, and hold orientation meetings to direct their selection of the courses (Butler, 2002). However, among the schools studied by Spade et al. (1997), it was the degree to which these decisions were relegated to parents, the roles the guidance counselors and teachers played, and their reliance on test and objective indicators in guiding student placements. In the more affluent schools, the teachers, guidance counselors, and parents play a more active and systemic role in placing students in courses when compared to those in working class schools. Research by Gushue & Whitson (2006) has shown that teacher support is positively related to career decision self-efficacy and the careers the students consider, which confirms the importance of these contextual supports.

Gayes (2005) has criticized the plethora of research to explain the educational failure of African American males, rather than exploring their successes. Many African American males are successful, in spite of the coping tactics they must use that are required for life in high risk environments. There are African American males who ‘beat the odds’ (Hrabowski, Maton, & Greif, 1998; Maton & Hrabowski, 2000) and overcome the barriers of economic disenfranchisement and social ostracism to flourish academically. These students recognize structural constraints and refuse to allow these barriers to impede their social mobility. Individual determination, hard work, effort, and support are key factors for high achieving African American males in their quest in overcoming obstacles to become successful (Young, 2009).

### *Student success in general*

The effect of course taking on student learning is affected by variables such as the content of the course and the quality of instruction (Wiggan, 2008). When students view the content of the science course as too challenging or overwhelming, it can lead to a weak level of student achievement in science and mathematics due to course fear. The same is true if the students experience an inadequately trained or overworked teacher for the course (Long, Monoi, Harper, Knoblauch, & Murphy, 2007).

There is also supporting evidence suggesting that the number of years of schooling has a significant impact on student achievement (Aschbacher, et al., 2010). Students from high socio-economic families or more affluent families may experience more schooling, leading to greater achievement because of increased opportunities when compared to their peers from less affluent families and influenced by their socio-economic status. The student's backgrounds may affect their achievement in school by influencing decisions in which courses to take, such as whether to enroll in an AP science course. When African American males are encouraged and supported by their teachers and their families, they can excel despite the societal influences and school forces that can stand as impediments (Wright, 2009; Marsh, Chaney, & Jones, 2012).

Other positive relationships were found by Ozgen & Bindak (2011) between the amount of schooling students received in science and mathematics and their academic achievement as measured during their last three years of high school. The more time students spent enrolled in science and mathematics, the higher the achievement in those

subjects. These findings were consistent across gender, ethnic groups, and academic subject areas.

*Factors that predict African American male student failure*

Researchers assume there are deficiencies in the lives of African American students that include low family income, parental educational level, quality of schools, peer influence (Lewis & Connell, 2005) and a lack of motivation (Long et al., 2007). Lewis and Connell surveyed a sample of college students to gather data on these factors and found these deficiencies did have an effect on students' course taking in high school, which also affects their future career decisions. Findings by Watt, Eccles, & Durik (2006) found that a high school student's enrollment in advanced mathematics is one of the best indicators of pursuing a career in science. Similarly, the college science majors surveyed reported taking more high school science and mathematics courses than non-science majors, indicating a positive correlation between the number of high school science and math courses taken and the students' field of study. Lewis and Connell concluded that the college students' career consideration is caused in part by the courses taken in high school.

For many African American males, academic achievement is not a priority; therefore, it is no surprise that "one in five" African American students drop out of high school (Young, 2009). Concentrating on athletics is more important to some than earning good grades in the classroom; these young men will do 'whatever it takes', such as playing sports, to be part of the 'in' crowd and be considered 'cool' (Thompson & Lewis, 2005).

Insinger (2004) notes that knowledge of the “code of the street” is important in projecting manhood and commanding respect - both of which are essential for negotiating the potential threatening environment of the street. To avoid possible ridicule, harassment, and potential physical harm, young African American males must know and abide by the street code (Carter, 2003). To earn peer respect and prevent challenges from others, African American males must adopt a façade of toughness and lack of fear. In many instances, an academic orientation or academic excellence is not the goal. It is more acceptable among urban high school students to see African American females achieve academically than it is to see African American males experience the same (Young, 2009).

In a study of African American middle school males, nearly one third of these males respected and admired high achieving socially compliant females but they felt that academically low achieving socially deviant males were most admired, respected, and emulated (Young, 2009). These African American males often spent more time developing their physical attributes with the hopes and dreams of obtaining a college basketball scholarship, being drafted by the NBA, signing a multi-million dollar contract, and having a multi-million dollar basketball shoe contract.

Usually in many resource poor, all African American urban high schools, the more “gangsta” a male acts, the “cooler” he is considered among his peers and placed on a social pedestal. This was the sentiment supported by a high achieving African American young man from an East Baltimore high school (Thompson & Lewis, 2005).

Many African American males living in major urban areas in the United States face numerous social and economic barriers. There is very little support or encouragement among their peers to pursue career goals and acquire an extensive college or university education. Instead, drug activity, violence, and crime provide African American males personal experience with all the things they do not want to be in their lives (Thompson & Lewis, 2005). Many of these students attend schools that reflect the dominant, White-middle class culture and values, and the values held by African Americans are not valued in their schools, lending these students to an educational disadvantage (Young, 2009).

The families of African American males do not enroll them in gifted and talented programs, which limit these students' preparation for advanced academic and college preparatory work (Klopfenstein & Thomas, 2009). Combined with peer pressure not to achieve, these are possible explanations as to why so few African American males are in honors or advanced placement courses (Kyburg, Hertberg-Davis, & Callahan, 2007).

African American males took only 5.2% of all AP examinations administered in the US (Cross, 2006). Only 7% of African Americans took the AP English literature test, the most frequently taken exam of the 35 AP exams, and their scores were considerably lower than those of their White class-mates. The national mean AP score for Whites was 2.98 and the mean AP score for African American students was 1.99. Only 28% of African Americans score a 3 or above on the AP exam compared to 63% of White students who took the exam in 2005 (College Board, 2012).

### *Factors that cause student failure*

Student failure or poor performance in school can be attributed to a lack of quality instruction (Wiggan, 2008) and curriculum alignment. A students' background may have an effect on their achievement in school, and those with a low socio-economic status (SES) may not have access to the richer experiences of those who are from more affluent families.

Students cited several reasons for not enrolling in advanced science courses; a greater interest in other subjects, the belief that these courses were not important to their future career goals, and the fear of course failure due to course difficulty (Updegraff et al., 2001). These factors were not influenced by gender, type of community (rural, urban, or suburban) or the content of the course curriculum (Dalgerty & Coll, 2006a).

Student's friends also influence their academic motivation, though sometimes negatively; failure is an option so as not to appear as "acting White" (Ogbu, 2004). The selection of a course is influenced by other student concerns, such as if a student likes the subject material, whether or not the course is required, and whether or not the course meets one of the individual's long or short-term goals. If a student's history of prior performances in science courses was negative, including the grades they earned in those courses, then, the student is influenced by their past experiences, gender role beliefs, and the behaviors and goals of one's socializers, peers, and personal choices (Spade et al., 1997; Roth, 2006).

The failure to enroll in advanced science courses because of course fear often results in missed opportunities for these students (Cunningham, Corprew, & Becker, 2009). They could have had prior bad experiences in science classes, inadequately prepared science

teachers, and a lack of role models. These students experience gender and racial stereotyping in the popular media as well as the stereotyping of scientists (Udo, Ramsey, & Mallow, 2004). A low math self-efficacy has also been connected to students' avoidance of science classes, especially those with any mathematically related coursework requirements, such as Chemistry or Physics. This fear of course failure may help to explain the underrepresentation of African American males in science classes and science based careers (Cunningham et al., 2009).

### *Theoretical framework connections to STEM African American students' success*

#### *Science Identity*

Learning science has typically been viewed as a process of acquiring an understanding of science and applying these understandings in new situations (Brickhouse, Lowery, & Shultz, 2000). Students are always engaged in activities that lead to learning. To understand learning in science, one needs to know how students are engaging in science and how it is related to who they think they are in the community of practice in which they participate (Brickhouse & Potter, 2001). For example, is he a good student, (a basketball player, or a gossip) and who does he want to be (e.g. a teacher, gemologist, or scientist). Students learn new communities as they transform their identities, acquiring the requisite knowledge and skills for being a part of the new community learned. When students learn science, they develop identities compatible with scientific identities.

Brickhouse and Potter (2001) define science identity as the sense of who students are, what they want to do, and what they believe they are capable of in regards to science.

Science identity is informed by a students' lived experience and social interactions in school, at home, and in the world at large. This identity is based on how students view themselves and how they are viewed by others as they participate in scientific activities (Aschbacher et al., 2010; Carlone & Johnson, 2007). Because students can participate in multiple social communities, they must negotiate their identities back and forth following the rules and values determined by these different communities (Furman & Barton, 2006).

The concept of identity is used to understand the student's point of view on studying science. Identity is informed by situated learning, a model of practice theory that views learning as occurring through daily social interactions within "communities of practice", such as those found at school or home (Aschbacher et al., 2010). Students can belong to many different communities of practice, those in which they have both formal and informal opportunities to learn the common language, rituals, and stories valued within each of these communities (Charney, 2007). The social nature of learning and knowing is developed through meaningful student engagement, and practice within their social communities. As knowledge, competency and meaning are developed from these social interactions, students begin constructing their identities, or who they are in relation to their communities or even who they wish to be (Aschbacher et al., 2010; Carlone & Johnson, 2007).

The definition of identity used for this study most closely aligns with the science identity described by Brickhouse and Potter (2001), which focuses on who the students think they are in relation to science, their science related goals, and their capabilities with regards to science. All of these are informed by their school activities (e.g. band, sports, clubs) and

their social interactions in science class and in conversations with their parents and with their mentors (e.g. coaches, older siblings).

Students can have multiple social identities and must decide which groups they identify with. Although the process of identity development is an individual one, the process is socially situated, and gives rise to meanings that are part of the social world. These science classes are places where students can engage in a large variety of activities that may be crucial in understanding how students are constructing an identity relative to school science (Brickhouse & Potter, 2001). Students formulate identities based on the groups with which they identify. Slovacek, Whittinghill, Flenouny, & Wiseman (2012) examined the beliefs about the rewards of success among African American high school males, concluding that it was difficult for these students to join peer groups that encouraged academic excellence. Witherspoon, Speight, and Thomas (1997) concluded that African American high school students who desire to excel academically are faced with isolation and cut off from their peers and other social networks that exist in high school.

Many African American males find their identities, pride, and self-efficacy in a number of domains-sports, music, and acting (Young, 2009). Some Black males see themselves as capable and talented in school settings. A scholar identity is one in which Black males perceive themselves as academicians, studious, intelligent and talented in school settings (Whiting, 2006). Self-efficacy is the foundation for scholar identity which helps Black males to be resilient and persistent when facing barriers and challenges, and is critical in how a student performs in school. Leading scholars on gifted Black students contend this

attribute of resilience is a noticeable trait of high achieving Black males (Grantham, 2004).

When self-efficacy is high, Black males share the characteristics of high resilience, high self-confidence, strong self-control and a clear understanding of the tasks they face and the belief that they can accomplish all the subtasks associated with their goals (Whiting, 2009). Black males believe they are strong students, and elect to reject stereotypes imposed on them because they view themselves as talented and intelligent. These students with these efficacious attitudes are more willing to seek out academic challenges such as taking advanced science courses, as discovered by Whiting.

Motivation is defined as an internal state that directs, arouses, and sustains science-learning behavior (Bryan et al., 2011). Motivated students achieve academically by engaging in behaviors such as studying, asking questions, seeking advice, and participating in classes, labs, and study groups (Schunk, 2003). Students who are motivated to learn science and engage in science-learning behaviors pursue goals such as good science grades and science-related careers. These motivated behaviors were evident in a case study of Black males by Whiting (2009) of students with a strong scholar identity. According to Sanfeliz and Stalzer (2003), motivated students enjoy learning science, believe in their ability to learn, and take responsibility for their learning. The motivation to learn science is a multi-component construct, and is conceptualized as such in the social cognitive theory (Bryan et al., 2011).

#### *Expectancy-value theory*

The expectancy-value theory is a possible framework through which to try to understand why African American males choose to participate in advanced level science

classes. Research by Eccles (2009) showed that teachers' expectations of students do influence students' behavior and outcomes. The influence of self-expectancy also affects student motivation (Pajares, 2003), and academic choices (Feather, 1988).

An individual's choices are based primarily on his or her expectancies and value of participation outcomes (Wigfield & Eccles, 2000). Ford (1996) suggests that gifted Black students' perceptions related to social influences (those to include peers, teachers, academic courses and curriculum, and school environment) impact their course-related decisions. The more positive students' perceptions, the more motivated they were to achieve. These are all related to the constructs of participation competence expectancy, participation outcome attainment expectancy, and value of participation outcomes. In participation competence expectancy, it is a student's belief that he is able to perform at a desired level as a gifted program participant. That is, the more likely a student believes that he has the ability to perform at the expected level, the more likely he will chose to participate (Grantham, 2004).

A student's belief that effort will lead to benefits or consequences is a result of participation, such as participation in a gifted program. This expectancy results from the interaction between a combination of beliefs regarding the outcomes of program participation and the value or attractiveness of these outcomes to the student. That is, the more a student feels that his effort and performance will led to attaining value benefits, the more likely he will choose to participate in gifted programs (Grantham, 2004) such as believing that participation in a gifted program can lead to increased opportunities to prepare for college. If a student believes making A's in a gifted class leads to scholarships and academic

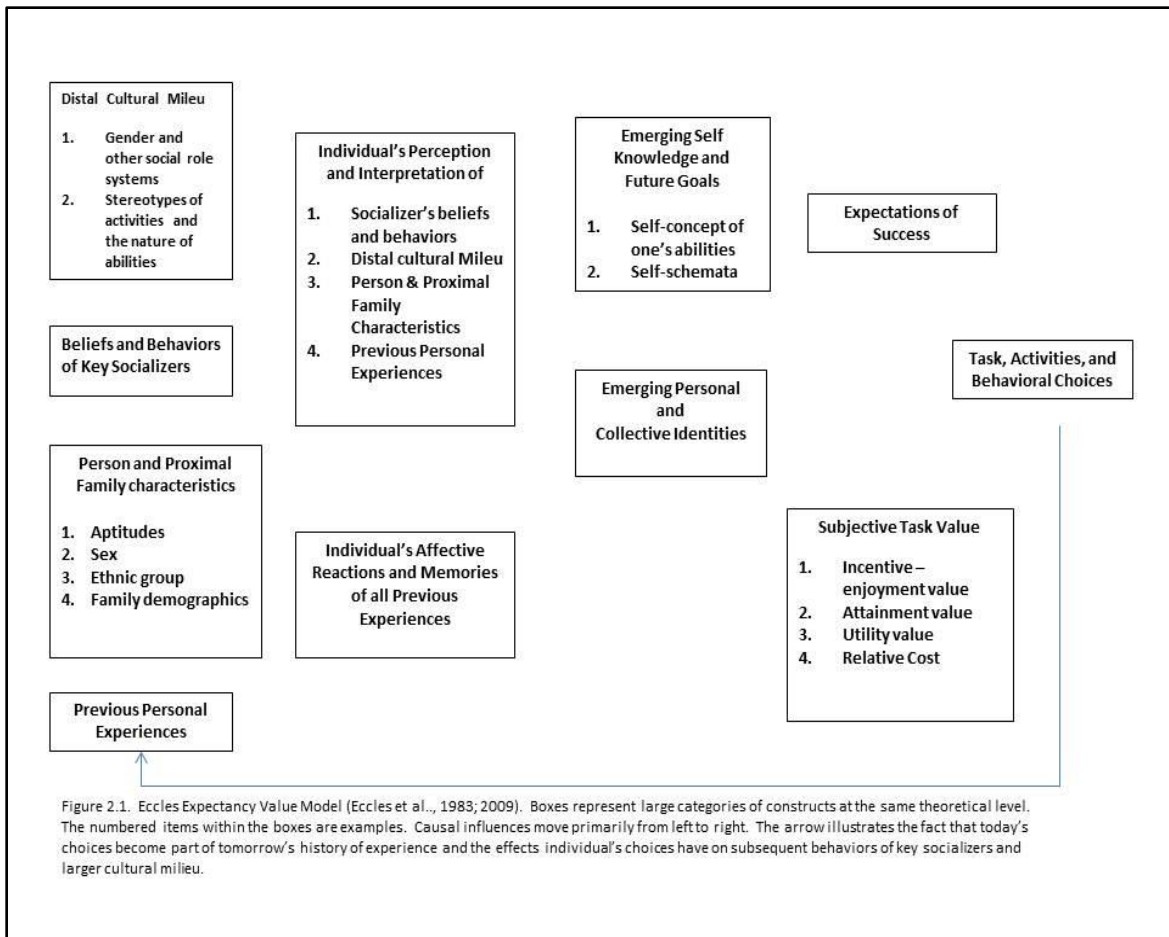
opportunities, students may choose to participate in such a program. But a student may also choose not to participate in the class because they believe that the participation may lead to excessive homework, more time spent on studying, leaving less time for fun or friends. These examples suggest that student's perceptions are beneficial and may inform their decisions about participation in gifted education (Griffin & Allen, 2006).

Students hold different values as they relate to outcomes and the impact of these values on their decision to participate in gifted programs. Their participation can support or devalue the students' own values. Some outcomes are mediated by external factors, such as teachers and peers. If students believe their participation in the advanced program is important, they may feel a sense of accomplishment from having been challenged and prepared for college; or they may feel the participation in the advanced program is not worth it because of the additional and unnecessary work, work they do not value, that is assigned by teachers. Some outcomes may be more valuable because they are seen as leading to the attainment of higher level outcomes that have direct value for the student (Grantham, 2004; Garibaldi, 2007).

The expectancies and value of outcomes suggest that logical explanations may inform Black males' decisions to participate in advanced programs. Students are most likely to participate in the advanced program if participation competence expectancy, outcome attainment expectancy, and the value of gifted program outcomes are positive. Or, refuse to participate if these same values are negative. It is also possible that a combination of positive and negative beliefs would influence a student's choice whether or not to participate in

advanced level programs (Cross, 2006). Drawing upon the expectancy-value theory of achievement motivation, related choices link the individual's expectancies for success and the importance or value the individual attaches to the various options they perceive as available (Eccles, 2009; Eccles & Wigfield, 2002). This model links the students' achievement-related beliefs, outcomes and goals, input of socializers (primarily parents and teachers), gender role beliefs, self-perceptions and self-concept, and perceptions of the task itself. These factors influence both the expectations one holds for future success at various achievement related options and the subjective value one attaches to these options (Bong, 2001; Harackiewicz et al., 2012).

The expectancy-value theory (Figure 2.1) predicts that students will be most likely to enroll in courses that they think they will do well in and have a high task value for them (Eccles, 2009; Eccles & Wigfield, 2002). The expectations for success depend on the individual's confidence in his intellectual abilities and the estimation of the difficulty of the course. Students' beliefs have been shaped over time by their experiences with the subject matter and their interpretations of those experiences (e.g., if a person thinks that his success is a consequence of his or her hard work or high ability) (Eccles & Wigfield, 2002; Updegraff et al., 2001). The value a student assigns to a course is influenced by several factors, including: does he like the subject matter?; is the course required?; does it meet the students' long or short range goals?; do their parents or counselor insist they take the course?; have others tried to dissuade an individual from taking the course?; and is the person afraid of the material to be covered in the course? (Eccles, 2009; Eccles & Wigfield, 2002).



Achievement related decisions are made within a complex context that provides each individual with a wide variety of choices. Eccles (2009) argues it is essential to understand the dynamics of the student's achievement related choices and are guided by the following:

a) the value the individual attaches to the various options and b) one's expectations for success on the various options.

Expectations are influenced most directly by one's history of previous performance, such as course grades, and aptitude. The value is most directly influenced by the relation to

one's long and short range goals, the core self-identity, the pleasure one derives from doing various activities, and the potential cost of investing time in a particular activity. These psychological variables are influenced by one's experiences, interpretative frameworks, cultural norms, and the behaviors and goals of his or her socializers and peers (Updegraff et al., 2001; Eccles & Wigfield, 2002).

A student's expectations and values are strong predictors of academic and sports-related choices. For example, students' intentions to enroll in elective science courses were associated with their interest and belief about the importance of these domains (Meece, Wigfield, & Eccles, 1990; Eccles & Wigfield, 2002). Students' task values, such as interest, and feelings of importance, predicted the number of science courses adolescents took in high school (Farenga & Joyce, 1998; 1999).

Research suggests that math and science achievement are positively associated with students' values and self-concept and that students who perform well in science are more likely to enroll in additional elective science courses (Updegraff, 2001; Harackiewicz et al., 2012). Students' science experiences change significantly as they progress through school, the topics become more challenging and advanced with development. Student expectancies and values also continue to change over time (Eccles, 2009).

### **Summary**

African American males have been traditionally omitted from the science pipeline and fewer African American males pursue a science discipline due to a variety of limiting factors they experience in school and at home. The enrollment of males in advanced level

high school science courses occur at a lower rate for African American males than do African American females. Despite this, there are African American males who excel despite the obstacles they face and pursue STEM careers. Research suggests these individuals probably benefit from supportive, motivational, creative learning environments, peer support, teacher encouragement, and positive familial influences. The expectancy-value theory of achievement (Eccles et al., 1983; Eccles, 2009) has been applied in several studies to show students emerging self- knowledge and future goals, characteristics and experiences of their socializers, expectations of success, subjective task value (interests, attainment, utility, costs/benefits), task activities and behavioral choices, individual and collective identities. This predictive model has been used in a variety of contexts and populations. The literature suggests it should be further explored. Studying students' science identity, using this model, is likely to produce results to explain influences on student's decisions in their advanced science course choices. This study uses the recent findings and implications from science identity literature and expectancy-value theory literature to examine the factors African American males give for enrolling in advanced level high school science courses. The methodology used in this study will be described in Chapter Three.

## CHAPTER THREE

### METHODOLOGY

This study investigated the underlying factors that influence science course selection decisions made by African American males in an inner city high school. To understand the nature of the students' stories and success, a case study design was employed. Qualitative research allows for a rich in-depth description and interpretation of the social cognitive and science identity theories (Bogdan & Biklen, 2007). Quantitative research provides a numeric approach to summarizing the findings suggested in the study. This research design was appropriate for analyzing the lived experiences of young African American males as they made decisions regarding their futures in science and mathematics based careers. According to Bogdan & Biklen, it is through qualitative methodology that such stories may be told, anchored in real meaning and experience.

#### *Study Design*

Because of the small sample size of twelve students used in this study and the focus on student's science identities, a case study design (Stake, 1995) was chosen. This method was chosen in order to capture the rich, authentic data and experiences directly from the participants so that their stories could be told in their own voices in relation to their advanced science classes. In addition, this methodology allowed the researcher to gain an understanding not only of the perceptions of the students but also the parents' and teachers' perceptions of the students, and the students' backgrounds and family experiences as described by these participants. These rich descriptions regarding students' science

experiences in the context of their lives, allowed the researcher to focus on the academic experiences of these Black male students, both in and out of school and identify factors that contributed to the students' decisions to enroll in advanced science courses.

Creswell (2007) defined a qualitative study as inquiry into a research problem that individuals or groups ascribe to a social problem: an intensive description and analysis of an experience. He asserts that qualitative researchers are concerned primarily with the process instead of the outcomes and are more interested in how individuals make sense of their experiences and their lives. The primary instrument for data collection and analysis is the researcher. The research data can be facilitated through a human instrument in combination with inventories and questionnaires. Through this type of study, the researcher goes into the field to observe and record student behavior in their natural setting. From these observations, the researcher usually derives concepts, hypotheses, and theories from the data collected.

A decision needed to be made about which of the many possible theoretical frameworks could be used for the study related to students' choices of advanced science courses. Initially, the researcher intended to use aspects of the social cognitive career theory (SCCT; Lent, Brown & Hackett, 2000) as the guiding framework, due to the focus on students' potential selection of science majors and careers. Given the focus on students' science identities, an interview protocol (Kier, 2013) was selected. It was not until the data were collected and the process of coding the data commenced that the researcher realized the SCCT was not working well to explain the data that had been collected. That is, the focus on

students' science identities were not highlighted in the SCCT framework, nor was there a way to represent how students grappled with the decisions they made.

Therefore, an alternative framework, the expectancy-value theory of achievement motivation (EVT) (Eccles et al., 1983; Eccles, 2009) was employed. This broad framework encompassed all of the data that had been collected, and allowed for the researcher to categorize the relative costs and benefits the students discussed in relation to their goals, their identification with science, and all of the other salient factors (e.g. key socializers, self-concept). As a result of the way the selection of the analytical tools was selected, the identity questions were selected first, and the EVT was selected second. As a result, the interview questions were not directly generated from the EVT; yet, the data generated by the identity interview questions mapped onto this framework.

An identity work the primary source is typically the individual, and the data used to generate the EVT (Eccles, 2009; Eccles et al., 1983; Wigfield & Eccles, 2000) was from student survey data. However, the researcher wanted to also tap into the parent and teacher data from students, to triangulate the data (Stake, 1995) on the students, with the hope of giving more trustworthiness to the findings. As a result, the data from the parents was 'mapped onto' the EVT of the students, to see if in fact externally, the parents', students' and teachers' views of the students, in terms of their identification with science and related factors, would reinforce one another in all, some or no cases. This process was a way to gain an additional lens through which to view the student, with the hope of better understanding

the student's identification with science through shared, partially shared, or differing perceptions of the students' relationship with and around science.

### *Research Context and Participants*

This study takes place at Concord High School (all names are pseudonyms), an urban high school, located in the southeastern region of the United States, with an enrollment of 1265 students. The school operates on a 4 x 4 class schedule, in which most of the students take four classes for the duration of a semester and others are in year-long classes. Sixty-seven percent of the school is eligible for free and reduced lunch (FRL). Ninety-seven percent of the instructional staff is deemed highly qualified, according to guidelines established by the No Child Left Behind Legislation. Sixty-seven percent of the staff is African American, 25% Caucasian, and 8% Other (Hispanic, American Indian). The staff is 38% male, of whom 29% are African American. Approximately 84% of the student body is African American, 12% Hispanic and 4% Caucasian and other racial/ethnic groups.

The researcher invited two science teachers, one male (Mr. Dunn) and one female (Mrs. Trent), both of whom are considered outstanding teachers, to allow students in their classes to take part in this study, and to participate in the study by providing information about their students. Because the researcher desired to work with these teachers, the males recruited for this study, who were students in these teachers' classes, represent a sample of convenience. All male students in both classes were invited to be a part of the study, and they all agreed. The data from all of the twelve male students were analyzed (two of whom were in both courses).

The 12 participants in this study were African American males who are enrolled in one of two advanced level science courses which include an honors level Anatomy and Physiology course and an International Baccalaureate (IB) Physics class. The student participants were in grades 11 and 12. These participants were selected because they have had an opportunity to take more than one science course and shown that they are able to matriculate through science courses with some degree of success. The characteristics of the students in this study are summarized in Table 3.1. The students' future career goals and parents' education level are also shown.

The Honors Anatomy and Physiology class met daily and was taught by Mr. Dunn during the fourth block of the school day (1:00 pm – 2:30 pm). He is an African American science teacher with 37 years of experience, who has spent all of his life in the city in which Concord High School is located. He taught at Concord High School for twenty-two of those years. Mr. Dunn is well known by his colleagues as well as in the community. He is always professionally dressed, most often in suits, and known for his sternness in class.

Mrs. Trent recently moved from Colorado to the area. She is in her third year of teaching and in her second year at Concord High School. This young, Caucasian female teaches IB Physics, and has won the favor of her students. All of the African American males in her current IB physics class were previously taught by her in their Chemistry class and because of the relationship she built with the students, they all enrolled in the IB Physics class. The Physics class met on alternate days during the third period of the school day (10:36 am – 12:14 pm).

Table 3.1

*Characteristics of student study participants*

<b>Participants*</b>	<b>Grade</b>	<b>Advanced Class</b>	<b>Career Goal</b>	<b>Parent's Education</b>
Kevin	11	Honors Anatomy & Physiology, IB Physics	Biomedical engineering	Both College graduates
Bobby	11	Honors Anatomy & Physiology, IB Physics	Veterinarian or Marine biology	Mother – no college Father – college graduate
Terrance	11	Honors Anatomy & Physiology, Honors Physics	Maybe science	Mother – some college
Omar	11	Honors Anatomy & Physiology, IB Chemistry	Neuroscience / medicine	Both college graduates
Edward	12	Honors Anatomy & Physiology	International Studies or Civil Rights Law	Both college graduates
Steven	12	Honors Anatomy & Physiology, Honors Physics	Anesthesiologist	Mother – no college
Ricky	11	Honors Anatomy & Physiology	Biology / Animal Studies	Mother – no college Father – no college
Ronald	11	IB Physics	Astronomer	Mother – no college Father – no college
Nate	11	IB Physics	Sports Agent	Mother – college graduate
Kenneth	11	IB Physics	Sports Medicine /Chemistry	Both college graduates
Jerry	11	IB Physics & IB Biology II	Animal Science /Wildlife Biologist	Both college graduates
Grant	11	IB Physics	Maybe military/ or computer engineering	Father – no college

\*Pseudonyms

### *Context of Study*

This study was conducted at an inner city high school whose population was 84% African American, 12% Hispanic, and 4% other to include Caucasian, Asian, and multi-racial students. The school is rich in history and well known within the school community. The researcher for this study asked two teachers of advanced science classes if they would like to participate in a dissertation study that would analyze factors as to why African American males enroll in advanced level science classes and to investigate their science identities. These two teachers agreed and asked their students to participate during the fall 2013 and spring 2014 semesters.

During the fall semester of 2013, the researcher introduced the project to the Anatomy and Physiology class, then to the IB Physics class. The researcher explained the purpose of the study was to understand the influential factors that African American males used when deciding to enroll in advanced level science courses. It was to also identify those influential factors and to see if these males had science, technology, engineering, or mathematics (STEM) interests and career goals. Permission forms (see Appendix A) were distributed during the initial class visit, asking the students to participate, along with consent forms for their parents if they gave assent for participation in the study. Students were informed that their names and the school name would be changed to protect their identities and to provide anonymity. All of the twelve African American males in both classes agreed to be a part of the study (two of the students were in both classes.)

### *IRB Approval*

A submission form was submitted to the university's internal review board (IRB) requesting approval for this dissertation study. The IRB approved the study in December 2013 (approval # 3669), and then the permission forms were distributed and collected from the students, teachers, and parents. The researcher then began class observations of both advanced science classes. All 12 African American males returned their permission forms as did both teachers (see Appendix B). Seven of the parents who agreed to be interviewed signed their approval forms (see Appendix C) prior to the interviews.

### *Data Collection and Analyses*

In order to capture vivid information from the students, the researcher used a combination of class observations, interviews, analysis of PowerPoint presentations, and questionnaires with the African American male students from the two science classes. A summary of all data collection methods are shown in Table 3.2.

Table 3.2

*Data Collection Plan*

<b>Type</b>	<b>Description of Form</b>	<b>Length</b>	<b>Location</b>	<b>Frequency</b>	<b>Timing</b>
Student observations	Observe students during science class	90 min.	Science classroom	Once per week	Throughout the semester
Teacher Interviews	Ask about students' role in science, interest and perceptions of students	45-60 min.	Classroom after school	Once	End of semester
Parent Interviews	Ask about students' role in science, interest in science	15-20 min.	Schools' conference room, offices	Once	During semester
Student Interviews	Ask about the value they put on science learning	20-30 min.	Schools' conference room	Once	During semester
Student Surveys	Ask about school interest, motivation, value of school, self-concepts	30 min.	In classroom	Once	Beginning of the semester
PowerPoint analysis	Reveal reasons for enrolling in advanced science courses	10-12 min.	In classroom	Once	End of the semester

## *Interviews*

### *Student interview data*

All twelve students agreed to be interviewed for the study and took part in the interviews. Students were interviewed with questions related to their experiences with science, interest in science related goals, identification with science and social supports. The students were interviewed, at their convenience, during school and after school, in a private office. These interview questions were selected because they were focused on drawing out the identities of the students in relation to school and home. In this interview students answered questions about social influences, their characteristics and experiences, questions about their future goals and expectations of success in the future, their self-concept, questions focused on their developing identities in science class, students' chosen tasks and the reasons why they enrolled in their advanced science courses. Sample Science Identity interview (Kier, 2013) questions include

#### Academic and Extracurricular background

1. Let's start with your typical school day. Which classes are you taking this semester?
2. Which is your favorite class? What about it do you really like?
3. Which is your least favorite class? What about it do you not like?
4. Now I'd like to get a sense of what you do outside of school. Can you tell me a little about how you spend your time when you are not at school and which kinds of things you are involved in?

### Science Biography

1. How would you describe your science class experiences this year?
2. How do you feel about your science class this year?
3. How about your involvement in science activities outside of school? What kinds of things are you doing this year?
4. Can you think of any experiences that you've had in school that made you think you could be a scientist? Can you tell me about those experiences?

### Perceptions of Science and Scientist

1. In your opinion, what sorts of people become scientists? Which kinds of personal characteristics make people more or less likely to go into science?
2. Which characteristics of being a scientist make this job seem like something you could do? Or which characteristics of being a scientist make science jobs seem like something you could not do?

### Sense of Self

1. Do you have any feelings about what it means to be a [male] in society?
2. If most of your friends shared your ethnic background, is it important to you that your role models or mentors share your ethnic background? Do you have any feelings about what it means to be [a Black male] in society?

### Role of parents, extended family, peers

1. What do your family members expect from you in high school? How do you know they expect these things from you?

2. What do your family members expect from you in the future, after high school?  
What do they think you should do? How do you know they expect these things from you?
3. Do you and your good friends have the same opinions about science and math, or different opinions? How do they feel about science and math? Do they enjoy it? Do they do well in it?

#### The Future

1. What do you see yourself doing when you are all finished with high school?
2. Can you think of someone who is very influential in your life, or someone whom you really look up to (not a celebrity, but someone you know)? Who is this person?  
What is your relationship like with this person? If you had to choose a role model or mentor, what kind of qualities would they have? What would make someone a role model for you?

#### *Student interview data analyses*

A typological analysis (Hatch, 2002) was conducted on the interview transcripts. First, the researcher read through the entire data set and divided the various elements into topics based on pre-determined categories. The student interviews were transcribed verbatim by an independent transcriptionist, and consisted of 140 double-spaced pages. Second, the data set was organized around the main aspects of the expectancy-value theory (EVT) of motivated behavioral choice (Eccles, 2009; Eccles et. al, 1983). The main categories were coded using these *a priori* factors: perceptions and interpretations of experiences (key

socializers), future goals (self-concept and self-schemata), individual and collective identities, expectation of success, subjective task value (interest, attainment value, utility value, relative cost/benefits) and task, activities, and behavioral choices. The third step in the typological analysis was to create a set of summary sheets for the twelve students. The summary sheets included a consolidated table of how each of the participants' responses was coded. Fourth, the researcher used the summary data from all of the students to look across each category of the model and discern possible patterns or themes for the African American males in advanced science courses. The following examples illustrate the coding using the EVT used in this study:

Researcher: "So can you think of any experiences that you've had in school that would make you think that you could be a scientist, and if so, tell me about it?"

Response: "I think doing...some of the *materials that we've done* (coded: previous experiences) in this anatomy class, how I picked up on it and *how interesting it was to* (coded: interest)...to expand on these things...on these certain subjects. I think like...how fun it was to like...it would be better for me to *keep going with this researching, experiments and things* (coded: goals)."

The students' response to the question refers to the *materials* already done in class so he is referring to his previous experiences in the science class and coded as such. This student also expresses *how interesting* the class was (coded; interest) and when mentioning his desire to *keep going with the research*, it is coded as future goals according to the expectancy-value theory.

Researcher: "In a typical school day which classes are you taking this semester? Of those, which is your favorite class? What is it about the classes in that order that you like?"

Response: I'm taking *Calculus, Physics, Marketing, Psychology* (coded: task choices), and that's it. *My favorite is probably Physics* (coded: interest), Psychology, and ...I like math...well Calculus, but it's a little challenging (coded: cost)...Well I like to do Astronomy, so *that's why I like Physics* (coded: interest). *That's what I want to do* (coded: goals) when I get older, so that's why I like Physics.

When this student responded to the question, he listed his courses which were coded as a task/behavioral choice and his *favorite* was coded as interest because he enjoys the class. He also describes Calculus as *challenging* which is his belief about the course and coded as cost. When the student states the reason for *liking Physics*, it was coded as subjective task value (interest) because of the enjoyment value for him. He furthered identified what he wanted to do for the future (*Astronomy*) and it was coded as future goals.

Initially, the intention was to code all transcripts with two coders. The researcher met with her advisor and conducted trial coding with both the expectancy-value theory codes and categories of the social cognitive career theory (SCCT) (Lent, 2005; Lent, Brown, & Hackett, 2000). It was determined that the EVT better fit the data. Additionally, the codes of the two coders were in agreement approximately 90% of the time, and discussions about the disagreements were always readily resolved. Then, both coders coded students, a parent, and a teacher. The codes were in strong agreement. The decision was made, given high levels of agreement and time constraints, that coding by the researcher would accurately reflect the data.

#### *Teacher interview data*

Each of the teachers of the participants was asked to participate in separate interviews. Each teacher was interviewed in their classroom and asked questions about each

of the African American male students in their respective science classes. Interviews lasted from 45 to 65 minutes. The teacher interviews were conducted to provide the researcher with insight into the characteristics of each of the research participants regarding their strengths and weaknesses as a science student. For each student the teacher had in class these interview questions were asked:

1. How would you describe your role in your science student's education?
2. How would you describe \_\_\_\_\_ as a science student? What are his strengths?  
His weaknesses?
3. Do you believe \_\_\_\_\_ has the potential to perform well in this science class?  
How?
4. Can you describe \_\_\_\_\_'s performance in relation to his abilities?
5. Have you ever discussed college with \_\_\_\_\_ or encouraged him regarding other courses or careers?
6. Describe the expectations you have for your science students.
7. Does \_\_\_\_\_ meet these expectations?
8. Describe the interactions you have observed for \_\_\_\_\_ in this class with you and other students.
9. How do you think \_\_\_\_\_ is perceived by other students in your science class?
10. Describe the learning method preferred by \_\_\_\_\_ in your class.
11. Have you ever talked to \_\_\_\_\_'s parents about his science progress?
12. How did \_\_\_\_\_ gain entry into this advanced science class? [2-12 were asked for

each student]

13. Why do you think there are so few African American males enrolled in this higher level science course?

*Teacher interview data analyses*

First, the teacher interviews were transcribed verbatim by an independent transcriptionist, and consisted of 51 double-spaced pages. Second, just as was done for the student interview data, the data set was organized around the main aspects of the expectancy-value theory of motivated behavioral choice (Eccles, 2009; Eccles et. al, 1983). The main categories were coded using these *a priori* factors: perceptions and interpretations of experiences (key socializers), future goals (self-concept and self-schemata), individual and collective identities, expectation of success, subjective task value (interest, attainment value, utility value, relative cost/benefits) and task, activities, and behavioral choices. However, in this case, the teacher data was coded onto the charts generated for the students. Now the student summary sheets also included teacher data, based on their perspective of the student. This data acted to triangulate the student data, by adding the perspective of the teachers of each student. The following examples illustrate the coding of the teacher data using the EVT categories:

Researcher: How would you describe your role in science with [Omar's] science education? What would you say his strengths and weaknesses are?

Mr. Dunn: ...He *comprehends well* (coded: ability) and his focus...he *likes to remember hard things* (coded: interests). He challenges himself...To learn as much as you can about any subject he's working on. He *brings a lot of different questions to the class* (coded: interest).

This response (*comprehends well*) was coded as ability because it was the teacher's (socializer) belief of the student's ability in comprehending information. But the statement (*he brings a lot of different questions to the class and he likes to remember hard things*) are coded as interest because the teacher believes Omar has an interest in the Anatomy and Physiology class and asks lots of questions because of his interest in the subject as well as remembering things the teacher considers challenging.

Researcher: Have you ever discussed college with [Omar] or encouraged him regarding other courses or careers?

Mr. Dunn: Omar is *interested in a science career* (coded: goals) and he's highly interested in Duke University...

In response to the above question, the interest statement is coded as future goal because Omar has stated his interest in a specific career, science, and interest in attending a specific university, Duke as he makes plans for his future.

Mrs. Trent: I know Kevin wants to *pursue something in science* (coded: goal). I think it was Biology related but...I definitely *have encouraged, 'Please go into science* (coded: previous experiences).

And, the statement *pursue something in science* is coded as future goals because that is what the teacher expects of him. The statement, *'have encouraged, 'Please go into science* is coded as previous experience because this is the action of the teacher (a socializer).

#### *Parent interview data*

Seven parents (one father and six mothers) of seven of the students consented to interviews. The intention of the research was to provide another key perspective of the students and the social influences related to their education and their futures. This third

perspective on many of the students would provide another view to enrich the understanding of the science identities of these African American males. Specifically, parents were asked about their son's science abilities and the factors that have contributed to their child's success in science. The researcher met the parents at their convenience to conduct the interviews; at a school basketball game, in the school's conference room, in the school's athletic director's office, and by telephone. The interviews with the parents ranged from 15 to 20 minutes and were audio-recorded. The interview questions were:

1. How would you describe your son's ability to do science?
2. Describe your son's progress in science over his academic career. Are there any science moments that stand out in your mind?
3. Has your son always performed up to his ability in science?
4. Has he always been assigned to the appropriate level science course?
5. Can you explain why your son is enrolled in this advanced level science course?
6. How would you describe the science teachers your son has had in the past?
7. Have you ever requested a science teacher or asked that your child be moved to a different science class? If so, why?
8. Has your son ever had supportive peers in science class? If so, describe how?
9. Do you know if your son has any friends in his science class? Does he ever talk about any students or experiences in class?
10. Describe your family's opinion on academic support and help with school work.
11. Have you been able to attend any school meetings or events about your child?

12. What kind of things do you say to your son about science?
13. How did you do in science?
14. Do you think there are any factors that African American male students have to deal with that other students do not have to deal with? If so, describe them.
15. How do you help your son deal with those factors?

#### *Parent interview data analyses*

The parent interviews were transcribed verbatim by an independent transcriptionist, and consisted of 46 double-spaced pages on seven of the students. As was done with the teacher interview data, the responses were coded using *a priori* factors, from EVT (Eccles, 2009; Eccles et. al, 1983). Again the *a priori* factors were: perceptions and interpretations of experiences (key socializers), future goals (self-concept and self-schemata), individual and collective identities, expectation of success, subjective task value (interest, attainment value, utility value, relative cost/benefits) and task, activities, and behavioral choices. The following examples illustrate the coding from EVT used in this study:

Researcher: Would you describe [Kevin's] progress in science over his academic career or are there any science moments that stand out in your mind?

Kevin's Mother: "So, Kevin has been *very consistent in science* (coded: expectations of success) but I have to tell you that you wouldn't necessarily be able to differentiate from his other classwork 'cause he's *very consistent* (coded: expectations of success) over time, if you know what I mean."

Researcher: Can you explain why he's [Bobby] enrolled in these advanced level science classes?

Bobby's Mother: Well, ever since he was in middle school he always wanted to be a

*veterinarian* (coded: goals)...It really didn't change a little until maybe the beginning of this year that he wanted to *be in marine biology* (coded: goals). He just likes animals (coded: interest), *he likes the underwater study* (coded: interests), and so I think that's *why he's taking those courses* (coded: utility value) because *he already knows what his goal is* (coded: goals).

Kevin's mother's comments were coded based on the EVT. The statements made by her about the *consistency* of her son in science were coded as expectations of success because she expected him to continuing succeeding in science as he had done in the past. Her expectations for him were continued success in science. Bobby's mother comments were coded as goals about her son; *he always wanted to be a veterinarian* and *he wanted to be in marine biology*. The additional comments, *he likes animals* was coded as interest as was *he likes the underwater study*. The other statements, *why he's taking those courses*, was coded utility value because the mother was aware that her son saw the usefulness of taking the advanced science courses in preparation for his future goals, as she stated when she commented, *he already knows what his goal is* (coded as goals).

#### *PowerPoint presentation data*

The study participants were asked to prepare a PowerPoint presentation outlining the reasons for enrolling in advanced level science classes. The research participants were told they were preparing this presentation to be presented to younger high school science students as a recruitment tool for the honors/advanced level program. The research participants were organized into groups of 3-4 by their teacher, to work on their presentations. The students were given a preparation session of 90 minutes in which they organized their information as they were preparing the slides. After the presentations were created, a student from each

group copied their presentation onto a thumb drive for the researcher. The school in this study has a cart of 30 laptops in each classroom in the school and there are enough laptops for each student in the school to have a laptop. Therefore, each group used their school laptops on which to create their presentations. The participants presented their PowerPoint presentations to their class, and the researcher watched and recorded the presentations, which took place approximately three weeks before the semester ended. The next week, the males in the class then presented the PowerPoints they had worked on to a tenth grade biology class.

#### *PowerPoint data analyses*

The students presented their PowerPoints to their class describing their reasons for enrolling in the advanced level science courses. The various group presentations lasted approximately 8-10 minutes. The students stayed very closely to the wording on the slides they were presenting from their PowerPoints. The transcripts of all the students' PowerPoints were analyzed one statement at a time and themes related to EVT were coded. The students made references to academics and grades, preparation for the future, teacher influence, learning environment, familial influence, and peer influence. When students made reference to *boosting their grade point average (GPA)*, these statements were coded as attainment value. The references the students made to *their future, or careers* were coded as goals. Students' statements about these courses helping to decide future decisions, meet college entrance requirements, or ACT preparation were coded under subjective task value (attainment value), a way to attain their college career goals. Students made specific

statements about the teacher's reputation, influence of the teacher, a motivational teacher, being motivated and required by parents to enroll in the class and having a sibling or peer influence on course choice; all of these statements were coded as key socializers.

Expectation of success was the code for the following statements: being with like-minded people and increase your desire for learning. After each PowerPoint was analyzed, percentages for their statements in each category were calculated for the various statements in the five categories.

#### *Focus Group interview*

One focus group interview was held with all of the male students who created the PowerPoints to understand their thoughts on the process of making and presenting their information to younger students. The students' comments about the process and the changes they would make after giving their presentations were recorded and analyzed. The students were asked to give self-critiques of their presentations.

#### *Focus Group interview data analyses*

The focus group interview did not yield any new information and this was unexpected. The students did not make any changes, nor wanted to; they were satisfied with their initial PowerPoint creations, making statement such as "no, there's nothing I would change." These young men felt their PowerPoints provided an effective message to the younger science students. One student said,

You guys are already in the honors Biology class, as you are ahead of the curve. You are taking an honors level class which can boost your GPA when you do well. If you are looking to continue in that path, there are other options such as honors Anatomy

and Physiology with Mr. Dunn.

### *Questionnaires*

#### *Twenty-Statements Questionnaire data*

The twelve students completed the Twenty-Statements Questionnaire (TSQ) (Kuhn & McPartland, 1954; Aypay & Aypay, 2011). The TSQ is an open ended self-report instrument in which the participants list their self-concepts (see Appendix F). Each statement begins with “I am...” and the students were asked to complete the twenty sentences by writing a self-descriptor on each line. The students were given the survey during class time, hand writing their responses. Once the students completed the statements, the researcher analyzed each statement and assigned each statement to one of six categories as described by the graphical representation of the expectancy-value theory (Eccles, 2009; Eccles et al., 1983). A completed sample TSQ is shown in Table 3.3.

Table 3.3

*TSQ sample of student statements*

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**Twenty Statement Questionnaire**

I am glad I had the opportunity to take Anatomy

I am glad I am in the honors class

I am keeping up with my peers

I am excelling over most students

I am glad I have Mr. Dunn as my teacher

I am thankful in passing this class

I am more a hands on learner

I am an intelligent young man

I am thankful for Anatomy

I am excited when I come to Mr. Dunn's class

I am a hard working student when it comes to science

I am going to be an anesthesiologist

I am in high hopes that I pass this class

I am always on task & focused

I am one who participates all the time

I am enjoying my class along with my peers

I am enriched with the things I learn in Mr. Dunn's

I am learning new things everyday

I am taking this class for my major in college

---

### *Twenty-Statements Questionnaire data analyses*

An analysis of the Twenty-statement questionnaire (TSQ) was completed by reading through 240 statements coding them using pre-coded categories organized around the main aspects of the expectancy-value theory of motivated behavioral choices (Eccles, 2009; Eccles et al., 1983). The *a priori* categories were: perceptions and interpretations of experiences (key socializers), future goals (self-concept and self-schemata), individual and collective identities, expectation of success, subjective task value (interest, attainment value, utility value, relative cost/benefits) and task, activities, and behavioral choices. The next step involved creating a set of summary sheets of how each participant responded to the TSQ. Next, the researcher looked for themes and patterns across the data with similarities and differences in the students' responses as they related to science, their interests and goals. Examples of the coding for some TSQ statements are as follows: "I am very intrigued by both anatomy and physics" (this statement was coded as subjective task value interest). Another example is, "I am confident in my cognitive abilities" (coded as emerging self-concept). This questionnaire provided another tool to gain insight into the students' identification with science, goals, and key influences.

### *Student Observations*

The researcher made classroom observations numerous times throughout the fall semester. The purpose of these observations was to assess and understand the ways in which the participants interacted with their peers and teacher during science class; to augment what was learned about the students through interview data. Field notes and the behaviors of the

participants were recorded during each of these observations. Observations intentionally acknowledged student engagement (if they interacted with their peers or the teacher in the class), level of understanding in their classes (did the student ask questions or participate in class discussions), student questioning (how frequently they asked questions in class), and interactions in their science classes (who did they talk to in class). These observations were helpful in better understanding the students in the study, as a form of supplemental data.

#### *School perception data*

Students in the study were asked to complete the School Perceptions Questionnaire (SPQ) (see Appendix E). This survey was designed to measure students' level of identification with academics, their sense of belonging, and their valuing of school (Osborne & Walker, 2006). The students completed the 32 item questionnaire at the beginning of the research study, handed out by the researcher. All items in the SPQ were measured on a Likert scale of 1 (strongly disagree) to 3 (neither agree nor disagree) to 5 (strongly agree). Sample questions for each subcategory are shown as follows.

Sample questions measuring the *valuing of school* include:

- 2: School is important in life;
- 13: School is very boring for me;
- 23: How I do in school is really not important to me.

Sample questions measuring *identification with academics* include:

- 1: Being a good student is important to me;
- 3: I don't care whether I get good grades or bad grades

12: If I do well in school I will get a good job.

Sample questions about *school belonging* include:

7: I'd rather be anywhere but in school

17: I get treated with respect in school

32: I feel comfortable when I am in school, like I belong there.

The SPQ was validated by Osborne (1997) and found to be reliable with a Cronbach's alpha of .82, and a correlation of .76. The following SPQ items were reverse coded; 3, 7, 13, 14, 15, 22, 23, 24, 28, 29, and 31. Items 4, 6, 7, 9, 14, 15, 17, 18, 27, 29, 30, and 32 measured a sense of belonging. The valuing of school was measured by items 2, 13, 22, 23, 24, 28, and 31. The identification with academics was measured by items 1, 3, 5, 8, 10, 11, 12, 16, 19, 20, 21, 25, and 26. The highest possible score for the SPQ was 160, but the range of the score, given reverse coded items, more typically would range from 99 to 153.

#### *School perceptions data analyses*

The students' information for each of these subcategories was totaled and averaged to obtain a mean score for each subcategory using a Likert scale of 1 to 5. The African American males in the study had an average of 4.3 with academics and identified strongly with academics. They averaged 3.8 on the valuing of school and on the sense of belonging, indicating they valued school and felt they had a sense of belonging in school, just not as strongly as their identification with academics.

### Inter-rater reliability

Initially, this researcher planned to code all transcripts with two coders. The researcher met with her advisor and conducted trial coding using both the expectancy-value theory (EVT) (Eccles, 2009; Eccles et al., 1983) codes and categories of the social cognitive career theory (SCCT) (Lent, 2005; Lent, Brown, & Hackett, 2000). After the coding trials, it was determined that the EVT better fit the data and these codes were used. Both coders independently coded students, a parent, and a teacher. The codes of the two coders were in simple agreement approximately 90% of the time. For those codes that were not in agreement, discussion about the disagreements took place and the coding was readily resolved, resulting in 100% agreement. Therefore, the decision was made for the researcher to continue coding the rest of the transcripts, given high levels of agreement, time constraints, and her deep familiarity with the participants and the data.

### Limitations

African American males are an often unstudied population in terms of academic success, particularly in STEM areas. However, there is a plethora of information regarding the academic failure and struggles of these individuals. This study sought to observe and examine African American males enrolled in advanced level science courses to understand why these students made the choices they did and how they developed their science identities within these courses. While given a small sample size and all of the students are members of the same southeastern urban high school, the data collected may not be generalizable to a larger population of students with similar demographics. This is included here as a

limitation, as it certainly may be viewed as such by those who read this dissertation, or future manuscripts that may result from this research.

However, specific focus on this group may also be considered a strength. Focusing on one specific group of Black, male students in an inner city high school who are enrolled in advanced science courses may allow the researcher to delineate differences and uniqueness between these individuals. That is, the range of identification and differences in how they consider the value of their choices versus the costs, key socializers, goals, etc. Therefore, we believe it is a strength rather than a limitation to focus intensively on a particular group of students to explore them in detail, and that this holds to promise of contributing to the literature a more in depth and accurate portrayal of these individuals than could be accomplished with a different method.

The survey data and the Twenty-Statement Questionnaire were self-reported data from the students and therefore may contain some bias. There also was no control group for this study, as this author sought rich and authentic data from the African American males in this study (Erlandson et al., 1993). The sample group of a single gender of males and one race (African American) may be limitations, as well.

There may be some biases from the researcher in that she works at the school where the data was collected, is an African American female, worked as a science teacher for twenty-four years in the school and is currently employed as an instructional facilitator. However, the researcher does not teach any of the students in the study and this may have

made the researcher a better instrument of data collection, given her compatibility with the study (Erlandson et al., 1993).

During this study, in-depth interviews were conducted with the students, teachers, and some of the students' parents. Class observations were used as measures to triangulate the data and increase the credibility of the findings of this study (Stake, 1995). The data in this study was analyzed to determine the similarities among the males, the factors that influenced their decisions to enroll in advanced level science courses, and the development of their science identities.

### Summary

Data for this study was collected on each of the twelve African American male students who were enrolled in one or two advanced science classes. All data collected during this study, interviews, PowerPoints, questionnaires, and field notes from observations were analyzed through the lens of the expectancy-value theory of achievement related choices (Eccles, 2009; Eccles et al., 1983). A description of the data analysis was given for each data source collected individually for each student, and a cross case analysis of all of the students was done searching for patterns across each of them, or typologies for how they identify with science, their level of interest in school, and key motivating factors. The findings from this study will allow the voices of the study participants to be heard and the lived experiences of successful African American high school males to be shared so as to inspire others to follow in their paths. The findings from the study will be presented in Chapter 4.

## **CHAPTER FOUR**

### **FINDINGS**

This chapter describes findings of data gathered on twelve African American high school students enrolled in IB Physics or Honors Anatomy & Physiology. The findings from analyses of student interviews, interviews with their teachers and parents, student profiles, teacher profiles, class observations, PowerPoint presentations, and research questionnaires are detailed.

First, the two teachers' profiles are presented. Next, summary findings from classroom observations of the Anatomy & Physiology course and the Physics course are described. Following that, the cases for each of the twelve students are presented. Each student profile includes a summary of findings about the student based on teacher data, student interviews, and for seven of the students, parent interview data.

Next, findings from students' group PowerPoint presentations are presented, followed by findings from the Twenty Statements Questionnaire. Finally, the students' results from the School Perceptions Questionnaire are presented.

#### **Teacher Profiles**

##### **Mr. Dunn**

Mr. Dunn taught both the Honors Anatomy and Physiology class and a general Biology class. A 57-year old African American male, he has been a science teacher in public education for 37 years. Mr. Dunn can be characterized as a stern, devoted, and caring teacher with high expectations for those students who choose to walk through the doors of his

classroom. Educated by this public school system, Mr. Dunn holds firm beliefs that all students, especially African American males, need strong role models and structure in their lives. Mr. Dunn has taught science in the same classroom for the past 18 years and has been an educator in the same city for his entire teaching career. He is typically dressed in a suit, with a dress shirt, a necktie, freshly pressed slacks, dress shoes and is always well groomed. When he speaks, his firm deep voice immediately captures the attention of his students or anyone nearby. Upon hearing him, the students immediately respond with a “yes sir”.

Mr. Dunn’s expectations in the classroom are demanding. He expects students to come to class with their homework completed and ready for learning with all of their materials. Yet he is also a realist, because he knows that this will not always occur. Mr. Dunn talks with his students, but he also listens when the students want or need someone to listen, and counsels them when needed. Although he is a stern teacher and seems inflexible, he tutors students after school and does what is best for the student. With high standards in place, he expects his students to arrive to class on time but he gives them additional time to complete class assignments when needed and he requires them to re-do assignments when they fail to meet his expectations.

Mr. Dunn’s reputation precedes him; he is a model teacher and is community oriented. This charismatic African American male has taught thousands of students and maintains an outstanding reputation in both the school and church community. It is very common to look up and see him at an honors society induction, athletic event, school play, or quiz bowl competition; he is very supportive of the students.

## **Mrs. Trent**

Mrs. Trent is a young Caucasian female in her third year of teaching and second year of teaching science at Concord High School. She taught both International Baccalaureate Physics and Honors Chemistry. This petite female is very soft spoken and quiet. She does not stand out in any particular way but she can be found working on her lesson plans or grading papers while listening to her iPod©. Mrs. Trent was fairly new to a school that is so rich in history and tradition, but adjusted very quickly to teaching mostly African American students rather than mostly Hispanic and Caucasian students. She was able to get to know her students well. She embraced the culture of her students and attended several school events, including athletic events and theatrical performances. She also tutored students during lunch or after school. Upon entering her classroom, Mrs. Trent was often found engaging her students in hands-on activities in class.

Mrs. Trent is an engaging teacher who maintained good relationships with her students. She has a desire to and excels at getting students involved in the class activities and enjoys teaching Physics through continual hands-on activities. The students seem to enjoy her instructional methods. She is demanding yet flexible with her students and her requirements. Mrs. Trent worked with her students individually and tolerated behavior that most teachers would not, such as allowing students to move freely around the room and listening to their iPods while working their problem sets in Physics. But, her methods were productive in her classroom. However, she admits she could have been stricter in class but it was more important for her students to learn the Physics. There was no raising her voice to

her students; instead, she understood their needs, such as those who needed to move around and not sit idle for extended periods of time. She guided them in a positive direction. Mrs. Trent wanted her students to share in her passion for Physics. She could see that some of her students had the desire to learn and for some, pursue science in the future. Mrs. Trent wanted her students to recognize the applicability of Physics to their daily lives and be successful. She recognized their potential and held her students in high regard.

The IB Physics class was taught during the third block of a four block school day and met on alternate days. Each block was 90 minutes long. Mrs. Trent revealed that she had taught all of the male students in her class the previous year in Chemistry, making the relationship between her and the students even stronger. She knew them and their habits and they knew her and her requirements. Having this smaller Physics class (14 students; 7 males and 7 females) also allowed her to understand her students more deeply; their interests, their future plans, and how to motivate them to work hard in her class. For example, when explaining projectile motions to the class, she helped the footballs' team quarterback understand how his actions during the game exemplified the meaning of projectiles and that he consistently applied concepts of physics during this activity. She knew the sports played by each athlete in her class and used these as examples to encourage and motivate her students.

### **Class Observations**

Class observations were done weekly (ten times by the researcher) for each of the two advanced science classes during the fall semester. The students were observed for their peer-

to-peer interactions and student-teacher interactions. Class activities and students' interactions were also observed to gain a more complete understanding of the students in the study.

### **Observations in Honors Anatomy and Physiology class**

Mr. Dunn's Honors Anatomy and Physiology class was observed ten times during the semester. Thirty nine percent (7) of the students in this class were African American males and they all agreed to participate in the study. This class took place during the 4<sup>th</sup> block of the school day each day from 1:00 p.m. to 2:30 p.m., the last class period of the academic day. Upon entering Mr. Dunn's classroom, one would immediately recognize the room as a science classroom, with huge plants sitting around on the counter tops. There were numerous student projects on the counters, science models around the room, microscopes on the counters, and student-produced posters hanging from the ceiling. The classroom is truly inviting, giving students a glimpse of the things they may be exploring when enrolling in his class.

During observations, the students entered his class clearly knowing the habits and routines of the teacher. They arrived on time before the tardy bell sounded, and Mr. Dunn started his class quickly, giving little time to engage in non-academic activities. The students would take out their question sets for the current topic then, Mr. Dunn would read or have a student read a question and ask for volunteers (or he would draft someone) to respond to the questions. During each class period observed, Terrance, Ricky, and Omar dominated these

sessions by asking and answering questions and making real world connections. They were eager to participate, seemingly to please the teacher with their responses. They often responded to the teacher's questions followed by their own questions, attempting to elaborate on the selected topic for that day.

These questions became their avenues for class discussions; they shared stories back and forth which clarified the students' understanding. For example, in one class discussion, students were discussing their ears popping and why people chewed gum on an airplane flight. These students were also making connections to someone swimming and having water trapped in their ears. In addition, they discussed topics such as concussions that may occur during the various athletic events such as football, basketball, and softball, and what happens to the brain and the areas of the brain that controlled long and short term memory. The students completed a virtual laboratory activity in which they observed an athlete experiencing a concussion and the brain scans showing the effects of the concussion.

### **Observations in IB Physics class**

The IB Physics class being observed had a total of 13 students at the beginning of the study and increased to 14 students by the end of the semester. There were 7 African American males in this class who participated in the study (100% of the males in the class). The IB Physics class occurred during the third period block and met every other day from 10:40 a.m. to 12:14 p.m. The students picked up their problem sheets upon entering the classroom. The class began each day with a warm-up activity lasting the first ten to fifteen minutes of class, during which the students worked a few problems, and conversed on the

content from the previous class session. Mrs. Trent offered support to the students and gave them the time they needed to solve the problems.

The males were almost always present in class and participated frequently in the activities. Students would submit their problem set to the teacher and then begin the lesson for the day. When the students struggled with the warm up problems, they would work the problems on the board. The males would often volunteer to work problems and ask clarifying questions, as needed. Usually Kevin would finish the assignment first and submit his problems, followed by two more males (during half of the observations). Mrs. Trent would direct the students to place their problem set into their notebooks giving them a specific page on which to place it.

After the students completed these warm-up problems, Mrs. Trent would present the lesson for the day, including a brief video clip of the concept in action and new Physics equations, followed by a new problem set. She would monitor each student's progress on the problems and allow them to move freely in the class, obtaining assistance from fellow students or working the problems at the board. Usually, all males were engaged in class. Five of the seven males would volunteer to work problems on the board. Grant would often lag behind the other males, who would eagerly volunteer to work the problems on the board. Grant would often wait until approached by the teacher before completing his problems. The other males would work in pairs, calling the teacher for assistance and clearly asking for clarification when they did not understand.

Following the introduction of the lesson for the day, Mrs. Trent would supplement her lesson with a demonstration of the principle presented during her instruction followed by a few problems for the students to work, usually about five. Kenneth usually worked his problems with a female in class. Jerry, Ronald, Bobby, and Nate would frequently work some of the problems at the board, with the assistance of Kevin. Kevin appeared to be the most confident of all the males in class, when working his problems. He often finished before the others, submitted his work and provided assistance to the other students. Almost all other males in the class would ask him for help and he complied. Most of the males would finish their problems and Mrs. Trent would then instruct them to place the problems in their notebooks.

Following the problem set, Mrs. Trent would instruct them on their upcoming lab activity. For example, the students completed a lab on projectile motion in which the students were launching various types of balls. The students were instructed to move into their lab groups. They usually worked in the same groups (students were allowed to select their own lab partners). Ronald and Nate routinely worked together. Kenneth always paired up with the same female. Kevin most often worked with Jerry, and sometimes Bobby, or sometimes with anyone in the class. Grant mostly worked with males in the class, usually moving from group to group.

During each new lesson, the teacher had lab activities for the students, during which the students moved freely and communicated with one another. The students appeared to have special relationships in this class; they joked with one another and helped one another,

but they also questioned what they were doing during the activities. Although the students moved freely within the room, they worked closely during their lab activities, sometimes at the insistence of the teacher. During the lab activities, leaders for each group emerged and remained so throughout the class observations. Kevin, Kenneth, and Jerry generally led their lab groups.

During each class observed, Kenneth worked with a female, perhaps the person with whom he was the most comfortable, including the first lab activity that this researcher observed, during which he was stretched out on the floor recording measurements. Ronald and Nate would usually work in the same group, joined by two or three other female students in the class. Usually when Ronald and Nate worked in lab groups, Mrs. Trent spent more time helping these students stay on task.

Based on observations, the students' communication flowed freely among themselves and the teacher. Mrs. Trent had seven African American males in her class, all of whom seemed to respect her and enjoy the class and the way she conducted her class. Mrs. Trent gave explanations for the concepts taught, always followed by hands on activities.

### **Student Profiles**

#### **Kevin**

Kevin is a 16-year old 11<sup>th</sup> grade African American male who was confident in his abilities and activities. He was always well dressed with matching outfits, or sometimes sporting college attire (a local university t-shirt) or his high school's attire in navy blue and white. He commented, "It was kind of instilled in me as a child. I always looked nice when

I was a little kid. My hair was always groomed, I always wore nice clothes and they [parents] told me to act the right way.”

Both Kevin and his younger sibling live with both of their parents. His mother is a pediatrician and chemist, and his father is an athletic director at a local middle school. He says that his family members “expect for me to always make good grades, to look presentable, and to represent my family well.” His parents expect him to go to college and to be successful.

They expect for me to be very successful. I plan to go to college and that’s something they would want. I don’t think they’d be very happy if I didn’t go to college but they would understand...Because they push me so hard academically, that not going to college would almost be like futile.

This young man is academically ranked number one in the junior class, plays varsity football, and belongs to several clubs and organizations even while enrolled in the schools’ elite International Baccalaureate (IB) Program. He recently received accolades for an honorable mention in the district’s math competition. Kevin is enrolled in Anatomy and Physiology primarily as an independent study course and he is also enrolled in IB Physics. He explained,

My favorite class would have to be my Physics class...science is one of my strong suits and there’s a lot of math in it, and math is probably my best subject and I really enjoy my teacher so she helps a lot.

Kevin is not shy about asking questions in class when he needs clarification. He sees science as relevant and beneficial:

In school, when I started to really understand the formulas for Physics, I could think of things that...I could find the formulas and ...well, like real life situations and use

them for my benefit.

In Physics, he grasps the concepts very quickly and finds himself helping other students. He said,

Because I've had so much success and people know so they kind of lean on me for help in the classroom. So I think that's how I lead.

Kevin identifies as a Black male both on a personal level and collectively. He muses,

As a male, I have to be successful because unsuccessful men are not looked highly upon and it's almost like a disgrace...I feel like I have a big void to fill, just because of who I am as a person. Because I'm Black, I have to dress completely different from White males. Like a White guy could walk in with jeans, like a little buttoned up shirt and some Sperry's and get a job. I would have to come in like a full suit and tie just to show that I have the proper image.

When asked during the interview whether it is important that his role models or mentors shared his ethnic background, Keith responded,

...I don't think so. I feel like I can have a... role model in another ethnic background because one of Martin Luther King's role models was Mahatma Ghandi, and they don't have the same background, but they both stood for the same thing.

Kevin expects to be successful, but what he mostly wants is to like what he does professionally. He said,

Probably the most important thing is that I'm happy with what I'm doing...I think [my parents] worry most about my happiness 'cause they know I do a lot of things well but they just want to make sure I'm happy with what I'm doing.

Kevin has been influenced not only by his family members and teachers, but by his coaches.

He explains,

My basketball coach...he's like a...mentor really 'cause...we have a relationship with basketball and he's also my dad's fraternity brother so they have that connection and he knows I aspire to do the same thing so we talk...we connect on that. ...I've

been able to talk to him about anything.

### **Teacher perspectives**

*Mr. Dunn.* Mr. Dunn described Kevin as a “remarkable and capable” student, who has a strong work ethic and is well respected by his peers and teachers. He characterized Kevin as an avid reader with a high level of comprehension. Kevin’s wealth of knowledge is welcomed by Mr. Dunn during science class and during the interview he frequently referred to Kevin’s highly supportive parents and relatives and the plethora of resources and exposure to science they already have provided for him. Mr. Dunn acknowledged Kevin’s high level of community engagement, and as a result, he intentionally has higher expectations of his course work. Kevin is focused, creative and research oriented. Kevin is allowed to complete several of his research-based assignments independently and Mr. Dunn deduces that Kevin’s mother heavily influences his behaviors, including the decision to take this class, because of his desire and interest to delve further into the scientific details of Anatomy and Physiology.

*Mrs. Trent.* Kevin’s IB Physics teacher described him as one of the “strongest science students she has ever taught.” Highly intelligent and academically focused, he has the ability to solve his Physics problems correctly and truly discuss the science. This young man expects to excel and puts forth the effort to do so. He seeks additional assistance during lunch or after school when he needs clarification. With the teacher’s assistance, Kevin is able to be thorough in working his problems and rectify his mistakes.

Mrs. Trent describes Kevin as having strong potential for science; defining him as “great” the previous year in her Chemistry class and his continued performance this year in

her IB Physics class makes her point. With science as a prospective career, she continually encourages him because of his scientific aptitude. She believes he is viewed by his peers as a leader in the class and as someone from whom they can seek assistance. Kevin has learned the Physics, can apply the concepts, and speaks the language of science. Mrs. Trent holds exceedingly high expectations for him in science, saying, “I expect him to be able to use the science language more than some of his other peers” and to understand the “why” in Physics.

Kevin is described as a respectful student, one who has positive peer relationships with everyone in class; he is recognized as *smart* and a solid source of information and scientific thinking when they struggle as a group. Mrs. Trent also believes Kevin is a role model for other students; she does not describe him as perfect, but says he is fairly close to it. She feels the other students consider Kevin as out of their league; he likes doing the science, has a preference for the interactions with Physics, doing labs, and solving problems. Mrs. Trent recognizes a strong maternal influence in his life, she states, “Which encourages his natural talents and hones them to a fine point.”

### **Parent perspective**

The interview with Kevin’s mother took place during a basketball game in the athletic director’s office in the school’s gymnasium. She was very interested in the concerns of African American high school males in the advanced science courses. She is a pediatrician and chemist who teaches science and medicine at a local university. His father is the athletic director at a local middle school. When asked to describe her son’s ability to do science,

Kevin's mother repeatedly expressed her pride in her son's accomplishments and attributes his success to his personal motivation and family support. She said he is planning a career in a scientific field. She explained, "He's been exposed...had a natural interest...had more exposure than most... [and] engaged in a lot of science related activities." He has traveled to Costa Rica as part of the *BOOST* science program at a local university and participated in *Scientifica*, another science based enrichment program.

When asked about her family's opinion on academic support, Kevin's mother said, "We view our role as parents...[and] also partners with his teachers." When asked what she said to her son about science, she said the credit had to be shared with his grandfather, who was also a scientist. Kevin and his grandfather discussed science careers, the manifestations of science that people do not see, pursuing biomedical engineering, and science in everyday context.

When asked if there were any factors that African American males had to deal with that other students do not have to deal with, Kevin's mother commented that her son is automatically assumed to be an athlete, as opposed to being a scientist, just because he is an African American male. She helps him to deal with those factors by discussing them, talking about her expectations, encouraging him to do his best and, to know that his parents will always support him.

Student summary: Kevin is a top-ranked student athlete who identifies strongly with science and intends to become a biomedical engineer at a prestigious university, such as Duke or Stanford (see Table 4.1). He is enrolled in both IB Physics and Honors Anatomy

and Physiology. He has strong family support and his teachers confirm his academic excellence and strong self-efficacy.

Table 4.1

*Summary Key aspects of Expectancy-Value Theory for Kevin*

Student & Career Goal/ College	Key Social Influences & Career	Science/Scientist Definitions & Identity	Science Self-efficacy (Perceptions of his own abilities Re: subjects / activities)
Kevin Biomedical Engineering Duke or Stanford	Father (athletic director) & two coaches Mother: Pediatrician & Chemist Grandfather: scientist Two-parent household	<p><b>Science/Scientists</b></p> <ul style="list-style-type: none"> <li>◆ Science is about understanding how the world functions</li> <li>◆ People who ask questions and are not afraid of failure become scientists because they are always looking for answers.</li> </ul> <p><b>Science Identity</b></p> <ul style="list-style-type: none"> <li>◆ Formerly participated in STEM clubs &amp; organizations</li> <li>◆ Experienced college trips and did experiments</li> <li>◆ Great influence of outside science experiences, great influence and applications of physics to real life situations</li> <li>◆ Now more interested in different types of science, “when I understood the physics formulas I could use them and benefit from them.”</li> <li>◆ Black males have a void to fill</li> </ul>	<p>Favorite subject is Physics</p> <p>Helps other students; role model</p> <p>Ranked #1 in his class</p> <p>Honorable mention in district’s math competition</p>

**Bobby**

Bobby is a 16-year old African American male in the 11<sup>th</sup> grade. He lives with both parents and has no siblings. Bobby is enrolled in Mrs. Trent’s third period IB Physics class

and also enrolled in Mr. Dunn's fourth period Honors Anatomy and Physiology class. Bobby describes these science classes as among his favorites,

Because it kind of leads into the field I want to be in dealing with marine bio life. I want to be a marine biologist or either a veterinarian so it kind of makes me, um, look at myself and evaluate myself and inner self so I can help other things, not even being people but animals.

He carries a demanding class load and participates in the International Baccalaureate program. Bobby is an extremely quiet young man in class, yet a consistent participant. He gives few responses, and he usually only speaks to the person with whom he sits. In the Anatomy and Physiology class, he usually sits beside a female, although he has few conversations with her. He chose the class because of the teacher. He recalls,

When I heard that...some guys from my [basketball] team last year that graduated had Mr. Dunn last year, I'm talking about Anatomy and Physiology, they said that he was strict but then again he knew how to have fun. So when I had a spot on my, um, schedule to fill it, I remembered that and so I chose Mr. Dunn.

Bobby further describes the expectations of Mr. Dunn,

The first day...I walked in and had...a toboggan on. I forgot to take it off so he kind of like looked at me and was like, are you gonna take your toboggan off? And that's when I kind of knew that he was firm but he wanted the best for his young men in the class.

When he speaks in the Physics class, it is usually with the other males in the class, but not very much. He participates by asking questions to gain a deeper understanding of the subject. Bobby said, "Things in Physics make me think, well why does this happen or why when I add this and that, this does this? He participates in all lab activities, working mostly with other males in his lab groups, especially in Physics. Bobby speaks of having Mrs. Trent

as his 10<sup>th</sup> grade Chemistry teacher and states,

So, when I looked at my schedule and I saw that I had Physics, it kind of made me smile because Ms. Trent was good in Chemistry and I knew she would guide me along in Physics the same way.

This respectful young man stands about 5'10" and plays on the schools' varsity basketball team, sporting the number three; he is the starting point guard. He succeeds academically as well (confirmed by both teachers). He is well dressed and wears matching outfits, dressing a little conservatively. He is very proud of his school and so is his father. At a recent basketball game, Bobby and his father were dressed identically in matching warm-up suits; they were both in navy blue outfits with a white stripe down the side of the jackets (the school colors) and pants with the schools' mascot over the left front pocket. This was truly reflective of the pride they both shared for the school and a father for his 16-year old son. Bobby describes his parents' expectations for him,

I'm going to college. My parents have already said that. So I already know what to expect after I graduate. I know it's not going to be sitting around...I know that, regardless, I'm going to be attending university.

Bobby describes the expectations of his parents for him,

Since day one, they've expected me to do the best I can do in class and my school work is always first, then basketball, then sports and things of that nature. My parents have always driven me to be the best I can be in anything but when it comes down to school they know that's the bottom line. I mean with no school there's no ball, no phone, no electronics, no anything, so I know that what's expected of me is very high because I know that if I don't do what I'm supposed to do in the classroom that everything else will be taken.

When asked about being a Black male in science class, Bobby describes the following, understanding the comments from his teachers;

When my teachers see a Black male , 'cause there's several in my class, in my two higher level science classes...it makes them proud. Like Mrs. Trent said, when she saw that...some of her returning students coming back to enroll, that it made her happy that we were in there. And so did Mr. Dunn. Mr. Dunn said he likes giving back to his community, being...African American men or women, but he said the men more so because he doesn't see many men in his class that are successful and this semester I had the pleasure of being one of Mr. Dunn's students.

Bobby is well aware of his learning environment and describes the community atmosphere.

He says,

We're all in IB and that helps us with learning because we know if our friend's in our class, yeah we'll have some time to talk, interact with them but we know that together we can get through the problems that we have in that class.

But also describes students' reactions to his earning good grades in science and math, "at this school it's sort of stereotyped but it's not a bad stereotype. It's not like ...you're a geek or anything like that but when people see you score high on...your biology...EOCs...they kind of look up to you. So when they're struggling they might look to you for help...well, geez, [Bobby's] got a good grade...so he's pretty smart.

Bobby also describes his feelings when other students perceive him as being smart;

"Well when they look up to me it makes me feel good, like I can help this person or I can make an impact on this person." When asked about someone he looked up to, Bobby described his father as being influential in his life,

If had to say I had to look up to someone, it would be my dad. He's taught me everything I know, basketball, school, how to treat ladies, how to treat people around you...how to convey your thoughts...how to be a man, how to dress...always know your surroundings, just be aware.

Bobby also wanted to give his science teacher, Mr. Dunn, credit for providing some guidance to him. He explains, "He's taught me on several different occasions about my relationships... and...with people around me how to...not break so easily...how to be a strong

Black male in society.”

### **Teacher perspective**

*Mr. Dunn.* Bobby’s teacher, Mr. Dunn, described him as a “scholar athlete.” He described Bobby as a very quiet student who did not readily volunteer to participate in class but contributed when called upon. He was respected by his peers, academically focused, serious minded and a good writer. Bobby did not tolerate playfulness or foolishness in class. His grades were important to him, he maintained an A average in class. Mr. Dunn stayed in contact with Bobby’s parents to keep them apprised of his progress. He believed that Bobby’s parents kept him academically focused in school, active in his church community, and provided him with whatever resources he may have needed.

Bobby was also competitive with the other males in the class, specifically Kevin and Omar, he tried to keep up with them academically. Bobby had been in school and classes with these same students since they were in middle school; they all knew one another very well. They were a competitive class. Mr. Dunn said, “What I’m working on with him is his presentation skills, because he lacks being in front of people. He is a little shy but, he is a strong advocate for himself.” Bobby requested that Mr. Dunn allow him to enroll in this class, he was aware of the teacher’s reputation beforehand and desired to be in such a structured learning environment.

*Mrs. Trent.* Bobby was also in Mrs. Trent’s IB Physics class. She described him as a “smart young man” and she tried to get him to become “excited” about Physics, “to help him

love it,” because she recognized that he possessed the physics skills. He was strong in math and she could see that he wanted to do well. He sometimes dissociated from class when he got stuck. Because he had such potential, her goal was to keep him inspired and interested in science. She also insisted that he would think more scientifically and worked more independently. He did well as long as she stood with him, but she wanted him to have the self-confidence in knowing that he could solve the problems alone. He appeared to be self-doubting at times. He did ask for help when he needed it and was working towards meeting the expectations of the class.

Mrs. Trent described Bobby as a respectful yet sociable young man. He interacted with all of the students in class; they respected him, she thought, more because of his athletic prowess on the varsity basketball team than because of his academic talents. His fellow classmates saw him as someone who was going to do something important one day. Bobby was smart, but he liked to slack off and could be distracted rather easily. He learned best when he was engaged with the physical manipulatives and “doing labs,” as he had to see something happening; he did not like taking notes. However, Mrs. Trent said, “going through solving problems together does help him learn it [the material].”

### **Parent perspective**

Bobby’s parents were attending a Saturday afternoon basketball game, when they were asked directly and invited to participate in an interview. Bobby’s father agreed, but Bobby’s mother wanted to do the interview. She said that she did not have a college degree, but her husband did, and they encouraged and supported their son. When asked about

Bobby's ability to do science, she spoke of Bobby's natural talent, his curiosity, and his interest in wanting to know why things happen.

His parents have also instilled in Bobby the values of "being a standout" by being a very strong African American male who "represents himself and his family well." He has always been in "academic" level science classes as he wants to be a veterinarian or marine biologist, because of his love for animals. Bobby's mother stated she and her husband felt very strongly about the support they gave their son and the confidence in him that he could do it [Physics] on his own. But, if he needed anything, such as tutoring or supplies, they would provide it. She also said that Bobby often explained science concepts to her when they were observing events.

When asked about possible factors he may face as an African American male, Bobby's mother said that "some people will still stereotype her son as a struggling Black male, but for him, that will not be the case." "He is a smart Black man" she explained, "We want him to have that edge of being successful and being able to go out in the world and say...my parents have taught me well. They have given me the things I need, the tools...to succeed."

Student summary: Bobby identifies strongly with science and is simultaneously enrolled in IB Physics and Honors Anatomy and Physiology. His future plans include becoming a veterinarian or marine biologist and attending college at North Carolina State University for their veterinary science program. He is also contemplating attending Mississippi State or UNC-Asheville to play basketball. He is a scholar athlete and has strong

family support. His teachers verify his confidence in his academics and his strong self-efficacy. He identifies both courses as being among his favorite subjects.

Table 4.2

*Summary of Key aspects of Expectancy-value Theory for Bobby*

Student & Career Goal/ College	Key Social Influences & Their Careers	Science/Scientist Definitions & Identity	Science Self-efficacy (Perceptions of his own abilities Re: subjects / activities)
Bobby	Father (office worker)	<b>Science/Scientists</b> ♦ Science is about trials and errors. The goal is to make something happen that will benefit someone while working with other scientists ♦ Self-motivated people become scientists	Knew the physics teacher would guide me in class
Veterinarian or Marine Biologist	Mother (no college degree)		Felt prepared coming into physics
North Carolina State University, Mississippi State, or UNC-Asheville	Mrs. Trent, Physics Teacher	♦ Science is about asking questions ♦ Inquisitive people become scientists	Willing to help others
	Two-parent household	<b>Science Identity</b> ♦ Worked in summer camp interacting with kids learning science ♦ The overlap of concepts in science classes influenced him towards the sciences along with a love for animals. ♦ Relates to characteristics of scientists	Physics and Anatomy & Physiology are among his favorite subjects

**Edward**

Edward, an African American male, is a 17-year old senior who takes a demanding class load. He is an only child and lived with both of his parents. Both of his parents were college educated. His father was a high school performing arts teacher at the high school he attends and his mother was a social worker for the county. He was in Honors Anatomy and

Physiology during the 4<sup>th</sup> block with Mr. Dunn and enrolled in Advanced Placement (AP) Psychology, 20<sup>th</sup> Century History, and AP English IV. Edward described his participation in these classes as being competitive and his belonging to several clubs at school, including performing in theater and the Drama Club, because he “didn’t want to just do one thing, but I wanted to...do a bunch of different things.” An avid reader, he also belonged to the schools’ book club. Edward expressed how he loved to read, “especially...biographical books...I also like watching like CNN...and the news and you know...most teenagers find CNN and other news outlets boring but I actually find it interesting”. His future involves law and becoming an advocate for individuals with disabilities.

Edward was a very quiet student in school; he did not volunteer very frequently in class, but usually answered correctly when called upon by his teacher (during observations). He hesitated somewhat but answered when called upon by his teacher. He has a small frame and was always well dressed in jeans and usually a collared shirt. On occasion he dressed in slacks, a necktie, and dress shirt. He always sat near the front of the class, as his vision was weak, evidenced by the eyeglasses he wore. He was extremely well-mannered and always, without fail, addressed adults with a “sir” or “ma’am.”

This young man was very intelligent and was usually on the honor roll. He applied to several colleges and was waiting on all of the responses before he made his decision as to which one he would be attending. He informed the researcher of his struggles in his young life because of his premature birth, weighing less than two pounds at birth. He spoke freely

of being in the Neonatal Intensive Care Unit for several weeks before his parents were allowed to take him home. He credited his parents, grandparents, and aunts with providing him with love, encouragement, and support to make him a successful individual. Edward said,

My family, they have very high expectations of me...my dad's always saying...'can't is not in your vocabulary'. My family has huge expectations of me because I'm the only male. For my parents, I'm the only child...You set the expectation for everybody else.

He further described the comments from his family members and how they used him to inspire other family members. "My aunts, they always tell my cousins...if [Edward] can do it with all he's been through...there's no excuse for you."

Edward informed his parents of the classes he wanted to take this year, such as Anatomy and Physiology, because he wanted to have the experience his fellow classmates had when they took Mr. Dunn's class. They shared with him how the class was challenging yet fun at the same time. Edward explains, "My parents...didn't have a chance to take advanced classes...they know that these advanced classes is what's going to set me apart from other males...and other African American males." Edward explained there were only seven African American males in his other class, AP Psychology, and described them as "inquisitive, just as I am, but they also...I think they feel too that they have a lot to prove" in comparing himself and others to the females in class. In two of his other IB classes, Edward said he is the only male and felt he had a lot to prove. He stated, "Then, you also feel that you have to speak up for the males, even if that's not the case." His perception of a male in

society is to be a provider, caring for his family.

When Edward was asked about role models being of the same ethnic background, his response was,

I don't really look at that...I do think that it helps having...those that you look up to as the same background, especially being a minority because you already feel that you're at a disadvantage and you feel that society isn't equal, as the law may tell you that it is and you know that certain people get advantages. So just seeing someone...in your same racial group...is very important.

When asked about the type of person who goes into science, Edward made some comparisons. He stated,

We're very creative and we have this huge artistic side about us...in our everyday life...and athletes are the same way...I think those type people that are always inquisitive and they're always trying to ...see why things work and why things are the way they are...those are the type of people that really get that inkling to say, hey, I want to go into science, I want to do this.

### **Teacher perspective**

*Mr. Dunn.* Mr. Dunn described Edward as a deliberate and consistent worker who had some special needs; some of his assignments had to be modified because of his visual disability, but he was well respected and liked by his peers. Mr. Dunn complimented him on his strong presentation skills and noted he was strongly involved in drama activities at the school. He does come from a theater background, from his father. Edward often sought additional assistance from Mr. Dunn and came back after school for additional tutoring.

Mr. Dunn knew that Edward had very supportive and college educated parents who provided him with any resources he needed to complete his assignments. His parents made it

clear about their academic expectations for their son; it is expected that he will do well in this honors science class and further his education by attending college upon graduation. He was a focused student and did not waste class time. He liked to sit alone, but Mr. Dunn preferred to sit someone next to him so that Edward had someone to work with. He asked for help when needed and his classmates were very supportive of him. Mr. Dunn said, “His dad wanted him here in this group. Whether he was going to use this as a career or not, he just wanted him here for the structure.”

### **Parent perspective**

Edward’s father described him as ambitious and functioning at a high level in science when asked about his ability in science. He shared how proud he was of his son and his academic accomplishments, particularly in the completion of his science projects in class, but suggested that Edward could probably do more. He believed Edward was always willing to learn more in science, especially as his confidence level increased, and agreed that the advanced science course Edward wanted to be in was the appropriate level science course for him. Edward wanted to be in the advanced courses. Edward’s father said he was well aware of the challenges the class would present but he wanted the structured environment offered by Mr. Dunn. Edward’s father believed his son had very supportive peers in class and could ask any of them for help, if needed. Edward’s parents have provided their son with the academic support and resources he needed to succeed. Academics are a high priority in his

family, and they provided a strong support system that extended to his grandmother and aunts.

During the parent interview, Edward's father spoke of their discussion about "embedding science instruction" in theater and how they are intertwined. Edward's father admitted there were factors that African American males may have to contend with that other students do not. As a case in point, he stated that the African American males were not viewed as being academically ranked in the top of their classes and were often misplaced into standard classes instead of being placed into advanced level classes because that was where the students thought they should be. He helped his son to deal with those factors by encouraging him to study, work hard, challenge himself, and work on his time management skills to help him excel in his classes.

Student summary: Edward enjoyed the Honors Anatomy and Physiology class but had little interest in pursuing science. He was a very quiet young man who plans on becoming an international studies or civil rights attorney. He has a very strong family support system, an unusual visual disability, and a strong self-efficacy in his academic abilities. Edward had no stated science identity but enjoyed the activities in science class. He plans on attending North Carolina Central University for undergraduate studies and eventually attending their school of Law.

Table 4.3

*Summary of Key aspects of Expectancy-value Theory for Edward*

Student & Career Goal/ College	Key Social Influences & Career	Science/Scientist Definitions & Identity	Science Self-efficacy (Perceptions of his own abilities Re: subjects / activities)
Edward	Parents & extended family (grandmother & aunts)	Science/Scientists ♦ Challenging science class.	Engages in science class
International Studies or Civil Rights Law	Two-parent household	♦ Goal of science is to observe and view substances around you ♦ Scientists are creative like artists & athletes	Picked up on class easily, (struggled last year to understand the science teacher)
NCCU	Mother – Social worker Father -Theater Arts Teacher	♦ Scientists are inquisitive people, trying to see why things work and why things are the way they are, asking questions Science Identity ♦ No stated science identity	

**Omar**

Omar is a 16-year old African American male of Nigerian origin. This young man was a very active participant in Mr. Dunns’ 4<sup>th</sup> period Honors Anatomy and Physiology class. Omar responded very frequently in class. He read his materials before coming to class, as evidenced by his responses in class. Omar found the sciences rather easy, and understood concepts rather quickly. He is an honors student, but afraid that his grades were not where he wanted them. He expressed his desire in attending Duke University, but feared he may not have the grades for admission. Omar stands about 6’1”, a clean cut, well dressed young man who is the starting center on the schools’ varsity basketball team; jersey number

#44. He was confident in his abilities, even as he recognized his weaknesses. Omar acknowledged that he needs to earn a scholarship to attend college, as he had three siblings at home, where he lived with both of his parents.

Omar was in the IB program and carried a demanding course load. He was currently enrolled in two advanced level science classes: he was in Honors Anatomy and Physiology and IB Chemistry II. If he had to select a favorite class it would have been Anatomy and Physiology. Despite his aptitude for science, his least favorite class was IB Chemistry II, not because of the content but because of his experiences with the teacher, whom he did not care for.

Omar engaged in many activities outside of school. He was involved in his church and was in the process of getting confirmed. He was also a member of a school fraternity (a high school leadership development organization) and the National English Honor Society. Basketball was his favorite activity. He used reading, running extra laps in the gym, and playing basketball for relaxation.

His participation in a summer program offered by the Environmental Protection Agency (EPA) was a pivotal point in his vision of his future. He learned from the EPA program that the material learned in school is applicable to his future accomplishments and goals. Participating in this summer program at EPA made him consider science as an option. Omar said,

The EPA program was... fun and it...showed me ...the results of really studying in school, so I see like this is where you can really end up liking what you're doing instead of just being forced to do it. You're actually doing what you like and I was

really interested in being there someday.

Omar believed the goal of science was to learn new things and that curious people were individuals with a strong mental acuity who had determination and perseverance and liked to figure out things. He intended to participate in another summer research program at a local university this year and planned one day to be involved in Neuroscience or Neurobiology.

Omar described his science experiences in his Honors Anatomy and Physiology class, stating,

Well Mr. Dunn has been great and fun and...although I might say, I knew a lot of the stuff, we revisited the topics in a way I hadn't really understood 'em and it made 'em fun and interesting and made me eager to learn everything. It made me eager for the next day so it was always fun.

The class had developed a gender competition. The other males in the class looked to him and Bobby to help push the males beyond the females in class. Omar believed becoming a scientist was an easier task for a male because his vision of a "scientist" was of a male in a lab coat. He said, "There is probably one female scientist for every five males in a lab coat thus the job was made for a male."

When asked what it means to be a male in society, Omar stated, "Males are expected to like run like everything or be involved in ...like being like the supporting...the foundation for society." He recognized there were normal stereotypes such that men were supposed to be stronger and the head of the household. His view was that females were expected to do better than males in society and saw the females as scoring better than he did in class. Omar

acknowledged that society viewed African American males with ambivalence. Any decision made by a Black male seemed to be the wrong decision. People of other ethnicities were quick to judge a Black man depending on the way he dressed. If he dressed in a manner that society viewed as “thuggish” with sagging pants and a “do-rag”, many felt threatened. He continued by saying, “if he [Black man] is dressed ...in a...sensibly, like business-wise or something and then he walks past like another Black male ...and that Black male would turn against him because he’s thinking...like ...he’s not like his own race. He’s just associating with White people so...either way, it’s...the wrong choice.”

When asked if his role models had to be Nigerian, Omar replied in the negative. He described a role model as someone “that I aspire to be...someone I guess that does everything right or looks like they do everything right.” He viewed a former student, Mariah, as being an influence for him. As an underclassman, he heard of her accomplishments and felt he could do the same. He admired her because of her accomplishments; she received the IB diploma and the Bill Gates Millennium Scholarship (paying for six years of college) to attend Dartmouth. He stated that his role model had to be someone he could envision himself as.

Omar described his family’s expectations for him, he said, “They expect me to go to a good college for free...through academics.” He knew this because this is a mantra they told him daily. Omar described an example of his parents’ comments, “It seems like they [colleges] offer student loans and it’s four of us so it is going to be hard if we all have student loans to pay for, pay to go through college.” His parents thought he should study medicine in

college to become a doctor. His mother was a nurse working in the catheter lab at the Veteran's Hospital and his father worked as a therapist at the mental hospital in an adjacent city.

When asked about his friends, Omar said he had different friends this year because of his new classes and the groups that he had joined. Being in the Kappa League fraternity had introduced him to new people in addition to his friends on the basketball team. He felt secure and popular when they acknowledged him in the halls. Omar viewed sharing grades as a middle school phenomenon. Now, he desired that his grades be kept private for multiple reasons. He did not seek to be viewed as the smartest one in the class and was concerned that a day may come that he may not do his work and his grades would suffer. However, he was very confident in his abilities, and he would help other students. He said, "It's like genuine help, I usually help other people, but if it's something I didn't do, then I might get the help from them."

#### **Teacher perspective**

*Mr. Dunn.* Mr. Dunn described Omar as a very bright young man who brought a wealth of science knowledge to the class. He was strong minded, well respected by his classmates and had a clear science focus with strong comprehension skills. As an inquisitive learner who challenges himself and others, Omar offered much in the classroom. Coming from Africa, he was academically focused and placed a priority on education. He was strongly interested in a science career and wanted to attend Duke University to pursue a

medical career in neuroscience. The variety of reading he did for pleasure added insightful information to the class. One of the few weaknesses Omar exhibited was that if he lacked an interest in something, he did not give it adequate attention. He was viewed by his classmates as being very smart, second to Kevin. He balanced his athletics with his academics. Omar preferred a lecture style type of learning and was a strong writer. He said he was taking this class to prepare himself for his future. Mr. Dunn stated that, "Omar wants to be a doctor or something in the medical research area."

Student summary: Omar, a scholar athlete, was enrolled in Honors Anatomy and Physiology as well as an IB Chemistry II class. His favorite class was Anatomy and Physiology. He was a very quiet student with a strong science identity and had a high level of self-efficacy. He planned on attending a prestigious university and pursuing a major in either neuroscience or neurobiology. His parents were very encouraging and supportive of him.

Table 4.4

*Summary of Key aspects of Expectancy-value Theory for Omar*

Student & Career Goal/ College	Key Social Influences & Career	Science/Scientist Definitions & Identity	Science Self-efficacy (Perceptions of his own abilities Re: subjects / activities)
Omar Neuroscience or Neurobiology	Mariah (college student, neurobiology major) Mother (Nurse)	Science/Scientists ♦ Science is about the study of something and learning new things. ♦ People with curious minds, perseverance, determination and ranks in the top of their class become scientists	Good in Science  Learned science information in new ways
Duke University	Father (therapist in mental health hospital) Mr. Dunn (Science Teacher)  Lives with both parents	Science Identity ♦ I have the mental acuity and curiosity to become a scientist. ♦ I was influenced by summer science programs.	Anatomy & Physiology was the favorite class  Fun to learn challenging information and eager to learn for the next day  Participated in summer research program at EPA

**Terrance**

Terrance is a 16-year old African American male in the 11<sup>th</sup> grade. He was always nicely dressed and was a cheerful guy. As one of the most active students in his Anatomy and Physiology class, he was often the first to raise his hand to answer a question posed by Mr. Dunn asked or he would just blurt out the response. He quickly volunteered to assist the teacher, such as distributing books or papers or demonstrating a point in class. He seemed to aim to please Mr. Dunn. This student was a very pleasing, pleasant, and intelligent young man. He was likable and wanted the teacher to be proud of him. During the class

observations, he made frequent eye contact as if to say, “I am doing well in this class, see how much I know!”

Terrance was enrolled in several honors courses, Pre-Calculus, Advanced Marching Band, Honors Anatomy and Physiology and Spanish II. He stated that his favorite class was the Anatomy and Physiology class and when asked what it was about the class that he really liked, he responded;

Mr. Dunn...he’s a great teacher. I’ve been with him for two years now, always had his class, since I was a sophomore. And...he’s just one of those teachers that...really captures your learning...triggers your learning experience and he’s not even...just a regular teacher. He teaches outside of the books. That’s what I like about it.

When he was asked to describe his science class experiences this year, Terrance said (about his new Physics class),

I can already see that in her [Mrs. Trent’s] class...it’s going to be fun but it’s also not going to be a walk in the park. ...It’s going to be a good learning experience throughout the whole entire semester.

Terrance felt they had a family atmosphere in Mr. Dunn’s Anatomy and Physiology class because he said,

He’s not beating your head with a textbook. It’s more of...learn at your pace and if you don’t get something they will go back for it and...the students in the class actually do help out a lot with the learning process in this class.

For example, when Terrance was absent for two days, a female, Bobby and Omar all texted him to make sure he had the missing assignments and knew where to find some helpful information from the textbooks so that he would not fall behind. Terrance felt these classmates were helpful and supportive of him.

Terrance spoke of his elementary science experiences as being his least favorite and the most boring subject, he emphasized that this feeling about science persisted until he got to high school Biology with Mr. Dunn. Then all of a sudden, Terrance said, “it was hoorah for science, he got me really intrigued into science.” He said after hearing guest presenters from Neurobiology, he was inspired to have an internship somewhere to have the experiences in science they described. He also related the speakers to his middle school science experiences in a program called *BOOST* in which the students visited a local university and experienced hands-on science activities such as extracting DNA from strawberries. Terrance said this was an eye opening experience for him, as he did not realize DNA could be extracted from strawberries.

These experiences have allowed Terrance to believe he could become a scientist; he felt he had a curious attitude and could investigate the unknown. He said, “Mr. Dunn’s class...made me really believe that if you work real hard...you get paid off for it.” The goal of science was to understand the unknown things in this world and scientist obtain their ideas from experimenting. The more they experimented, then the more they wanted to know, and they were always asking the question why? Terrance gave an example of a mint dissolving further describing that a scientist wanted to know why it dissolved and that the answers were not always immediate and could take a while to discover.

Terrance believed that science gets shortchanged in society, there needed to be more funding available for science research. In this way, the United States could forge ahead of everyone else in the world. He believed that anyone could become a scientist, “you know,

science...Einstein dropped out of high school so...anybody can become a scientist...your average drug dealer can be a scientist.” Terrance believed his curiosity could make him a scientist, along with his work ethic.

When asked about being a male in society, he did not believe that males had any advantages over females: they were fairly even. He stated, “I believe that I am supposed to pull more of their weight... [do some] household chores...I should be at the top of my game all of the time.” Males should have a competitive spirit. He believed there were many opportunities available for Black males, but society as a whole does not want Black males to prevail as much as other races due to historical aspects and stereotypes. He said, “Black males must take advantage of those opportunities that are available, such as the scholarship programs.” While it was good to have role models or someone to look up to, Terrance stated,

I don't believe they have to have the same background as I do, but it would be more of a relationship or a connection. There would be more of a connection between me and that idol because of where we come from.

People around him, such as in his Anatomy class, gave him that “Huxtable” feeling (referring to a 1980's television show about a middle-class Black family); they had a fun time while getting their work done. He believed he had a good outlook on society, although he said he had not experienced much in life, yet.

Terrance described his friends as belonging to two types: he had one set of friends in class who was academically focused and another set of friends, outside of class, who was not academically focused. The second group lacked that ‘go get it’ attitude, they did not want to do anything and they certainly lacked aspirations for science. Some of them focused on

Social Studies and English. He had some of the same friends as last year but simply added more friends this year. He did not mind sharing his good grades with his friends because then they would know that he did well in school. If Terrance made good grades, he felt good, but if he made bad grades he preferred to keep them private. He said that he and his friends joked and ridiculed each other about getting punished (beatings) for earning bad grades because, after all, they were competitive.

This young man expressed his interest in the schools' marching band. He had always wanted to be in the band and now he is in, he plays the trombone. He was also active in a high school fraternity organization at the high school, and planned to play golf again this year. In addition, Terrance volunteered at the local community center helping elementary students complete their homework, giving advice and providing direction for young learners.

There were family expectations for Terrance to earn good grades and learn as much as he could in school. He spoke of his experiences in elementary school of being punished when he did not earn good grades. He would lose privileges; for example, no video games, which in term inspired him to perform better in school and earn better grades. Terrance said, his mother described his attitude and work habits as being similar to hers and she wanted him to do better than she did. When asked about his family members expectations, he said,

They expect me to go to college. I will be the...not the first, but...it seems as if I will graduate high school, and I will go on to college, and I will graduate from the campus. And I will be the first in my family to do that.

He and his mother have had some conversations about his education beyond high school; she

helped him with gathering information for taking the SAT trying to raise his scores. They have also discussed careers options, but Terrance remains uncertain as to his future plans.

Terrance's priority is trying to do well in band class and to obtain and learn a solo piece in preparation for a band college scholarship audition. He has envisioned himself earning a scholarship to pay for college at an HBCU (Historically Black College and University). Terrance said he would seek the assistance of the school's college counselor to help him prepare for his future college career.

When asked about someone who is influential in his life, Terrance responds with,

My mom...the reason why I say that is because she always wants me to be better than she is. She says...she keeps saying I am just like her, I am exactly like her and she wants me to be better than her so she gives me advice to be better than her.

He heeded her advice and thought if all students were to take some advanced science classes they could help move our country forward to flourish in the area of science. But, to get students, especially Black males, into these advanced science classes, Terrance said,

I think one thing that should be implemented into science classes to get more Black males in there is to have an African American teacher. And, to have an African American teacher...it would be more of a relationship between Black males and an African American teacher.

Terrance believed students needed teachers, like Mr. Dunn, who could intrigue them and move them away from the boring, textbook driven classes with the "awful environments" and build relationships and environments in which they could learn science.

### **Teacher perspectives**

*Mr. Dunn.* Mr. Dunn described Terrance as "very energetic and participates a lot in

class and likes to talk, likes to express himself, and has knowledge about a lot of things.” He said that Terrance was a student who needed a very structured environment. Having taught him in Biology I, Mr. Dunn noted that Terrance thrived on the attention because it gave him a chance to show off his knowledge in the class; he was inquisitive. He had a tendency to “think well outside of the box” but Mr. Dunn sometimes had to help him focus his attention in class and stay on topic. He did not have as many material resources as some of the others in class but he did well in class in areas in which he had a strong interest. If he was not interested, he did not fare as well. Terrance needed help with organization and Mr. Dunn worked with him to keep him organized in his work habits. Mr. Dunn stated that Terrance was more musically inclined and was uncertain if he had a strong science focus for the future. However, Terrance stayed after school for extra help, to finish some work or to just sit and talk with Mr. Dunn about college, his behavior, and his future. Mr. Dunn further described Terrance as a hands-on learner; “he still talks about his experiences in Chemistry and how he really liked that. So, I think he may like Chemistry a little more than he did Anatomy but he wanted to be with me.”

### **Parent perspective**

Terrance’s mother completed the interview by telephone. She described her son as a curious young man who needed to be continuously challenged in class. He had always been interested in how things worked such as the systems in the human body. His interest in things was a trait that contributed to him excelling in school. She described him as a smart kid who was not performing up to capabilities in science, but he had a sincere interest in the

sciences. She attributed Terrance's interest in science to one of his elementary school teachers, who always involved her students in some sort of hands-on activities in class. This early interest has continued with him into high school.

On his way home from school on the day of the parent interview, Terrance described his interest in the hands-on activities he had experienced in class that day. She admitted she did not know her son's current science teachers and left the completion of his projects up to him. She listened when he spoke with anticipation about the activities yet to be completed in his new Physics class, and knew that he liked cause and effect reactions.

Terrance's mother said he had friends in his science class, but most of his friends were in the band. He really loved the band; she said "He is married to the band." She supported him academically, and if he needed anything, all he had to do was ask. She also offered her advice to him and left it up to him to accept it and/or make changes. However, there were some things in which she did not give him a choice, one being the selection of the honors level science class. She told him he had to take a challenging class; she just did not say which class it had to be. Terrance chose to take the Honors Anatomy and Physiology class, and also enrolled in Physics for the next semester.

Terrance's mother admitted that she did not perform well in science when she was in high school. She did not like Biology, nor could she handle the dissections they were doing in class, and advanced courses like Anatomy and Physiology and Physics were not even offered. She did not have a knack for science, but has used opportunities at home, while cooking, to discuss the importance of science to her son. She stressed the use of fractions

and measuring at home because it was also important at school, explaining that solutions must be combined in appropriate proportions to obtain the desired results, such as in baking a cake.

Terrance's mother stated that her son had a job of going to school and the presence of African American males in advanced level science classes should be the norm instead of the exception. She said she came from that "old school" where African Americans had to work twice as hard as others in order to succeed. Instructing Terrance to work twice as hard was her advice to him as that is how she helped him deal with those factors, such as being stereotyped as low performing, that African American males have to deal with that are not issues for other students.

Student summary: Terrance, a very social young man, thoroughly loved the band. He was enrolled in Honors Anatomy and Physiology then enrolled in Honors Physics for the next semester. He had a sincere interest in science and considered science as a possible option for his future. Anatomy and Physiology was his favorite class, but he remained undecided about his major for college. He moderately identified with science and wanted to obtain a band scholarship to attend college. Terrance had strong support from his mother, his science teacher, and high self-efficacy.

Table 4.5

*Summary of Key aspects of Expectancy-value Theory for Terrance*

Student & Career Goal/ College	Key Social Influences & Career	Science/Scientist Definitions & Identity	Science Self-efficacy (Perceptions of his own abilities Re: subjects / activities)
Terrance	Mother (cashier)	Science/Scientists ♦ Science is about curiosity and finding out, questioning the unknown and understanding everything. ♦ Scientists do experiments to answer questions	Anatomy & Physiology was his favorite class
Maybe study science but undecided	Mr. Dunn, Science Teacher		Expecting Physics to be a fun and challenging experience
South Carolina State		Science Identity ♦ After taking Biology & Chemistry, he decided science is something he wanted to do, because now he has been intrigued by his Anatomy and Physiology teacher. ♦ His curiosity and work efforts could make him a scientist ♦ The neurology speakers in class also had an impact on him ♦ Science programs have influenced him.	Loved the helpful family atmosphere in Anatomy & Physiology

**Ricky**

Ricky is a 16 year old African American male in the 11<sup>th</sup> grade. He is enrolled in Mr. Dunns' 4<sup>th</sup> period, Anatomy and Physiology class, and usually sits at a desk by himself in class. He was a very active participant in class and enjoyed responding to the teacher's questions. This researcher observed the admiration that this young man had for his science teacher. He readily volunteered to answer questions in class, pass out textbooks and distributed other materials in class. He consistently worked to please Mr. Dunn by answering questions and shared his experiences in class and observed as a very helpful participant in

class. He was also quick to ask clarifying questions on concepts he was not certain of or anything he deemed needing further explanation. He was a friendly and a happy young man.

Ricky spent his time outside of class preparing for football, working out and conditioning. He had been playing football since his 8<sup>th</sup> grade year. He said, “That was my first time playing and since then I really liked it, so I just stuck with it.” He occasionally played basketball and liked reading articles about football.

Ricky found the Anatomy & Physiology class very challenging compared to his previous science classes, which were Biology, Physical Science, and Earth Science. He did not have good experiences with his previous science teachers. During his freshmen year the teacher suffered a stroke at the beginning of the semester and did not return, essentially not having a science teacher but a substitute teacher for this science class. During his sophomore year he had a physical science teacher with a very strong African dialect which made it difficult for him to understand, he struggled to grasp the concepts. Ricky then had Mr. Dunn for Biology and said, “I really like Biology and animals and stuff like that so, I picked up on it easy and ended up doing really good in the class.” He was an animal lover and grew up having cats and dogs around the house. He has raised three turtles since he was eight years old. Participating in the activities in the Anatomy class increased his interest in science and he said “I think...how fun it...would be better for me to keep going with this researching, experiments and things.” Although Ricky is uncertain of his future aspirations as they relate to science, he admitted his occasional laziness and the heavy workload of a scientist could be a hindrance to pursuing science. He also believed, “a lot of curious people have great careers

in science because they like asking and answering questions; anyone can become a scientist if they put their mind to it.”

When asked about being a male in society, Ricky said his expectations were not as high as they should have been for a Black male,

I think I should be more mature, and just from my past experience, I think I have to grow up a lot faster than I usually would, and knowing what the right time and place for certain things and knowing when I can talk and can't, and things like that. As a Black man, you have to know your limits.

He believed it was a little different for African American females; they could excel depending on how they carried themselves. When asked if his role model had to share his same ethnic background, Ricky explained,

Yeah...definitely. Because...it's a little different seeing a White man with a lot of money than seeing a Black man with a lot of money because, in society, White men ...I guess you could say are expected to be...successful, where it's the complete opposite for a Black male.

He believed there were differences in the expectations for various ethnic groups in society.

Ricky admitted he had difficulty retaining the small details covered in class as he was not as detail oriented as the females were in class. He did, however, feel that his ideas were respected by the teacher and his classmates. He said he had the tendency to go off topic a lot but the teacher kept him on track. He persistently asked questions in class about a variety of things and described himself as being curious.

When asked what his family members expected from him in high school, he said,

I want to say they expect too much of me but they expect a lot of me. ...they want me to...be really successful with my grades and...college right now is one of my main priorities...especially with this football thing I'm trying to take. So the grades,

they're really heavy on me with grades and then it's...the football...balancing that out.

While Ricky focused on attending college, he aspired to receive an athletic scholarship. He is one of three male children, the middle child, in his family. Ricky said his mother focused on his grades but his father promoted football and his preparation for college and eventually playing for the National Football League. Ricky concentrated on his future in football at UNC-Pembroke or NC State and has spoken to both coaches, a couple of times.

When describing his family's expectations beyond high school, Ricky explained,

One time, my mom told me whatever I do, she just wants me to be happy and be successful and not struggle. My dad...really wants me to be in the NFL but that's a priority for me but, it's not a main priority. Mine is just being stable, like being financially and emotionally stable in life.

He was considering animal studies or chemical studies in college; he has been slightly influenced by all of the research organizations in the county in which he resides, and focuses on having a satisfying future.

Ricky described his friends as having different future goals than he has. They follow two completely different paths but he tried to maintain his focus on football. Ricky said of his friends, "Like they're on the streets and all...they're not really into the school and the football thing, and I try to keep myself centered on this." He admitted that he and his friends had similar opinions about science and math but confessed they all struggled in math, so he sought assistance from his football coach. The coach helped the players find the academic assistance they needed in school. He earned good grades in his classes and when others found out his grades they were shocked, according to Ricky, they did not know he was that

smart. He would keep his grades private if they were not satisfactory. Ricky said he encouraged others to “do better” when they did not get good grades in science and math but when speaking of others finding out about his grades, he remarked, “...I like that feeling, I like proving people wrong,” referring to others finding out that he actually earned good grades in school.

Ricky looked to his football coaches for advice and relied on them steering him in the right direction. He also viewed his father as being very influential in his life because, “he is a provider, working 12 hour shifts and overtime to provide for the family.” His role model was “someone who does what they need to do and still have time for leisure things and still have fun with their life, who still has that great work ethic.”

### **Teacher perspectives**

*Mr. Dunn.* Mr. Dunn described Ricky as an academic athlete whose interest lied in playing football as a career. He characterized Ricky as smart, a little lazy at times, and at times, ill prepared for class. Mr. Dunn taught him previously in Biology and said, “He wanted whatever I was teaching.” Mr. Dunn stated that Ricky had great potential and could think fast on his feet, but he had a weakness in time management. For example, “projects are always in, but they’re always late.” Mr. Dunn knew that Ricky wanted to earn an athletic scholarship for college to play football and has planned for football to be his ticket to college (his family thinks so too), but he is in need of more structure in his life if he is to reach this goal. Mr. Dunn said, “He is very popular among the students; most football players are, and he’s [a] very pleasant and pleasing young man, always very willing to help out and he’s very

observant.” Mr. Dunn described Ricky as a very consistent student who liked the challenge of working with others who were a little smarter than he was. Ricky played the “devil’s advocate” in cooperative groups and challenged the ideas of the group with ‘what if’ questions. He liked participating in classroom discussions; it seemed that he came alive during those discussions. Mr. Dunn maintained close contact with Ricky’s parents. Mr. Dunn said, “Having had biology... [Ricky] wanted to take something else under me.”

### **Parent perspective**

Ricky’s mother completed the interview by telephone. She described her son as an average student in science who could perform better if he applied himself a little more. When he had an interest in something, he worked more diligently than when he had no interest. Ricky took it upon himself to enroll in Honors Anatomy and Physiology. When asked about the class by his mother, he explained to her that colleges would be looking for courses that challenged a student. Ricky’s mother explained that she was glad he wanted to challenge himself a little more and become a stronger student.

Ricky’s mother said he was influenced by one of his African American teachers, whom he admired. He shared with her how the teacher was so professionally dressed with his suits and matching shoes and how he wanted to emulate him. The teacher’s advice to him was to work hard, earn good grades; go to college and emphasized he could make earnings to afford those same items.

Some of Ricky’s classmates were described as being helpful to him in class when he struggled. They worked with him to bring him up to their level as described by his mother.

She stated that most of his friends were on the football team, but he also had supportive peers in the Anatomy and Physiology class.

When asked about the academic support he received from his family, Ricky's mother stated that as his parents, they would always describe real world scenarios to him; if he wanted to go to college then he had to have good grades, as mediocre grades would not get him what he wanted. They also attended school meetings and events in support of their son, especially helping him to prepare for the SAT and ACT, and speaking with his school counselor. She checked his homework, asked if he needed assistance, and evaluated his grades to see if he was struggling in any subject. Ricky's mother described her own high school science experiences as almost non-existent and boring.

Ricky's mother described a particular factor that her son may have to deal with based upon his appearance, such as sagging pants. She believed that African American males are stereotyped and judged on their choice of clothing. She consistently encouraged Ricky to keep his pants pulled up so that he was not viewed negatively by society. She believed police officers often miss-judged the African American males solely on their physical appearance.

She helped her son deal with those factors by having continuous conversations with him about his image and encouraged him to associate with the right students, not those who were negative influences on him. Ricky said he had some friends, from middle school, who "wilded out," changed, started smoking "weed" and stuff like that. Ricky's mother said her goal was to keep him away from those negative influences and pushed him in a positive

direction. Ricky admitted to her that he did not socialize with those boys anymore and recognized they would not help him get into a good college but could serve as a deterrent.

Student summary: Ricky was a very energetic young man enrolled in Honors Anatomy and Physiology. He intended to attend college on a football scholarship with the future intent of playing in the NFL. He loved animals and planned on studying animal studies in college. He was influenced greatly by his parents and his football coach. Ricky has a moderate science identity and high self-efficacy.

Table 4.6

*Summary of Key aspects of Expectancy-value theory for Ricky*

Student & Career Goal/ College	Key Social Influences & Career	Science/Scientist Definitions & Identity	Science Self-efficacy (Perceptions of his own abilities Re: subjects / activities)
Ricky	Father (Plant worker)	Science/Scientists	Easily picked up on science concepts
Animal Studies & NFL	Mother (clerk in human resources)	<ul style="list-style-type: none"> <li>◆ Science is about answering questions, viewing the world around you, and understanding the things that occur and being able to explain them</li> <li>◆ Curious and adaptable people who like asking and answering questions become scientists</li> </ul>	Liked Biology and animals
College football scholarship	Football Coach		
UNC-Pembroke, North Carolina State University	Science teacher, Mr. Dunn	Science Identity <ul style="list-style-type: none"> <li>◆ Class better prepared him for the future</li> <li>◆ Class really challenging, have high interest and learning in class, enjoyed the experiences in class</li> </ul>	

## **Steven**

Steven is a 17-year old African American male in his senior year of high school. This young man was also a clean-cut student enrolled in Mr. Dunns' 4<sup>th</sup> period Anatomy and Physiology class. He was very quiet in class, did not talk very much to the other students in class, but responded frequently to the teacher and participated in class discussions. He worked well with the other students in class, was very cooperative and appeared to be a very serious student. Steven did not really have a favorite class but said, "I would prefer science, because that's what I'm going to school for, so that was what I was focused on more."

Steven worked at a job outside of school and he was president of a fraternity at the high school, one of the community based organization that helped young Black men improve themselves. He was also on the school's varsity track team so he spent some of his time at practice. Steven made a cognizant choice to participate in numerous activities while in high school.

Steven described his science experiences this year, planned for his future and has made some choices to help him obtain those future goals. He stated the following;

For most of my sciences, I have Mr. Dunn and he's just a terrific teacher. Like he teaches you what you need to know, not what...not like everything else around it. Like he gets to the point of what you need to know. So it like...it brings my attention to...focus on this class because I know, [what] I'm going to need to know before I go to college.

He admitted that science was difficult but it depended on the classroom environment. Steven said, "It's all about who the teacher is and your chemistry with the teacher in the

class...I knew the teacher and my peers were helping me and I was helping my peers.” He spoke highly of the support he received in this class. The class was helpful to him because he planned to study pre-medicine in college. He had already taken several science classes: Earth Science, general Biology, Physical Science, Chemistry, Anatomy and Physiology, and next semester would be taking Honors Physics. His interest in science came from taking these science classes, especially Biology and Anatomy and Physiology. He described his conversations with his mother about his classes and how she had instilled confidence in him. Steven said,

I was helping my mom learn what it was, so...and then when I came to Anatomy and Physiology, I learned about how the body works and all of that. Like diseases and how you can prevent them. Like...viruses and how you can prevent them. So I was telling my mom and she was like, oh, you’re really good in science, so it just boosted my influence, I’m like, all right, let me go ahead.

Steven enjoyed science and planned on becoming an anesthesiologist. He said his experiences in science classes had increased his science interest. Steven further described some of his experiences in his science classes; looking at a blood cell for the first time, and dissecting organisms such as a worm and a frog. He said that in his previous high school, in New York, they did not conduct hands-on activities in his science class.

Steven spoke briefly about his stay in New York. He said he was a different person, whose focus was on playing basketball because that was what everyone did, but after he moved here (to the South) he began shifting his focus and concentrated on school and changed his perspective on life. Having been here (in the South) for four years, he felt like males have been labeled as the dominant species but still no real difference between males

and females, only that males are physically stronger. Females can do the same things as males but they are also mentally stronger than males. Steven also described himself as being a sporty dresser. When asked about having a role model, he explained that he was not really a follower; he was a leader and liked making his own path. He recognized that he was stereotyped as a typical teenager, who probably smoked and hung out late at night, but he was not. Instead, he had a job, helped his mother and younger sister financially and was saving for college.

Steven recognized that in his science class the males in the class had some sort of bond and it would not have mattered whether they were taught by a male or female, they would still have had that male bond. He acknowledged there was a family-like atmosphere in that class and said, "Mr. Dunn is like our father." When asked what his family expectations were for him, he said, "She wants me to graduate with honors. She wanted me to be involved in a lot of activities; she wants me to go to college." Admitting that his mother has not specifically told him she wanted him to go to college, instead he stated that she had already purchased a dorm sized refrigerator for him when he does goes off to college. It was clear that he had college on his mind; on the day of his interview, Steven was wearing a sweatshirt from a local university and stated that he had been accepted by five colleges. Steven admitted he did not have friends; he called them associates, he felt like he could not trust any of them. Most of the students he associated with were athletes who played basketball and football, the same guys he knew from the previous year.

Steven also talked about earning good grades and he felt that other students “hate” on those who *do* earn good grades. Steven further explained,

Anybody could get good grades if you do your work, but if you don’t work hard enough to do your work, you can’t get good grades. So there’s no need to hate on other people, because you have the potential.

When others found out his grades, he was proud, and if the grades were not so good, it did not bother him he said because, “I have a high self-esteem.” He continued and explained that most people believed they really needed reading and mathematics and not science, but Steven was convinced that everyone needed science. He believed other students could be successful if they put forth the effort.

Steven’s future plans involved attending college to become an anesthesiologist or a surgeon, and recognized that he would be in school for quite a while. When asked if anyone influenced him, he spoke of the death of his step-sister and how the anesthesiologist at the hospital had helped her by medicating her. He described his role model as being someone who would dress casually, no sagging pants, have a good job, be supportive of his family, and have a strong and respectful quality about them.

### **Teacher perspectives**

*Mr. Dunn.* Mr. Dunn described Steven as kind of a loner in class. He was a very observant student but preferred to work individually rather than in cooperative groups. Steven was actively involved in some leadership activities at school; he was president of one of the high school fraternities, which was a social organization for young men. He was quiet but very popular, and was well respected by his peers, but could appear to be disengaged at

times. He had friends who often admired his northern accent. Steven was very selective in his choice of friends. Mr. Dunn believed Steven did not readily have all of the financial resources he needed for school, but he knew how to obtain them. Mr. Dunn was aware that Steven has been accepted by two colleges but had not yet made a decision as to which one he would be attending.

Mr. Dunn also taught him in Biology and described the experience as quite a challenge, as they disagreed a few times, eventually coming to have mutual respect for one another. Steven moved from New York and his focus was on playing basketball instead of academics. Now, he was more academically focused. Mr. Dunn recognized that Steven has a lot to offer and wanted him to be in his class. Mr. Dunn said, “He does well, he retains a lot of information. He can be absent two or three days and come back and do well...he knows stuff and he can relate things.”

Student summary: Steven was a very quiet student with a strong science presence. He was enrolled in Honors Anatomy and Physiology, and then enrolled in Honors Physics for the next semester. His goal is to become an anesthesiologist or a surgeon. He planned to attend one of the five colleges he had been accepted into, perhaps for track and field. Steven had the support of his mother and had high self-efficacy.

Table 4.7

*Summary of Key aspects of Expectancy-value Theory for Steven*

Student & Career Goal/ College	Key Social Influences & Career	Science/Scientist Definitions & Identity	Science Self-efficacy (Perceptions of his own abilities Re: subjects / activities)
Steven Anesthesiologist	Anesthesiologist at the hospital	Science/Scientists ♦ Science is about discovering. ♦ Adventurous people are the ones who become scientists	“Science is hard but it’s about who teaches the class and your relationship with the teacher”
WSSU, FSU, NCCU, SCS, Shaw	Mother (Day Care Owner) Mr. Dunn, Anatomy & Physiology Teacher	Science Identity ♦ Class is preparing him for his future ♦ Teacher was terrific, he focused his attention on class with things needed for college ♦ His mom told him he was good in science which boosted his confidence to pursue science ♦ He liked learning different things.	Teacher and peer support makes the class easier

**Ronald**

Ronald is a 16 year old African American male in the 11<sup>th</sup> grade, enrolled in the IB Physics class as well as the IB Biology class, thus taking two advanced level science classes in the same semester. He was often on the school’s honor roll and a varsity football player. This young man was very outspoken in his Physics class, frequently asked questions of the teacher as well as his classmates, usually of the other males in class. He was also very dramatic in class, frequently singing (during observations), but on task completing the assignment or lab activity. He appeared to have a need to hear music while he was working. It seemed that when he was unsure of a concept he began to act silly along with a classmate, joking and talking about non-class related concepts. Ronald described himself,

I'm a very social person, so I have a lot of friends, but my main circle has been kind of the same all my years of high school. But I've added a couple of people to my circle and I let some people go because not everybody's...has the same interest and goals as you. You need to surround yourself with people who have the same goals as you.

He has different values and expectations than his friends, disagreeing with their views on how to be successful in the future.

When asked about his experiences and feelings in his science class, Ronald said,

The experience has been harder, 'cause physics has been...a tougher subject than biology and chemistry...but I like it though...I think all science classes could be the funnest classes 'cause you do experiments and you just learn about the world around you.

Ronald carried a very challenging course load; he was enrolled in Calculus, IB Physics, Marketing, IB Psychology, IB Biology, and Honors Anatomy and Physiology. He described Physics as one of his favorite classes, although it was more demanding than his IB Biology class and his previous Chemistry class. He explained that he liked Astronomy and planned to study astronomy in the future. He confessed his dislike of reading and his pleasure in writing and debating.

Ronald participated in football training year round, which occupied most of his time outside of school, both during the week and on weekends. He spent his time lifting weights, doing speed work, and agility drills to perfect his football talent. He talked about asking Mrs. Trent about visiting a local planetarium so that he could see and study the stars. He also described having previously participated in science camps. Ronald spoke of the opportunities available at this high school if one were interested in science; all you had to do

was to talk to your science teacher and you can have the opportunity, simply by asking. He believed the goal of science was to understand everything around you and that people who were curious about everything are the ones who became scientists. He stated, “Scientists aren’t just regular people, they want to know why.”

Ronald was asked about being a male in society, he responded:

He needs to be a provider for the family, he may be the head of the household although that is not always true, but society views him as being the provider to care for everyone. Males are supposed to act in a particular way, mature and collective, less emotional than women.

He also believed that males had more opportunities than females because in general, males ran society. He did not think it should be that way, it should be equal between males and females, but that is the way it is.

When asked if one’s role model had to share his same ethnic background, Ronald stated,

I think it is important because you will always see somebody in your ethnic background, you know, be successful. But also, people from other ethnic backgrounds because that shows anybody can be what you want to be instead of , ...since I’m Black, only that Black person can be...if I’m White, only that White person can be...no,...anybody can be that.

He acknowledges that being a Black male in society was a challenge, especially in trying to be successful because of stereotypes against Black males. But he hoped that as times goes on there will be more successful Black males in society. Ronald felt that anyone could be successful, Black males and Black females.

Ronald described his science class, he said there were a lot of females and it appeared

as though the males did not want to take the time to learn science. When looking at professional scientists, Ronald noted that there were more males than females and he did not understand why this was; he did not understand the correlation.

Ronald's family had expectations of him. He said, "I think they expect me to get the best grades possible, which is an A, be the best student as possible, conduct myself well, and be the best athlete...that I can be, but while being the best student I am." His family has inspired him to be the person that other kids look up to instead of being the mediocre student. They expected him to go to college, get his degree and obtain a well-paying job, and he knew this because they have told him. He has had family discussions about college, careers and jobs, and how he needed to find a career that he wanted and would be satisfied with. Ronald said, "of course, my mom wants me to be a doctor, but it's just not me." Ronald's mother is his primary influence; she has inspired him by starting her own business. She did not get to finish college, but she started her own daycare business and now she has two locations. He said that could have been done without a college degree but a college degree would have made it better for her. Ronald concluded the interview with the statement that his mother was his inspiration.

### **Teacher perspectives**

*Mrs. Trent.* Mrs. Trent described Ronald as being a natural in science. He loved astronomy and "wants to become an astrophysicist," and he is inspired and self-motivated." She has a shared interest with Ronald and has talked to him about studying Astrophysics as an undergraduate in college. She heard him explaining his career aspirations to Nate in class;

Ronald said he was going to Brazil and look through that ‘giant telescope.’ Mrs. Trent explained, “He is very strong in science and math. He definitely understands...he’s got a physics mind...[She said] Oh, I throw a ball up; I know it pauses at the top so I know its velocity at the top is zero.” Ronald explained how the ball paused at the top and changed direction. She added, “He sees things through a Physics lens, he’s just very smart in that sense.”

Knowing him since last year in Chemistry, Mrs. Trent recognized that Ronald had a need to be social and he had changed a little. He did not put forth as much effort as he could and she thought that he was putting on an act for his classmates. She also admitted she was not as demanding as she could have been, and believed he took a little advantage of her. In spite of this, he performed very well in class and had great potential. He could miss a day or two from class and come back to class, learn the information, and outperformed several of his classmates. Mrs. Trent enthusiastically described how Ronald “gets” the Physics. She was very excited about his having a strong Physics background when he went off to college, which will work to his advantage.

Mrs. Trent said, “They know he’s smart...kind of a goofball...a ridiculous person...funny...a little nerdy...nerdy in a good sense.” She continued saying, “He is a hands-on guy and loves to argue about it;” he can see it and talk about it. Even when he was solving his problems he liked to discuss the problems with her first. When doing so, she could really see his comprehension of Physics.

Student summary: Ronald was an energetic student enrolled in IB Physics. He had future plans of becoming an astronomer and listed Physics as his favorite class. He said he had always had an interest in Astronomy; he strongly identified with science and had high self-efficacy. Ronald planned on attending either James Madison University or North Carolina State University. He has been inspired by his mother, but both parents were very supportive of him.

Table 4.8

*Summary of Key aspects of Expectancy-value Theory for Ronald*

Student & Career Goal/ College	Key Social Influences & Career	Science/Scientist Definitions & Identity	Science Self-efficacy (Perceptions of his own abilities Re: subjects / activities)
Ronald  Astronomer or Astrophysicist	Mother (small business owner)  Father (truck driver)	Science/Scientists ♦ Science is about learning and understanding your surroundings and using your imagination ♦ Scientists are people who are curious about everything	“I like physics, is a tough class, it’s a lot of material to attain, I like the class.”
NC State University or James Madison University	Mrs. Trent (Physics Teacher)	Science Identity ♦ The physics class prepared him for a future in astronomy ♦ All science classes could be the enjoyable because of the experiments ♦ He visits the astronomy dome and attends science camps. ♦ Just talk to teachers and they can provide science opportunities	

**Grant**

Grant is a 16 year old African American male in the 11<sup>th</sup> grade. He was a quiet young

man in class and often appeared withdrawn. He was a member of the schools' wrestling team (not a very popular sport at this school), but he chose wrestling because he enjoyed the sport. Grant lived with his father and wants to attend college but fears he cannot go unless he receives a scholarship. He had several colleges in mind, one of which was North Carolina A&T State University. Since he has taken honors classes he knew they were more challenging and more meaningful than the standard classes. Grant had already taken Biology and last year had Chemistry with Mrs. Trent. He cannot see himself majoring in a science in college, but expressed his interest in computer engineering.

He attended class daily and seemed to participate sporadically in the activities (during observations); he sometimes became disengaged in class. Grant engaged in class when he was prompted to by Mrs. Trent. It appeared as though he was unsure of himself in this class, and he usually participated by listening in class. He often asked a classmate for help during class, but occasionally called for the teacher. It seemed that he needed encouragement from her during class. He typically worked with other males in class but had a tendency to linger towards the back of the group. Grant had several friends in class with whom he joked around and socialized with.

Grant indicated that he really enjoyed his teachers and was most interested in history, because he immediately recognized its applicability to real world situations. He did not readily see the application of the other classes. He also admitted that he enjoyed his science teacher from last year (Mrs. Trent) and enrolled in this IB Physics class because of her. He enjoyed the class and stated, "It's a fun class," despite the fact that he struggled in it. He

liked the labs; he felt like he needed that in class. He also admitted he spent some time after school in tutoring for Physics, as it was a challenging class and he needed help. He said, “I just need to...well with this class, I just had to start going to tutoring more, because before this I never went to tutoring.” Grant believed people who did science asked questions and were trying to find solutions to those questions; “they are those people who are eager to learn, like Mrs. Trent.”

Grant spent his time outside of school doing activities such as working out for the wrestling team. He was also a member of the school’s poetry club, and a participant in one of the fraternities at the high school. He liked volunteering to work in the concession stand at football and basketball games, at a local university, as part of the Business and Finance Academy. This also allowed him the opportunity to personally see the college players in action.

When Grant was asked about being a male in society, he said, “They are supposed to practice chivalry, respect and be an outstanding citizen.” Grant was also asked if his role model had to share his same ethnic background, and relayed the following response regarding his expectations from a mentor,

I don’t really care, because if they’re my role model, they’re my role model for a reason. I look up to ‘em for a reason, not because of their skin color...really a role model for me would be someone who I can talk to, and look up to. They can give me like real input, not just on school, but life and stuff like that.

When asked about the expectations his family had for him, Grant stated that his father expected good grades because that was the path to success. Grant was accustomed to making

A's and B's; since elementary school, which was consistent until he reached high school, when school became more challenging. Grant spoke of his father and said he was preparing to make some choices about his future. Grant further explained,

My Pops, he's basically a single parent, so he's worked...he's trying to do that. And if I don't...my plan was, if I don't get...a scholarship or something that can really help me and help my father pay for my college, I was going to enroll in like [military] service.

Grant described his father working 12 hour shifts at an electric company, to provide for his family.

When asked about his grades, Grant admitted that when earning good grades, other people think you are smart and like working with you; he enjoys that. He confided that his father was very influential in his life, because he was the parent (not his mother) who had always been there providing support for him, his sister, and his grandfather. Grant stated that his grandfather used to own his own janitorial business, but now works as a crossing guard for a local elementary school.

### **Teacher perspectives**

*Mrs. Trent.* Mrs. Trent described Grant as kind of a goofy kid who tried to be the class clown. He was very social and interacted well with all of the students in class. He was frequently up moving around the classroom, she suspected, to avoid completing his class tasks. This young man has the desire to do well but Grant lacked the passion and “love for science,” and she wanted to inspire him. He was not a great physics student and probably took the class because Mrs. Trent was the teacher. She said he made the information more

difficult than it actually was. Grant would get a great start to a unit, encounter some challenging questions and then shut down and stopped working. She continually worked with him to stay focused and not give up. She was frustrated by him, because he could do the work if he remained persistent and focused on the assigned task.

Mrs. Trent thought that Grant used his silliness as a cover-up for not knowing what to do or his lack of ability. He perhaps recognized that his math ability was not as strong as the rest of the students in the class and used this behavior as an avoidance technique. Mrs. Trent said, “[My] goal is to show him that ...we can enjoy it [Physics]...we can learn a lot with science and that it is pretty cool.” He did not really participate in the lab activities, and he moved from group to group. She was not sure what he liked; she thought perhaps he liked to have class discussions a little more. Mrs. Trent was considering doing something to get him engaged that would allow him to verbalize a little more, such as creating a rap song about Physics. She believed the other students were very supportive of Grant in class, but did not see him entering a science field in the future.

Student summary: Grant was a goofy acting student in class. He was a scholar athlete who was undecided about his future. He was considering the military as an alternative to help him pay for college. He did not have plans to pursue science in college but tentatively planned to pursue computer engineering at North Carolina A&T State University, a school with a strong engineering program. Grant had no science identity and low self-efficacy. While he enjoyed the Physics class, he received strong support from his father and grandfather.

Table 4.9

*Summary of Key aspects of Expectancy-value Theory for Grant*

Student & Career Goal/ College	Key Social Influences & Career	Science/Scientist Definitions & Identity	Science Self-efficacy (Perceptions of his own abilities Re: subjects / activities)
Grant	Father (Day Laborer)	Science/Scientists ♦ Science is about questioning and finding solutions.	“I had to start going to tutoring for this class”
Undecided, maybe military or computer engineering	Grandfather Mrs. Trent, Physics teacher	♦ Scientists are always eager to learn, question and investigate new things No stated science identity	“The class is a fun class, harder than any science I’ve taken before.”
NC A&T State University	Lives with father		

**Kenneth**

Kenneth is a 16-year old African American male in the 11<sup>th</sup> grade; he was also in the IB Physics class. Kenneth lived with both parents; his mother had a degree in chemistry, worked in a research lab and his father was the director of a local Boys and Girls Club for over 20 years. Kenneth was the quietest male in the IB Physics class. He appeared to be very academically focused during class, serious about his work and he did not engage when the other males began to act silly in class. During lab activities, he consistently worked with the same female (his girlfriend) during each activity and practically all of his conversations were held with her. He completed his assignments and periodically engaged with others during lab activities. He appeared to grasp Physics concepts quickly and asked questions

when he needs to, although not often.

Kenneth stood over six feet tall, was always well dressed and wore a braided hairstyle. He played AAU basketball (a traveling team) as he did not make the schools' basketball team this year (as he did last year), but he still attended the basketball games. He participated in several activities, including being a member of the high school marching band and a member of the student council. Thus, he was very active, with practice and games during the fall of the year as well as many band competitions. He also volunteered at the local Boys and Girls Club where his father worked. He helped the younger children complete their homework and lead them in various games and activities.

Kenneth carried a challenging academic course load as he was in the schools' IB program. He disclosed that IB Physics was his favorite class. He talked candidly about his experiences in Physics this year and how he felt it had prepared him for his future goals. He explained, "This year has been actually really good. We've learned a lot in Physics. And, I think that's gonna help me for what I want do in college and beyond."

During Kenneth's interview, he revealed that he wanted to major in Sports Medicine or Chemistry, eventually becoming an athletic trainer for a professional sports team, a college or university. He liked helping people. Kenneth stated that he has had the same teacher (Mrs. Trent) for two years. And he said, "She...gives us a good perspective of science and puts it in a way that we can understand it. So, I've liked the class from both years." He also stated, "I'm glad I get to experience this now." Kenneth believed that males needed more hands-on learning and Mrs. Trent provided that in her IB Physics class. He

liked experimenting and experiencing the results first hand, not just reading about it in textbooks. Kenneth believed his learning in high school would definitely carry over into college as he prepared for his future goals in science. He was good at connecting science events he saw on television to the real world and questioned the reality of the science experiments he saw, often discussing them with his mother. From the observations of him in class, he sought to answer the question ‘why.’ Kenneth said he understood the science he observed on television and knew that he could one day have a career in science.

Kenneth’s plans for the summer included a science program at a local university. This nine day program was for students who were interested in medical careers. The students would take college classes and observe live surgeries while there. He described these activities as being useful for his future, he explained,

I feel fortunate to be able to be in activities like this that can prepare me for what I’m trying to get to in the future...I like doing things that are going to help me in the long run. It seems to be fun. It comes to be fun to me ‘cause, I get to meet new people and have new experiences.

The labs and activities in high school have inspired him to seek a science related career. Kenneth believed scientists were curious people and the goal of science was to keep the world running.

Kenneth’s family expected him to do well because he was a male; they counted on him to act and dress appropriately, and to have self-dignity. They knew that he was a strong student with good grades and they expected him to continue doing well. When he could see other males succeeding, especially educated Black males, it inspired him to want to do the

same because he knew that he can do it too. Kenneth was aware that Black males were negatively portrayed in society as having poor manners, being carefree, and wearing sagging pants. He has had discussions with his mother about becoming a scientist. Because she was a scientist, she knew the requirements and shared with him what it took to become a scientist. They talked about the required classes and the work ethic required. He said, “she told me that...if I wanted to be in sports medicine, I would have to take certain classes...and have to know certain things about the body and the human and other things about science.” When asked about the expectations his family had for him, Kenneth explained,

They expect me in high school to do my best. Um, they know that I’m a good student so they expect to see good grades, but now that they know I’m in higher classes, they just want me to do the best that I can, and not just quit when I see that I’m struggling. They expect me to graduate and go to a good college. I know this, because they are repetitive, and they keep telling me this almost every day so that I won’t forget about it.

Kenneth believed he was headed in the right direction and believed that his classes would help him in his future. He trusted his parents to give him good advice.

When asked about his friends, Kenneth said he had mostly the same friends as he did the year before, although he had a few new friends who also had the same mindset as he did for school and science. A lot of his friends were athletes and wanted to pursue careers that dealt with athletics, sports management or becoming a sports agent. Some of them were also into music, just like him. When asked further asked about his grades in science and math and how people responded to him, he said they were surprised (about his good grades), and they

also encouraged him to keep going, earn good grades, and even helped them become better in the subject.

At the conclusion of the interview with Kenneth, he was asked if he had any questions or any comments, he said, “I’m glad you...invited me to answer these questions ‘cause I like talking about this kind of stuff with other people.” Kenneth values his experiences and the choices he has made.

### **Teacher perspective**

*Mrs. Trent.* Mrs. Trent described Kenneth as a motivated, respectful, quiet Physics student who came to her class with a “love for science;” he had the passion and desire for Physics and used those “Physics buzz words.” She could see that Kenneth strived to understand the physics and her goal was to get him to speak more scientifically and use his science skills even more. He was definitely motivated to find the right answer to his physics problems and would continuously ask questions until he discovered the correct solution. She wanted him to take his time and think through the problem solving process and not rush through his work, especially on his assessments. Mrs. Trent felt that Kenneth did not show her all that he knew. Her conversations with him revealed that he truly understood the Physics.

Kenneth did not frequently volunteer in class, but answered when called upon. Mrs. Trent noticed that he spent most of his time in class working with his girlfriend, working on almost all of their labs and problems sets together. They had a good working relationship because they actually had good discussions when solving problems. They each liked

presenting their ideas to the teacher, so she could give them some feedback, and then they tried to decide who was actually correct in their explanations during their group work.

Kenneth enjoyed the hands on labs; he and his girlfriend were the first students to get up when they had lab activities. He did not voluntarily do lab work with the other males in class, only when assigned by the teacher. Mrs. Trent said, “Now with a ...smaller, more intense group...I see that family environment in here...I know their interests a little bit more, I know who they are, I know their abilities more and...I know where I can push them a little bit more.”

### **Parent perspective**

Kenneth’s mother was interviewed during a basketball game in the athletic director’s office. She described herself and her son as ‘electronic geeks.’ She spoke of his creative mind and enjoyment of science, especially in his Physics class. He liked to question things and hypothesized as to what would happen if they tried different combinations of solutions and scenarios, especially as they watched the investigative science shows on television. He discussed what took place in his Physics class with his mother and described how he enjoyed the class and the teacher. Kenneth’s mother said he wanted a challenge, which is why he enrolled in Physics. Knowing that his mother does research in chemistry influenced Kenneth in his pursuit of science. She said he had always been curious and interested in science, “he’s more hands-on, like I am.” After he completed an experiment, he realized how much sense it made. They were both visual learners and Kenneth had excelled in science and math. Kenneth’s mother said, “Those are his strong points.”

Kenneth's mother said that academics were a priority in their house and with their extended family. Their expectations were that Kenneth could receive academic assistance from any one of his aunts as they were supportive of him and willing to provide him help in history, math, and English. When they talked to him about science, she said, they reminded him of how fun it was, and how cool it was. She encouraged Kenneth by reminding him how intelligent he was. She said,

I wish there was something...a billboard or something to say; hey we have these very intelligent men here. You just don't see it. And they're doing multiple things. They're playing sports. They're into student government... and still getting good grades.

She kept telling her son that with a little effort, he could do anything that he wanted to do.

Kenneth's mother believed he had supportive peers in class, she said, "They are all on the same level...in the IB program...they like to get together and talk about things...they all have that little creative mind...discussing what happened in class...what they're going to do for different projects."

Student summary: Kenneth, an athletic scholar, enjoyed science and was enrolled in IB Physics. He was a very quiet young man with a strong science presence and planned to major in sports medicine in college. He had a sincere interest and desire to help injured athletes. He had a strong science identity and high self-efficacy. He was very passionate about Physics, it was his favorite class. Kenneth's mother was a major influence on him, but he received very strong support from both of his parents and his extended family.

Table 4.10

*Summary of Key aspects of Expectancy-value Theory for Kenneth*

Student & Career Goal/ College	Key Social Influences & Career	Science/Scientist Definitions & Identity	Science Self-efficacy (Perceptions of his own abilities Re: subjects / activities)
Kenneth	Mother (Chemist)	Science/Scientists ♦ Science is the study of everything. The goal of science to keep the world running ♦ Curious, investigative type people become scientists. ♦ Have a great teacher who gives a good perspective of science	He understood the physics and the usefulness of the course content.
Sports Medicine	Mrs. Trent, Science Teacher		
Hampton University	Lives with both parents	Science Identity ♦ Participated in summer science career program & experienced science and college activities. Experienced fun activities and got to meet new people and have new experiences ♦ Feel fortunate to be in activities that could prepare him for his intended future, he liked doing activities that prepared him for his future ♦ He likes helping people; it made him feel good about himself	Favorite class is IB Physics

**Jerry**

Jerry is a 16-year old African American male in the 11<sup>th</sup> grade in the schools' IB program and carried a challenging course load this semester. He was soft spoken, and a very intelligent young man who appeared to need a lot of attention from his teacher during class. Jerry liked to be challenged in class and disengaged from class when he was not challenged; he bored easily in class, but admitted that he enjoyed his science classes. He was very capable and frequently worked with other male students in class, he occasionally worked

with females, but he worked with the same group of males more often. He frequently volunteered to work problems on the board or when he did not understand a problem, he asked for further explanation either from the teacher or a fellow classmate.

Jerry was a varsity football player and spent an enormous amount of time after school conditioning for football. Outside of school, he also enjoyed walking on the trail, jogging and other physical activities; he did make time for doing his homework. He also spent time volunteering at the local science museum in the city in which he lived; he had done so for two years. He had been interested in animals ever since he was a small child, and wanted to pursue a study in Wildlife Biology or Animal Science. He enjoyed sharing this information with younger students, and said that Animal Planet, one of his favorite television shows, inspired him. Jerry's future desires were fueled by his dual enrollment in the IB Physics class and the IB Biology class. He said he tried to get as much science experience as possible. His favorite class was Physics, and he explained,

It's a great class...I don't know how much it'll help me with what I'm planning on majoring in in college but, I feel like it's a general good science class to have...to have certain knowledge about topics in areas that we discuss in the class.

Jerry said, "I love science. It's an interesting subject and it's something that I want to continue to grow in and major in [in] college." Jerry had goals and expectations for his future and made choices to help him achieve those goals.

He recognized that science was mentally challenging and wanted to be challenged and he stated, "I feel like if you're not challenged mentally, then you're just gonna fall asleep, because it's very boring." Jerry also believed he had the characteristics of a scientist.

He said, “it involves...critical thinking, problem solving...being a sociable person...being very hands-on. You have to take stuff in visually and auditorial and, you know, it’s just like characteristics that requires it, that I feel like I have.” He also felt his teachers had encouraged him to continue with science.

Jerry expressed his feelings specifically about being a Black male in society. He stated, “we’re not really looked at as being...[a] scientist...we’re just expected to fit stereotypes, you know, play sports all our life and not graduate from high school or college and all that stuff.” He also expressed that a role model did not have to share his same ethnic background. He believed, “as long as you are...know what you’re talking about and know what you’re doing, I feel like I can learn something from you, it doesn’t matter what race you are.”

His family members had expectations for him; he was expected to succeed, earn good grades, graduate in the top of his class from high school, obtain a college degree, and get a good job that will eventually support him and his family. When asked how he knew these things, he commented, “Because they constantly tell me, like, every day.” Most of his friends were not interested in science but they were still his friends, with different views. He also stated that others knowing his grades were not important. When asked why, he said, “I’m not here to impress them. I’m here to get an education and continue and go to college.”

Jerry plans to continue playing football in college, but if he could not, he would continue in college anyway to obtain his education and find a job he was interested in. Jerry’s older brother is a college student and was his role model and serves as an inspiration

for him. Jerry was the youngest of three children. His mother was an elementary school teacher and his father a patient representative at a local hospital.

### **Teacher perspective**

Mrs. Trent had the following to say about Jerry,

Oh, I love Jerry...I know he's taking this class because he likes me as a teacher ...His passion is Biology and he's taking IB Biology, but he's taking IB Physics...because he wants me as a teacher so he doubled up on science. He is a great science student...a good student."

She knew Jerry was planning a career in Wildlife Biology or Animal Science and was using this Physics class to enhance his knowledge of science. He sometimes appeared to be disengaged in class, when she thought he was not listening (he actually was) as evidenced by his performance on subsequent assessments. Jerry was a strong independent learner; he seemed to learn in intensive spurts. Mrs. Trent further described Jerry as one of her top performing students who was very methodical in his learning process. Her goal for him was to have him apply the Physics he had learned in his Biology class.

Jerry was further described by Mrs. Trent as being full of potential; he loved to joke around, have a good time, and talk to her. She knew that he had several close friends in this class but he did not always work with them. If he did, he failed to get all of his work done; so he chose to work with someone else. He did it in such a way that they did not know that was what he was doing, but she could see that was what he was doing. He was a smart kid, and his classmates knew it; they respected his intelligence and were sometimes a little jealous according to Mrs. Trent.

Jerry liked solving problems, the hands-on labs and seeing Physics in action; he was also very mathematically oriented. There were times when Mrs. Trent said he did not like the activities, but she saw him doing them anyway. Mrs. Trent said Jerry knew the math so well that Physics was kind of easy for him. She was excited for him because of his abilities in Physics.

Student summary: Jerry, a scholar athlete was enrolled in IB Physics and IB Biology II. Physics was his favorite class. He strongly identified with science and planned on majoring in Wildlife Biology or Animal Science in college. His older brother was a major influence on him but his mother provided a strong support system for him. Jerry has high self-efficacy and a strong science identity.

Table 4.11

*Summary of Key aspects of Expectancy-value Theory for Jerry*

Student & Career Goal	Key Social Influences & Career	Science/Scientist Definitions & Identity	Science Self-efficacy (Perceptions of his own abilities Re: subjects / activities)
Jerry	Brother (college student)	Science/Scientists ♦ Science is about trying to understand the world around them, gaining knowledge for improvement	In spite of previous Biology teacher, "I am still succeeding."
Wildlife Biology or Animal Science	Mother (educator)	♦ To become a successful scientist you have to be mentally gifted with a certain standard of knowledge.	Physics is interesting, I like the teacher and the way she teaches, a great general class to have.
College bound	Father (patient representative at hospital)	Science Identity ♦ I've always been a big science person.	
	Mrs. Trent, Physics Teacher	♦ "I love science and I want to grow in it and major in it in college." I get as much science experience as I can. ♦ Good experiences, learning things in preparation for college. ♦ Have a great teacher who gives a good perspective of science, I have critical thinking and problem solving skills and a sociable person ♦ I am a hands-on person	

**Nate**

Nate is a 16-year old African American male in the 11<sup>th</sup> grade enrolled in the IB Physics class. He was a very outgoing and colorful young man. He was well mannered, talkative, friendly and always dressed in color coordinated outfits, with a clean cut hair style. He was active in school and the quarterback for the schools' varsity football team. Sitting near the front of the class, he tried very hard in class and at times found the material extremely difficult. He asked many questions and often volunteered to work problems on the

board to understand them better. He worked with other males in class during lab activities and frequently sought their assistance.

When asked to describe his experiences in science class, Nate said,

Mrs. Trent, I like her class. She's really cool. She's a good teacher. Her class...is a lot a work and it ...requires a lot of thinking, like mental, and just physical like writing out every equation....It's really interesting though....Things you can do, there are really cool tricks with Physics, things you would have never thought, so it's very interesting.

In Mrs. Trent's class, Nate felt like she taught him a lot. He had been able to relate Physics to throwing the football, shooting a basketball, and enhanced his understanding of friction and collisions. He thought he could become a scientist because of some of the experiments they had done in class, Nate explained, "The experiments...we did...like projectile motion problems...I was kind of good at that so I just thought...to myself like, man, this is fun and interesting. I could learn a little bit more about this." He confessed he used it, but did not think about using it, "you have to know how much force to put on somebody to...stop their movement and, put 'em down' when playing football." Nate viewed science as time consuming, and scientists as people who must have patience, which was just not for him.

Nate had some ideas about being a male in society; one must be responsible, be a good role model, take care of and love your family, not just provide financial support. He also shared that males must be humble, respectful of their elders and everyone around them, have respect for other's opinions, be able to take criticism and listen to others, be honest, have faith and attend church. Nate also believed that being a Black man in society was

difficult because of the actions of others, the ones who were killing each other over such trivial things as colors, reputations, and gangs.

Nate's role model was his older brother, who went to college on a football scholarship. He graduated and is now a sports agent living in Miami. Nate talked about the discussions he had with his brother about life, his goals, and future success. Nate was inspired by his brother, and was determined to be just as successful as he was, following in his footsteps.

Nate carried a heavy course load as part of the IB program. His favorite class was Sports and Entertainment Marketing because of his future intentions of becoming a sports agent and recruiting athletes to sponsor athletic brands. Nate spent a great deal of time outside of school preparing for football; training and doing conditioning workouts. His mother required him to complete his homework before he could go to any workouts and conditioning activities for football. Nate was also active in his church, in student youth, a program in which students received tutoring from college students. Nate, along with members of the football team, belonged to the Brother to Brother program in which they tutored and mentored elementary students. Nate believed that anyone could be a mentor as long as they shared how to do a task correctly, to help someone become a better person. Nate did find time to hang out with his friends. His best friend attended a different high school, but they would get together on weekends playing basketball, football, video games and dining out.

Nate's family had high expectations of him. His mother expected him to obtain a college scholarship; she had not told him that, but Nate did not want money to be an issue for her. He said, "I want to buy her a house," or he wants to be able to say "Ma, I got you." He planned to earn his high school diploma with a high GPA, attend a major college, earn a degree, then an advanced degree, so that he could make as much money as he could and be able to provide for his family. He believed when students earned good grades they were viewed as smart and he liked that feeling of being recognized as someone going somewhere with his life. Nate said, "If my grades are not good, my friends tell me to step it up," and he does not want to be in Concord for the rest of his life. He and his friends tried to motivate each other because of their competitiveness and how they valued school, while sharing their grades among themselves.

### **Teacher perspective**

*Mrs. Trent.* Mrs. Trent described Nate as a challenge in that, he did not have the love for science that several of the others in his class had. Her goal was to inspire and excite him in Physics and to help him to grasp the concepts that explained so much in this world. She thought that he enrolled in the class because she was the teacher and would help him in the class.

She described Nate as having the ability but lacking the drive. She stated, "He is skilled in math and needs to build his confidence in doing Physics and see that 'science is cool' and that it's 'not nerdy'...it's showing him the importance of science." Nate did not consistently perform up to his capabilities. At every opportunity, Mrs. Trent tried to embed

his football activities into her discussions, to help Nate understand that football is all about the application of Physics, especially in their discussion of projectile motion.

Nate was a very social, respectful, goofy guy who liked to joke around in class. He enjoyed the atmosphere in the class, but perhaps he needed a bit more structure and seriousness. His classmates knew that he played around and did not really take him seriously, but they failed to see how smart he really was. While he may have occasionally lagged behind the others in class, he did eventually get the work done.

Nate usually worked with Ronald. Sometimes they would bring in a female but these two males consistently worked the labs together, with Ronald as the driving force behind this group. Nate was pretty good at talking things through, and he liked to discuss what was going on; problem solving was one of his strengths. He could really apply the math but “[he] just needs to have the confidence...to do it.” Mrs. Trent believed that Nate viewed the labs as just something to do; she did not feel that he learned anything from it, but learned more from the class discussions. She would like to see him participate in the analyses portion of the labs, such as, ‘did the car accelerate or not, and what was its rate?’ Mrs. Trent told him, “Hey, your life is run by physics.”

### **Parent perspective**

Nate’s mother described her son as smart and outgoing. She stated that she constantly monitored his progress and maintained frequent contact with his teachers. She described his science ability as high. He had always loved science and he enjoyed math, she admitted that he could do better. She believed the teacher made the difference in whether or

not her son maintained his interest in science. If the lessons were hands-on and he could relate to it and understood how it affected his life, then he enjoyed it. She always wanted her son in the higher level competitive classes, as being in those classes actually raised his self-esteem.

Nate's mother was proud of the educational history (three generations of educators) and legacy of her family and provided her son with a great deal of familial support, if he needed it. Nate's mother could recall accompanying him on a field trip to a local science museum when Nate was younger and again when he was older. Because he was older and had learned more information, he was able to view the same exhibit through a different lens and apply the newly acquired information. Nate's mother explained that it was important to support her son in his endeavors by attending as many of his school events as possible, showing him the support of his family in his education.

Summary: Nate was a very colorful young man in his IB Physics class but had no intentions of pursuing science when he attended college. He plans on becoming a sports agent like his older brother. He only enrolled in the class because of his prior relationship with the teacher. Although he could see the relevance of science, he did not identify with science and had a low science self-efficacy. He had a strong support system from his mother, grandmother, aunts and uncles, all of whom were educators.

Table 4.12

*Summary of Key aspects of Expectancy-value Theory for Nate*

Student & Career Goal/ College	Key Social Influences & Career	Science/Scientist Definitions & Identity	Science Self-efficacy (Perceptions of his own abilities Re: subjects / activities)
Nate	Brother (Sports Agent)	Science/Scientists ♦ Science is about everything, earth, space, atoms, bacteria, just about life ♦ People who are patient and interested in how things work become scientists	Previous science was easy, physics requires thought
Sports Agent	Mother (Educator)		
College bound	Family (grandmother, aunts, uncles)	Science Identity ♦ He was good at projectile motion and thought he could learn more about it ♦ Can relate to hits, throws, collisions, frictions, real activities such as football, and basketball, but does not see himself in science	Have a cool, good teacher in physics, a lot of work, requires a lot of thinking, class is interesting, lots of cool tricks
	Mrs. Trent, Physics Teacher		

**Summary of Interview Data**

All twelve students (100%) in the advanced science courses described the benefits of being in the courses. The courses were “challenging” (Bobby, Edward, Ricky, Steven, & Ronald), and “interesting” (Jerry, Kenneth, Kevin, Nate, and Omar). The student who described the course as “fun” (Grant) was unclear on his future choice, as was the student who wanted to pursue law (Edward), and another who aspired to become a sports agent (Nate). The participants of this study cited the benefits of choosing an advanced science and how it played into their futures. As stated by Kenneth, “I feel fortunate to be in such activities that can prepare me for my intended future, I like helping people; it makes me feel good about myself.” Nine of the students (75%) have strong to moderate identification with

science, and intend to pursue science careers.

Students mentioned the relative costs of their course selections, such as Stephen, “Science is hard, I’m not gonna lie, but it’s all about the teacher... the students were helping me and each other.” Overwhelmingly, these challenges were not presented negatively, but rather in a matter-of-fact manner. Students acknowledged the hard work required by advanced courses, but stressed they were “important for my future” (Ronald) and that they simply valued what they learned from the course. The relative costs were minimized by the students, and what they attained from course, or was perceived to be useful for their futures was often expressed. As Jerry said,

Physics is a great class. I don’t know how much it will help me with my major in college, but it’s a general good science class to have, you know, to have certain knowledge about topics and areas that we discuss in class.”

Nate said, “[Ms. Trent’s] class is a lot of work...it’s really interesting though, there are really cool tricks with physics, things you would never have thought so,” resonating with Kevin’s description of physics as increasing his “knowledge of the world.” Thus, the students, although recognizing the costs, spoke of their interest in and enjoyment of the teachers(s) activities, and topics. All of the students benefitted from good science teachers, and valued the excellent instruction, which involved nearly daily hands-on work. This was best summarized by Omar, as he described how the teacher made the class fun and interesting, and “made me eager to learn everything. It made me eager for the next day so it was always fun.”

## **Key Socializers**

The students in the study identified key socializers who had influence on them; four students identified their fathers (one student added two coaches), three students identified their mothers, two students identified their older brothers, one student identified both parents and one student identified a peer influence while yet another student identified a medical professional as being his influence. All but two of the students explicitly stressed the importance of doing well in high school and attending college. Omar said of his family, “They expect me to go to a good college, for free”. One student, Grant, was unsure of how he would pay for college: “If I don’t get a scholarship or something that can really help me and help my father pay for my college, I was going to enroll in the service.” The students identified their science teachers as having influenced them in class and provided inviting learning environments and made the course content relevant to their daily lives. Fifty-eight percent of the students have at least one professional parent while the other forty-two percent of the students’ parents have careers that do not require a professional degree. Fifty-eight percent of the students live in two-parent households while the other forty-two percent live with only one parent.

Students had a wide range of professional goals when considering their futures, even if they were not exactly clear on their future choices. The students identified careers such as neuroscience, astronomy, biomedical engineering, veterinarian, anesthesiologist, sports medicine, marine biology, and animal science. Several non-science careers were also identified by students such as becoming a sports agent, a civil rights attorney, and one

potentially majoring in computer engineering. The students' college choices have included those nearby, a few prestigious universities (Duke and Stanford), and a few colleges from out-of-state. All of the students are sure they are going to college once they graduate from high school.

## **PowerPoint Presentations**

### **Planning sessions**

The twelve African American high school males in this study planned and created a ten-slide PowerPoint presentation describing their rationale for enrolling in advanced-level science classes. There were seven male students from the Honors Anatomy and Physiology class and seven males from the IB Physics class. Two of the males in the IB Physics class were also enrolled in the honors level Anatomy and Physiology class and participated in the preparation of only one PowerPoint. During two 90-minute class periods, the students created their presentations. Later, they presented their PowerPoints to their classes and to a class of younger science students (10<sup>th</sup> graders). The students were organized into cooperative groups by their respective science teachers. The students were grouped as follows: Kevin, Ricky, and Steven; Omar and Edward; Bobby and Terrance; Nate and Ronald; Jerry, Kenneth, and Grant. Students were given instructions to create a PowerPoint that would describe why younger students should enroll in an advanced level science course. All students had access to a laptop on which to create their PowerPoints. Some students wrote notes (Omar and Edward) to gather ideas that they would use in their PowerPoint while the other students immediately started typing the information for their slides. Some of

the students worked together quietly while others were a bit more excited as they were working. Omar and Edward worked quietly during the class; Omar typed while the two of them discussed the content of their slides.

Initially, Kevin, Ricky and Steven were in different groups because two of the students were called out of class early on the first day of planning, but then on the second day they were re-grouped together to finish and present their information. Each student contributed slides for the PowerPoint presentation and edited it for its content. Bobby and Terrance created their PowerPoint presentation together. Terrance began typing, producing some creative and exciting slides.

Jerry, Kenneth, and Grant were grouped together for the project. This group did not mesh well together initially; but they eventually came together after they had an opportunity to gather their individual ideas. Kenneth worked on a laptop typing out his slides while Jerry moved to a different area in the classroom to work on his slides. Grant was very social during this process but he did eventually contribute information to his group. At the end of the planning session, these three organized their information together for their PowerPoint presentation.

Nate and Ronald worked together on their PowerPoint presentation. Ronald took the lead in creating the PowerPoint by typing in the information for the slides. It took a little while for these two to get going, as they had arrived to class late, but by the end of the planning session they did have a PowerPoint presentation ready. Ronald was more focused on creating the slides while Nate was being more social with Grant and the females in the

class. Nate would often wander around to the other groups but was redirected by his teacher to his project group to complete the assignment.

At the conclusion of the planning sessions, the groups presented their PowerPoints to their class.

### **PowerPoint presentations**

The five cooperative groups presented their PowerPoints: Group 1: Edward, Omar; Group 2: Kevin, Ricky, Steven; Group 3: Bobby, Terrance; Group 4: Grant, Jerry, Kenneth; Group 5: Nate, Ronald.

Omar and Edward presented their Power Point, *Why you should enroll in Anatomy and Physiology class with Mr. Dunn, who teaches this class?* They described the teacher as stern, caring, refusing to accept excuses, and have over 30 years of teaching experience. The students emphasized the class as, “fast-paced and taught at the honors level.” Further, they described the course as, “focused on the human body and its functions.” Edward and Omar alternated as they presented their information. They explained some benefits from enrolling in the Honors Anatomy and Physiology class: college preparation, improving your GPA, transcript enhancement, the fact that new material was learned daily, and the interactive classroom environment. They also emphasized how the Anatomy and Physiology class would benefit IB juniors, seniors, AP students, and honor students who have aspirations of becoming doctors, nurses, those interested in medical professions, and students looking for challenging coursework. Omar provided cautions for his peers: Mr. Dunn had a lack of

tolerance for disruptive behavior, failure to complete assignments, failure to show respect, in addition to the need to study to avoid being left behind. Edward finished their presentation by explaining the impact human Anatomy and Physiology could have on students. For instance, they could potentially pursue science as a career. Other benefits could include pursuing a career in medicine or addressing future societal issues, such as ending world hunger and sickness, or discovering a cure for cancer. Omar and Edward excitedly presented their work. Normally in class, Edward was very reserved and spoke very little, yet during this presentation, he was one of the most vocal and theatrical students in the class.

The second group to present their PowerPoint included Kevin, Ricky, Steven and a female. This group began by introducing themselves to the class while referring to their first slide. Kevin took the lead while presenting, which began by describing their rationale for enrolling in higher level science classes. They listed the following: performing well in these classes shows our aptitude to do well in honors level classes, raises self-esteem, and helps with GPAs. They said their science teacher really wanted them to do well and gave them background information for future professions. Being in an advanced level class allowed individuals to be surrounded by like-minded people, who wanted to get better and were not just coming to school for the social aspect. The benefits of the class were described as challenging students to do better in other classes, succeeding in a competitive environment, and providing better preparation for their future than standard level classes. This Anatomy and Physiology class, in particular, provided students with an understanding and information on the workings of bodily functions.

Next, Steven stated his plans of becoming an anesthesiologist; he felt that the class would help him to accomplish this. He also stated that taking this class helped young Black males “defy the odds,” and provided the background information they needed for life, in general. Kevin further described how Black males are stereotyped by the majority population into thinking that Black males are, “ghetto people,” and that most Black males would end up in jail or killed by the age of 21. He said, “We as Black males can show that we can be serious students.”

Then, Kevin continued by describing his motivation for taking advanced classes, as did his parents. He described his parents’ desire for him to do well and to have a successful life. Kevin’s parents did not give him a choice in his course selection. However, when taking these advanced science classes, it made him want to explore science even further. The more involved Kevin became in science, the more interested he became in science. It engenders a desire for learning and a yearning to explore even further. He finished by stating that taking a higher level science course was challenging. The female in his group described being influenced by a previous family member who had the same course under Mr. Dunn. Ricky described the Anatomy and Physiology class as fun, taught by a great teacher with a sense of humor, and being in a learning environment in which the newly acquired information could be used immediately, unlike other classes. He noted that the teacher gave tips for living healthy lives and allowed time for class discussions. The students in this group further described this class as a hands-on one which prepared students for future science

careers. The students' presentation ended with the statement, "Students would be proud of how hard you had to work to be successful in this class."

The third presentation was given by Bobby and Terrance. Bobby began with the joy of higher level science, and described how science brought out students' curiosity. They listed the following as reasons for enrolling in advanced level science classes: the teacher, past students, participating in labs, creating projects, and the learning environment. Terrance further described students' learning. The teachers were described as "great." Terrance also stated that students must be willing to change and experience a variety of things in class. Students will have the advantage of knowing the content of the class by the end of the class. They further discussed the utility of the class: in learning the concepts presented, it becomes possible to see course content intertwined into a student's daily life, as the content that is learned can be readily used.

Terrance and Bobby noted the benefits of taking these advanced level classes in that the GPA of each student will possibly rise from the weighting of the class and students benefit from the wisdom of the teacher, whose significant experiences, which he shares with the class, helps to prepare them for their futures. These males showed a 'YouTube' video clip on science to illustrate some of the things that would be learned in advanced science courses. Bobby also discussed his dual enrollment in IB Physics and Anatomy and Physiology. Bobby ended the presentation by telling the class, "nothing will be accomplished easily; everything takes hard work!"

The males from the IB Physics class planned and prepared their PowerPoint presentations. Two of the students, Kevin and Bobby, who were also enrolled in the honors level Anatomy and Physiology class had already created and presented their PowerPoints and did not create a second PowerPoint. Instead, these students worked with the females in class as they created their PowerPoints for their class assignment. The students used almost two class periods to plan and create their PowerPoints; they then presented their PowerPoints to the class.

Kenneth, Jerry, and Grant were the fourth group to present their work. Their title was, *Taking higher level sciences*. Kenneth began the presentation with the rationale for taking advanced level science classes. He included: enjoying the teacher, already knowing the teacher, having a general interest in Physics, and the enjoying the class, which Kenneth described as “fun.” He described the qualities of the teacher as: being nice and cool, well-educated, and providing students with the necessary tools and skills to pass the class. College credits can also being earned for the class if a student passes the IB exam. They also mentioned that the course “Looks good on a resume when applying to college.” Grant took over and presented the slide that gave the definition of Physics. He then described how they use some current events in explaining Physics, such as how Physics was related to Michael Jordan’s (retired African American professional basketball player) apparent defiance of the laws of gravity. Grant also explained how students have fun performing various experiments, and completing assignments that challenged as well as entertained them. Jerry

described the science teachers, and the ways in which they helped students when they needed it; saying that they are informative and fun to be around. The science teachers here made the content interesting by having the students do activities such as dropping items off the top of the building and shooting items through fire. This group also explained how taking this class could help class members excel when applying for college, because it provided important background information. This higher level class gives a boost in GPAs if the student does well in the class. It also helps prepare juniors to take the ACT.

The fifth PowerPoint given was created by Nate and Ronald. They began by introducing themselves and posing a question to the class, “What is your motivation?” Someone answered them, and they moved on to the next slide, describing the educational aspects of taking an advanced science class. They stated that taking an advanced science class could help a student decide on profession to pursue, as it could provide a basic understanding of that specific field of interest. It could be a major GPA boost to earn high grades, and it could be a required class. Nate and Ronald took turns presenting the information. Next, they described parental influences. Some parents required their children to take these classes because either one or both parents have a career in science, or some parents just wanted their children to take advanced science classes. Nate and Ronald also stated that it was essential to challenge yourself now, because the skills learned here may be needed for a future job. Ronald stated his reasons for taking this advanced class. He wants to become an astrophysicist, he knew these challenging science classes would provide him with strong background information for his college experience and potential career plans.

Another reason Nate and Ronald cited for taking the advanced science classes is that curious students wanted to learn more about their surrounding world, and these classes provided students with a wide range of information that helped them to understand things. They also described their parents and good teachers, like Mrs. Trent, as the motivation for taking advanced science classes.

All of the students were asked to present their PowerPoints to younger students at the high school. All of the presenters were well-dressed for the presentation with dress slacks and collared shirts. Kevin, Terrance, and Ricky presented their PowerPoints first to a tenth grade Biology class. Terrance and Ricky spoke first, explaining their reasons for enrolling in an advanced level science class. Terrance presented the first part of the PowerPoint, followed by Ricky. He said,

You guys are already in the honors Biology class, as you are ahead of the curve. You are taking an honors level class which can boost your GPA when you do well. If you are looking to continue in that path, there are other options such as honors Anatomy and Physiology with Mr. Dunn, as he is one of the best science teachers here at Concord High School. There are some other options because you can also take Honors Physics. A couple of us have doubled up on our sciences because it is preparing us for our futures when we go to college.

Both students made frequent references to their PowerPoint, which was displayed on the whiteboard.

Kevin spoke next, adhering closely to his PowerPoint. He talked about the grades, how students could earn higher quality points by taking an honors or IB level class, and how it prepared students for their future. He made comments as he did before, elaborating about the classes and being successful in those classes. Kevin reiterates the motivation that his

parents instilled in him and repeated some of the same information as the previous presenters, but tried to cover some different information to share with the students, highlighting the motivation aspect.

After they shared their PowerPoints with the class, the audience did not have any questions for them and applauded them for their presentations. The student presenters were a little nervous, but were willing to entertain any questions. Afterwards, the researcher met with the presenters, and asked them for their feedback on their presentations and questioned them as to if they would make any changes to their PowerPoints. Ricky, Kevin, and Terrance all indicated they would not make any changes. The students were satisfied with the PowerPoint presentations they had created.

### **PowerPoint presentation analyses**

Twelve African American male high school students planned and created PowerPoint presentations to be shown to other students. The five groups of male students created PowerPoint presentations which were coded into five of the six major themes citing the reasons the students gave for enrolling in these advanced classes based on Eccles expectancy-value theory (Eccles et al., 1983; Eccles, 2009). These themes were perceptions and interpretation of characteristics and experiences (beliefs/behaviors of key socializers); emerging self-knowledge and future goals (self-concept, self-schemata); emerging personal and collective identities; expectations of success; subjective task value (interests, utility value, attainment value, relative cost); and task, activities, and behavioral choices (see Table 4.13).

Table 4.13

*PowerPoint analysis based on themes of Expectancy-value theory*

<b>Subcategories</b>	<b>Group 1</b>	<b>Group 2</b>	<b>Group 3</b>	<b>Group 4</b>	<b>Group 5</b>
<b>Percentage of Comments</b>	<b>Kevin Steven Ricky</b>	<b>Omar Edward</b>	<b>Bobby Terrance</b>	<b>Nate Ronald</b>	<b>Grant Jerry Kenneth</b>
Perceptions & Interpretation of Characteristics & Experiences (Beliefs/Behaviors of Key Socializers)	25.0%	28.6%	33.3%	20.0%	10.0%
Emerging Self Knowledge & Future Goals	16.7%	14.3%	11.1%	40.0%	30.0%
Expectations of Success	16.7%	-	-	-	-
Subjective Task Value	33.3%	28.6%	44.4%	40.0%	50.0%
Task, Activities, & Behavioral Choices	8.3%	28.6%	11.1%	-	10.0%

Transcripts of the students' PowerPoints consisted of (54) slides that were analyzed line by line for coding using *a priori* themes of the expectancy-value theory. The student presentations were audio-recorded and transcribed to capture their actual statements made during the presentations. The students' comments were coded depending upon their actual statements made during the presentations. The majority of Group 1's comments were coded as subjective task value (STV), which included their interest, motivation, and enjoyment for science. It also included the personal importance they placed on doing well on a task (*attainment value*); or how useful the students believe the course relates to their current or future goals (*utility value*). The students also associated the amount of effort needed to take

such a course, its *relative cost*. Each of the subsequent groups focused mostly on the *subjective task value* (STV) of taking advanced science classes. For example, the following statements made by the students were coded as STV: the class raises your self-esteem, boost GPA, you benefit from the class, get real world application for the content, it is fun, and you have an interest in the class. This major theme had more comments from all of the groups than any of the other themes (see Table 4.13).

The second major theme coded from the student PowerPoints was a large category including the *interpretation of characteristics and experiences* (ICE) that encompasses cultural stereotypes and the beliefs and behaviors of key socializers such as their parents, teachers, siblings, peers and the media. It also includes students' previous personal experiences, such as their out of school activities (e.g. science programs), good grades, and past successes. Most (60%) of the groups had a large percentage of their comments coded under this theme. Each of the groups mentioned taking their advanced science class for at least one of the following reasons; the teacher, being with competitive students, or having a familial influence (parents or sibling). While the majority of the comments made by each group were coded under two major themes of STV and ICE, there were comments coded under the other themes.

The third major theme was *emerging self-knowledge and future goals* (ESKFG). All groups described comments coded as ESKFG with groups four and five making more comments here than the other three groups. The ESKFG theme included *students' self-concept of their own abilities* and their *self-schemata* to include their plans, and short-term

and long-term goals. Students used comments such as; “You can demonstrate your high ability level or skills, it prepares you for college, it prepares you for your future science career and it helps you make future decisions.”

The fourth major theme was *task, activities, and behavioral choices* (TABC), which described students’ achievement related choices and performances. All but one of the groups (80%) made a few comments that were coded under this theme. Group 2 made more comments here than any of the other groups. The students included comments such as; “The class presents an interactive environment, there is challenging coursework, you are doing lots of experiments, and you do labs and projects.” The students were indicating that their course choice was based on the activities that took place in the class.

The last major theme was *expectations of success* (EOS). Only one group made comments that were coded under this theme, which included the individual’s beliefs about how well they will do on an upcoming task. Student statements such as; the class increases your desire for learning and you will be in an environment with like-minded people were coded as EOS. All groups were very precise and clear in their comments during their presentations, focusing on what was important to them, what they valued, and their future intentions, all of which ultimately influenced their task, activities and the behavioral choices they made.

The cumulative findings for the PowerPoint comments by themes and student groups have been summarized in Table 4.13.

## Twenty-Statement Questionnaire

### Science Identity

As with the other qualitative data collected, the Twenty-statement questionnaire (TSQ) data was coded using the themes as described by Eccles (Eccles et al., 1983; Eccles, 2009): perceptions and interpretation of characteristics and experiences; emerging self-knowledge and future goals; expectations of success; subjective task value and; task, activities and behavioral choices. Each statement from the twenty-statement questionnaire was coded into one of these themes by the researcher (see Methods for examples of coding). The totals for each of the descriptors were summed for each participant, and then divided by the total number of self-descriptors to provide an average score for each category, as indicated in Table 4.14. Among the 240 statements analyzed, the majority of the statements made by the participants were in the category of *expectations of success* (37.5%), which included 90 statements in all. The next most commonly coded category *characteristics and experiences* (16.7%), with 40 statements. Next, was the category *activities and behavioral choices* (16.3%) with 39 statements, and then *goals* (12.5%), with 27 statements coded. The next most commonly coded category was *subjective task value* (6.7%), with 16 statements, and then individual and collective identities (2.5%), with 6 statements. These students listed more statements describing their expectations of success when using the TSQ than they had given when interviewed. This group is composed of all African American male students enrolled in an advanced level science class and who may have a higher awareness of themselves, demonstrating a strong self-efficacy. The themed student responses have been

summarized in Table 4.14. The students' level of science identity have been noted based on their responses and categorized into strong, moderate, and weak/no identity with science.

Table 4.14

TSQ student responses based on Expectancy-value theory

<b>Student</b>	<b>Characteristics &amp; Experiences</b>	<b>Individual &amp; Collective Identities</b>	<b>Goals</b>	<b>Expectations of Success</b>	<b>Subjective Task Value</b>	<b>Activities &amp; Behavioral Choices</b>
<b>Strong Science Identity</b>						
<b>Bobby</b>	<b>2</b>	<b>2</b>	<b>2</b>	<b>11</b>	<b>2</b>	<b>-</b>
<b>Jerry</b>	<b>7</b>	<b>-</b>	<b>4</b>	<b>2</b>	<b>1</b>	<b>6</b>
<b>Ronald</b>	<b>-</b>	<b>-</b>	<b>1</b>	<b>11</b>	<b>-</b>	<b>6</b>
<b>Steven</b>	<b>1</b>	<b>1</b>	<b>3</b>	<b>12</b>	<b>1</b>	<b>-</b>
<b>Kenneth</b>	<b>-</b>	<b>-</b>	<b>3</b>	<b>9</b>	<b>-</b>	<b>6</b>
<b>Kevin</b>	<b>9</b>	<b>1</b>	<b>2</b>	<b>4</b>	<b>1</b>	<b>-</b>
<b>Omar</b>	<b>2</b>	<b>-</b>	<b>1</b>	<b>7</b>	<b>8</b>	<b>1</b>
<b>Moderate Science Identity</b>						
<b>Terrance</b>	<b>2</b>	<b>-</b>	<b>-</b>	<b>16</b>	<b>1</b>	<b>1</b>
<b>Ricky</b>	<b>7</b>	<b>-</b>	<b>4</b>	<b>4</b>	<b>2</b>	<b>2</b>
<b>Weak/No Science Identity</b>						
<b>Nate</b>	<b>-</b>	<b>-</b>	<b>2</b>	<b>2</b>	<b>-</b>	<b>12</b>
<b>Grant</b>	<b>-</b>	<b>1</b>	<b>4</b>	<b>6</b>	<b>-</b>	<b>4</b>
<b>Edward</b>	<b>10</b>	<b>1</b>	<b>1</b>	<b>6</b>	<b>-</b>	<b>1</b>
<b>Percentage of Comments</b>	<b>16.7%</b>	<b>2.5%</b>	<b>12.5%</b>	<b>37.5%</b>	<b>6.7%</b>	<b>16.3%</b>

\*Nonsensical comments were eliminated from the analyses

These statements were further analyzed into positive and negative statements. Of these 240 statements, all but 7 statements were coded as positive statements with the remaining coded as negative statements. These high school African American males define themselves in terms of positive personal traits.

### **School Perceptions Questionnaire**

The school perceptions questionnaire (SPQ) consists of thirty-two items with seven questions pertaining to the valuing of school, 12 questions measuring sense of belonging and 13 questions relating to the identification with academics (Appendix G). Each question is based on a five point Likert-scale of 1 to 5. One corresponded to strongly disagree and five corresponded to strongly agree. There are three categories within the questionnaire with questions that address factors of the expectancy-value theory (Eccles, 2009; Eccles et al., 1983). The SPQ used in this study was designed to measure identification with academics particularly in secondary and postsecondary populations (Osborne & Walker, 1997). Its internal consistency (Cronbach's alpha was .82) and the scale determined to have good validity. It was determined that background factors, such as race or group membership, school climate, and family or community environment, influenced identification with academics, (Osborne, 1997).

The maximum score on the SPQ is 160. The average score for all of the participants was 129 (a 3.9 on the Likert scale) with a standard deviation of 0.76. The twelve respondents were African American high school males in grades 11 and 12 enrolled in advanced level science courses. The SPQ has three subscales; valuing of school, sense of belonging and

identification with academics. The males averaged 3.8 on valuing of school, 3.8 on sense of belonging and a 4.3 on identification with academics on the 5 point SPQ scale (see Table 4.15).

Table 4.15

*Student SPQ subscale responses*

<b>Participants</b>	<b>Valuing of School</b>	<b>Sense of Belonging</b>	<b>Identification with Academics</b>	<b>Total Score</b>
<b>Strong Science Identity</b>				
Bobby	2.7	2.8	3.5	145
Jerry	5.0	4.4	4.8	112
Ronald	4.9	3.9	4.5	141
Steven	2.9	3.3	4.0	151
Kenneth	4.9	4.6	4.9	150
Kevin	4.1	3.9	4.3	115
Omar	2.3	3.2	3.8	103
<b>Moderate Science Identity</b>				
Terrance	2.7	2.8	3.8	137
Ricky	4.3	4.4	4.5	142
<b>Weak/No Science Identity</b>				
Nate	3.1	3.5	3.9	103
Grant	4.4	4.5	4.6	99
Edward	4.7	4.3	5.0	153
Average	3.8	3.8	4.3	

Twelve African American males in this study completed the SPQ and reported that their identification with academics was the most important factor when examining their perceptions for school and ultimately for enrolling in an advanced science course. A sense of belonging and valuing of school averaged the same level of importance among the research participants. This was slightly below 'mildly agree' with these being important factors for them. Grant, the student with the score of 99, had a lower identification with academics when compared to Edward, the student, who was very much engrossed in academics, with a high score of 153.

The results of the School Perceptions Questionnaire indicated that students were most likely to positively identify with academics. Students' level of identification (strong, moderate, low/no) with science was not linked to the results of this survey, but rather was linked to the academic strength of the individuals (range: 3.5-5.0, mean 4.3). Similarly, students' results on the subscales for valuing school (range: 2.7-5.0, mean 3.8) and a sense of belonging (range 2.8-4.6, mean 3.8) was not linked to students' level of identification with science.

### Summary

In this chapter, first, descriptions of the teachers, Mr. Dunn and Mrs. Trent, and the classroom observations were shared. Next, findings from the case studies of each student, which also included interviews about the students with either Mr. Dunn, the Honors Anatomy and Physiology teacher, Mrs. Trent, the IB Physics teacher, or both, were presented. Case studies also included interview data analysis from seven of the students'

parent interviews. Then, analyses of data from the PowerPoints, the Twenty-statement Questionnaire (TSQ) and the School Perceptions Survey (SPQ) were shared. In Chapter Five, these findings will be discussed in light of the literature.

## CHAPTER FIVE

### DISCUSSION

#### Introduction

This study sought to gain an understanding of twelve African American males who were enrolled in one or two advanced science courses at an inner city high school located in the southeastern United States. Who were these students? What were the students' goals? Why were they choosing to be in these courses? What factors influenced their choices? In order to seek answers to these and related questions, the expectancy-value model (Eccles, 2009; Eccles et al., 1983) was employed. Identifying these factors for African American males can assist educational stakeholders, teachers, school administrators, and parents to better understand promoting resilience among these students and sustaining their social identity through achievement (Whiting, 2009). This research builds off of the pilot work of Johnson (2013), which focused on urban high school students enrolled in both general and advanced level science classes. These findings, and the literature (Eccles, 2009; Palmer, Davis, & Hilton, 2009) indicated the potential of research focused on the motivation of Black males to enroll in advanced science courses, an understudied issue. Given that these high school advanced science courses have been identified as gateways, for some students, to scientific careers (Updegraff et al., 2001; Aschbacher et al., 2010; Toldston & Lewis, 2012), learning more about these students' motivations to enroll in advanced science courses is vital.

The Eccles et al. (1983) model includes categories empirically found to be important aspects of students' identification with science and their subsequent choices, through the development and analyses of survey data. Using regression analyses, Eccles et al., analyzed subsets of survey items intended to assess students' characteristics and experiences, emerging self-knowledge and future goals, individual and collective identities, expectations of success, subjective task values, and task activities or behavioral choices. In their predictive model, identity, goals, and expectation of success were predictors of behavioral choices, as was the extent to which one associated value to a task versus cost. In this research study, these same factors were examined using primarily qualitative data, collected through personal interviews and other artifacts, in order to study African American male students enrolled in advanced level science courses. This research was conducted to gain a better understanding of how students develop science identities, as suggested by Aschbacher et al. (2010).

A wide range of data sources were used to try to understand as completely as possible, the nature of these students' identification with science, and the salient factors underlying their choices. Key participants in the study were twelve African American male students enrolled in one or two advanced science courses, their science teachers' beliefs about them, and what some (seven) of their parents reported during in-depth interviews. Additionally, students' PowerPoint presentations, data from a School Perceptions Questionnaire, and an "I am" identity protocol were coded qualitatively, using *a priori* factors from an adapted version of the expectancy-value model (Eccles, 2009; Eccles et al.,

1983). In addition, the researchers' field notes, taken during weekly observations during each of the two science classes, were used to gain a more complete understanding of these male students.

Four research questions drove the analyses for this study: 1) Who are the African American male students enrolled in advanced science courses?, 2) How do African American males in advanced science courses identify with science?, 3) How do African American male students in advanced science courses describe the relative cost and value/benefits of this choice?, and 4) What social factors influence African American male students' academic course choices and future goals? In this chapter, the findings from Chapter 4 will be discussed in light of the literature. Given the focus of the research on science identity, as findings for each of the research questions are discussed, they will be done so in terms of the students' level of identification with science.

Based on the analyses of all of the data sources, the students were categorized as having strong, moderate or weak/no identification with science. Seven of the twelve students identified strongly with science and had clear goals and interests in science, leaving little doubt about their pursuit of science in their futures. Students categorized as moderately identifying with science enjoyed science and could possibly see themselves in science careers. The students with weak/no identification with science had goals that were generally not aligned with science such as becoming a sports agent or a lawyer. This study was unique from other identity studies in the literature (Bryan, Glynn, & Kittleson, 2011; Carlone and Johnson, 2007) in that it focused on African American male high school students, was

qualitative in nature, took place in an urban setting, and focused on motivational factors underlying advanced science course selection. In contrast to other studies on marginalized Black students in advanced courses (Russell and Atwater, 2009) or who feel they have to change their identities (Fordham, 1997; Elmensky & Selier, 2007; Seiler, 2001; Ogbu, 2004) to be good students, this study focused on a school that was 84% African American, and on two advanced science courses in which African American students were enrolled.

### **African American male students in advanced science courses**

Six of the seven (86%) students who identified **strongly** with science lived with both of their parents. Most of them had siblings, and of these, one of them already was attending college. Of these seven, five of the students had at least one parent who had graduated from college, and seventy-one percent of the parents were employed in professional careers. Of these students, three of them had parents with science-related careers. In this group, only one of them (Steven) was a senior; the other six were juniors. All of these students were athletes and involved in other school activities. They all made choices to participate in numerous activities yet were able to maintain their academic standings in their science classes. It seemed likely, although this data was not specifically collected, that all of these households had a relatively high socio-economic status (SES). All of the students in this group dressed in a preppy or in a 'clean-cut' manner and most were from college educated parents.

Two students identified **moderately** with science; Ricky and Terrance, both of whom were juniors and had siblings. Neither of their parents had college degrees. Both of these males participated in several activities after school. It is likely that both of these households

were of modest means and of a lower socio-economic status. These two males dressed in a similar fashion, in jeans and shirts, in a clean-cut style.

Three students had **weak/no** identification with science; Edward, Grant, and Nate. Two of the three students had parents who were professionals. One student (a senior) lived with both of his college educated parents; the other two students lived in single parent homes. Two of the three students have siblings, and one of their parents was a college graduate. None of the males in this group had parents who had science backgrounds. Two of the three students seemed to have households with a relatively high socio-economic status. All of the students in this group were actively engaged in school activities. All of these students were very well dressed, often wearing dress slacks and polo style shirts for that ‘preppy’ look.

Students who have family friends and relatives in a science related field are more likely to enroll in a secondary chemistry course (Dalgerty & Coll, 2006b). Of the twelve students in this study, seven of the twelve students identified strongly with science, two of them moderately identified with science, and three of the students were not interested in science careers. Consistent with the research by Dalgerty and Coll, the students with weak/no science identity did not have parents in a science field. Of the nine students who either strongly or moderately identified with science, only three of the students had a parent in a science, they strongly identified with science. Therefore, although those students who had parents in science careers also intended to pursue science fields, it was not necessary to have a parent in science in order to have a strong or moderate identification with science.

In this study, seven of the twelve (58%) students had a least one parent who attended college. The literature (Joe & Davis, 2008) indicates that students are more likely to enroll in college if they have college educated parents. Nearly all of the students, eight of twelve (67%), lived with both parents. However, it was not essential to have a college educated parent in order to enroll in advanced science courses, or pursue a science career. It is possible that the peer group of these students, both in the science classroom and on their sports teams, favored dressing in a clean-cut style and influenced one another in their future pursuits. Many of these males were successful athletes (83%), as well, and in line for college scholarships. Their dress and behaviors contrast with the stereotypical views of Black males who need to dress and behave in “gangsta” ways to be popular (Thompson & Lewis, 2005) or to be socially deviant to be admired (Young, 2009).

#### **How African American males in advanced science courses identify with science**

Seven of the students in this study strongly identified with science. Students’ concepts of science identity were informed by their daily social interactions at school, home, and outside school in other science related environments (Brickhouse and Potter, 2001). Students identified engagement, experiences within their social communities, and interesting classes as related to how they perceive science and their identification with science. Most of the students in this study (nine of twelve) indicated moderate to strong career interests in the sciences and enrolled in the advanced science courses as preparation for their futures in science related fields. They had developed science identities compatible with those

described by Brickhouse et al., (2000). For those who did not have career intentions in science (three), they identified as being good students and future college students.

All seven of these students with strong science identities described themselves as being self-motivated, inquisitive, curious, investigative, knowledgeable, patient, having perseverance and determination, imaginative and adventurous, characteristics they also identified as belonging to scientists. These students expressed having good experiences in their science classes, which included participating in class activities, field trips, having fun in class, and using critical thinking and problem solving skills, while carrying out hands-on activities in class. They also described their out of school experiences in science such as working at museums, as furthering their science interests. Because of their science aptitudes, they were able to understand the implications and usefulness of the course content. Having excellent teachers push them to maintain a high level of curiosity and interest was consistent with the findings of Maltese & Tai (2011). The characteristics of these students are similar to those found by Whiting (2006) with Black males who had a positive scholar identity and viewed themselves as studious, competent and intelligent in school settings. The students believed the course content was relevant to them in their daily lives and they could immediately use what was learned in class. Terrance, who had a moderate science identity, highlighted the family-like atmosphere in his science class which allowed him to excel in class and maintain a high level of interest in Anatomy and Physiology, as he considered science as a possible field of study. The students in this study focused on the positive aspects of their science classes, similar to the findings of the study by Aschbacher et al. (2010), in

which the students' identities were also based on how they were viewed by others, as they participated in scientific activities, and resonate with Carlone and Johnson's (2007) notions of science identity as related to students' competence, performance, and recognition in science.

Students with strong science identities described themselves as sharing characteristics with scientists. As knowledge, competency, and meaning were developed from their social interactions, students began constructing their identities, or who they were in relation to their communities or even who they wished to be (Aschbacher et al., 2010). These two science classes provided the wide range of activities and interactions that allowed a large number of these African American males to construct identities in relation to school science. In providing rich descriptions of the students, using multiple sources, this study heeds the call of Brickhouse and Potter (2001) in understanding the factors leading to this identification with science.

Students who fail to enroll in advanced science courses because of course fear often experience missed opportunities (Cunningham et al., 2009) and contribute this fear to previous bad experiences such as a lack of role models, bad experiences in class, and inadequately prepared science teachers. This is also likely to be expressed negatively by gender, ethnicity, and the stereotyping of scientist in the media (Udo et al., 2004). The African American males in this study described their past science experiences as positive ones and did not speak about their classes in terms of fear or failure. There is no doubt that the positive, knowledgeable teacher role models, with whom the students had positive

relationships and experiences, were a major factor. Witherspoon et al., (1997) concluded that African American high school students who desired to excel academically were faced with isolation and cut off from their peers and other social networks that existed in high school. However, this was not the case for the students in this current research study; these students were proud of their accomplishments and focused on their futures.

A study conducted by Thompson & Lewis (2005) found that many African American males living in major urban areas in the US faced numerous social and economic barriers and received little encouragement and support from their peers to pursue career goals and acquire a college education. Kyburg et al., (2007) described the peer pressure experienced by African American males *not* to achieve as possibly explaining why so few African American males enroll in advanced placement or honors courses. Researchers also described the failure of families of African American males to enroll them in gifted and talented programs as limiting them in their preparation for academic and college level work (Klopfenstein & Thomas, 2009). All of these research findings described barriers for success among African American male students, which contrasted with the goals, behaviors, and expectations for the success of the twelve African American males in this study. The students in this study participated in summer internships, had the support of their peers, and were enrolled in advanced level science courses, expected and experienced academic success.

According to Whiting (2006), African American males in a school setting perceived themselves as intelligent, studious, academicians, and talented. Young (2009) explained that African American males find their identities, pride, and self-efficacy in sports, music, and

acting domains. The students in this study found their scholar athletic identities, similar to the assertions of the studies by Whiting and Young.

All of the males in this study expect success in their futures; seven of these expect this success to be in a science field, and two of them consider a science major and career as possible, in contrast to the findings of Farenja and Joyce (1998). According to Whiting (2006), when the self-efficacy of students is high, Black males share characteristics of high resilience, high self-confidence, high self-control and a clear understanding of the tasks they face and the belief that they can accomplish all of the subtasks associated with their future goals. The students in the current study expressed confidence in their science abilities, or in school, in general. They were highly motivated and wanted to learn. Similar to Whiting's study, these Black male students were found to be motivated to learn science, engaged in science-learning behaviors, pursued goals such as earning good grades, and for those who had moderate to strong science identities, pursued science-related careers. Although only seven of the students had strong science identities, all of the students had strong scholar identities, with college and career goals, resonant with the motivated students studied by Sanfeliz and Stalzer (2003) and Dalgerty & Coll (2006a; 2006b).

#### **The value and relative costs of choosing an advanced science course**

There is a high workload associated with taking advanced science courses. In the expectancy-value model of achievement motivation (Eccles, 2009; Eccles et al., 1983), the value or benefit of a decision is made up of a student's interest or enjoyment in what they were doing, how it was helpful or useful to them (utility value), and if it was perceived as to

the importance of doing well on a task (attainment value). In this study, students were enrolled in demanding courses, IB Physics, Honors Anatomy and Physiology, or both courses.

For the seven students who strongly identified with science, two of the students (Kevin and Bobby) were enrolled in both courses, and three other students were enrolled in other advanced science courses. These students did not speak in negative terms about the costs of taking these courses. Instead, most of these students commented on the work as being “challenging” or “interesting” and that the course(s) would prepare them for their future goals, which included all of these students who identified strongly with science. All of these students planned on attending college and majoring in science. The fields they were planning to study included veterinary science, marine biology, biomedical engineering, neurobiology, anesthesiology, sports medicine, and astronomy. Their future career goals included becoming a veterinarian, a marine biologist, a biomedical engineer, a neuroscientist, an anesthesiologist, an astrophysicist, and a doctor of sports medicine.

Two students had a moderate identification with science and were both enrolled in the Honors Anatomy and Physiology course. Ricky said he enjoyed the science class although it was really challenging, however, the class prepared him for the future. Both students said they benefitted from the learning environment and enjoyed their learning experiences in class, and down played the cost of taking the advanced level science course. Terrance also enrolled in the Honors Physics class during the next semester and was anticipating the events from that class because he was interested in science. One of the students was sure about

studying Animal Studies in college and the other seriously considered a major of science in college, but he remained undecided in spite of taking two advanced science courses in one academic year. Terrance had the interest in science but not the commitment for a future in science.

Three of the students who had weak/no identification with science talked about their science classes as being challenging, the most difficult class they had ever taken, but still described the class as being fun. Nate described the class as requiring a lot of work even though he found it interesting and was able to relate to some of the activities completed in class. These students did not speak negatively of the classes. Two of these students have decided on other career choices that do not involve science; becoming a sports agent, and a civil rights attorney. Only one of the students, Grant, was unsure of his plans (he did say, he was considering computer engineering).

These students have varied ranges of identification with science; because of their science aptitude they are able to understand the implications and usefulness of the course content. These findings were similar to those found by Whiting (2006) on Black males who had a positive scholar identity viewing themselves as studious, competent, and intelligent in school settings. The students believed the course content was relevant to them in their daily lives and they could immediately use what was learned in class.

Resonant with the findings of Maltese & Tai (2011) the students who were enrolled in the courses tended to have high interest in science. Those with the strongest interest in the course were more likely to express college and career goals related to science. In contrast,

the students (Edward, Grant, and Nate) who were least interested in science did not plan to major in science and did not have career goals related to science. However, students who had less interest in science did not express a greater cost of taking the course compared to those who had a stronger interest in and identification with science. All of the students successfully passed the course(s), although students with the strongest interest in science expended more effort during science classes. Other than students who were just naturals (Kevin and Bobby) there were not large differences expressed between costs and benefits of the science courses among the students in this current research study, other than specifying the relevance of what was learned for a college major, instead of simply for college preparation. Students made statements about the attainment value or importance of the advanced science courses in which they enrolled. The students believed these classes were good general classes to have, good for their intended major in science, and good for increasing their grade point averages, other students just enjoyed being in the class. They had different reasons but similar benefits and cost of taking these science classes.

While the literature focuses more on the failure of African American males, (Noguera, 2003; Ogbu, 2004) this research found that the twelve male African American students enrolled in these advanced science classes, resonant with the findings of Whiting (2006) and Young (2009). These students were demanding, they wanted creative, knowledgeable, teachers who could help them appreciate the science and make connections to their daily lives. Not all of the students identified strongly or moderately with science. Perhaps, in spite of this, the teachers in this study overcame some of that and got the

students, even those not as 'into' science to appreciate the Physics or the Anatomy. As expressed by a few of the students in the Anatomy class, the Black male science teacher as a role model was critical in their success as African American males in advanced science courses.

This study has emphasized the need to grow African American males as mentors as found by Frierson, Hargrove, and Lewis, (1994) in their interviews of 18 African American college students that indicated that those students with Black mentors had more positive attitudes and perceptions toward the research environment than those with White mentors which in turn highlighted the importance of mentors for those individuals. Having mentors is a concept that should continue in college to help foster the positive attitudes and perceptions of science for these young African American males. The African American faculty members should strategically plan to increase Black male enrollment in advanced science courses and think about how they will support these males in science and connect them to a college mentor (Harper, 2006).

### **Social factors that influence academic course choices and future goals**

#### *Teacher influence*

Seven of the students strongly identified with science. All of the students in this group spoke of the positive attributes of their science teachers. The two students who were enrolled in both advanced science classes described their teachers as preparing them for their classes, knew they would receive the guidance they needed in class, provided a great influence and made the hands-on activities enjoyable in class. Three of these students were

in the Physics class and expressed how they admired the teacher, her instructional methods and the encouragement she provided to them, and the learning opportunities she provided for them. The last two students in this group had Anatomy and Physiology and described this male teacher as terrific, made them eager to learn everything, made the class fun and focused their attention in class. Both of these students highlighted the student-teacher relationship as being extremely important and explained that it was about who was teaching the class and what your relationship was with them. The students in this group further described the male teacher as being rigorous, demanding, and intolerant of deviant behavior all while maintaining a positive attitude about the students' academic success, and his possessing personable characteristics. These characteristics of the teacher allowed these students to experience successful learning in class. Their positive relationships with the teacher encouraged them to pursue science in their futures; he provided worthy learning opportunities for them. Five of these students enrolled in the Physics class because of the excellent relationship they had had with the female teacher in a previous Chemistry class. These five students became more engaged in their learning as they proceeded through their coursework, resonating with the findings of Rascoe and Atwater (2005), and Russell and Atwater (2005) and in contrast to the findings of Ferguson (2001). It was evident to these African American male students that she was a caring teacher who had high expectations and positively interacted with her students.

The two students who had moderate identification with science spoke highly of their science teacher in the Anatomy and Physiology class. These students emphasized being

positively influenced by the hands-on nature of this class. Ricky spoke of his high interest in the class because of the manner in which Mr. Dunn guided him, and showed him such a caring and father-like figure with high expectations. Terrance further described how the teacher triggered his science and learning interest in class and got him excited about science, specifically Anatomy and Physiology. He acknowledged the teacher for providing such a great and family-like atmosphere in class. Both students described how the teacher pushed them to excel not only in the classroom but in their personal lives as well. The teacher was a crucial component in the success of these students in science class. Mr. Dunn was an effective teacher for these males but he was also a mentor for these students nurturing the learning of these African American males (Hrabowski, 2004).

The three students who had weak/no identification with science talked about the critical role their teachers played in their science interest in class. Though they do not have intentions of pursuing science as a career, they spoke of the positive experiences they had in class with their science teachers. Edward was in the Anatomy and Physiology class and explained how he desired the structured and nurturing environment Mr. Dunn provided. Several of his peers had already had the Anatomy class and Edward wanted to share their experiences. He had great respect for the teacher. He wanted to participate in the live and virtual dissections, collaborative work, opportunities to do presentations and projects that this male teacher used to engage his students, as recommended by Cousins-Cooper (2000). Grant and Nate were the other two students who were enrolled in Physics. They liked the teacher; to improve his understanding of Physics; Grant had to start attending tutoring sessions, but

still said it was a fun class. Nate described the Physics teacher, Mrs. Trent, as “good and cool,” which provided an interesting class that he could relate to football and basketball, especially the unit on projectiles and motion. She made the class interesting to them. In spite of some of their students not identifying strongly with science, these teachers overcame those issues and got these students to appreciate the Physics or Anatomy. Interview and observation data from this study showed that students knew that their teachers were genuinely interested in them and in their success. As found with this study, when students perceived their teachers as caring, provided quality instruction, and praised them for their efforts, the students were more likely to achieve (Britner & Pajares, 2006; 2001).

Teachers emerged as critical influences on the science interests of these students, and how they taught their courses was an essential part of this influence. Students emphasized being positively influenced by the hands-on nature of the two science classes and how much they admired and respected their teachers. The teacher as a role model, especially the Black male, was critical to the learning of science for these students (Maylor, 2009). Having great teachers helped to push these students to maintain a high level of curiosity and interest, consistent with the findings of Maltese & Tai (2011).

#### *Familial and peer influence*

Seven of the students who strongly identified with science all described their parents as having strong involvement and influence in attributing to their successes. Most (71%) of these students had at least one parent with a college degree and all of the parents had high expectations for their sons to graduate from high school, attend college and graduate and go

on to have successful careers. Most of these students had siblings, and participated in numerous activities after school. Their parents were supportive of them and attended their activities; basketball games, football games, and induction ceremonies all on behalf of their sons. All of these students have been told by their parents that they are expected to obtain a scholarship to attend college. Most of the parents of these students in this group were professionals (58%) and expected their sons to attain the same or reach a higher level of achievement as they had.

Both of the students who identify moderately with science said their families expected them to have good grades, be successful, and go to college. Ricky's mother expected him to have academic success, and be happy and successful in his chosen field while his father emphasizes athletics. Most of his friends do not follow the academic path; instead they hang out in the street ignoring academics and have other interests. In spite of these influences, Ricky intended to go to college, major in Animal Studies, and he depended on his family and coaches to give him good advice.

Terrance had some helpful peers in class. He knew his mother and the rest of his family members expected him to earn good grades, learn as much as he could, and become the first college graduate in their family. Some of Terrance's friends had similar goals, at least the ones he had in class, to go to college. The friends he had outside of class did not share his academic goals. Terrance on the other hand planned on attending a historically Black college or university (HBCU) on a band scholarship. He was considering science, but had not made definite decisions about his potential college major.

There were three students in this study who had weak/no identification with science. One student (Edward) identifies both of his parents and his extended family including his grandmother and aunts, as influences, another student (Grant) identified his father, and the other (Nate) identified his older brother. Two of these students had definite plans to attend college and knew these were the expectations from their families (Edward and Nate). Grant was somewhat unsure, because he feared his father could not afford to pay for college. Their families pushed them to excel in school and to work towards earning college scholarships. They each expressed having friends who similarly planned to go to college.

Similar to the findings of Whiting (2006), the students in this study were focused on their future career aspirations, and were clearly aware that their current choices and goals would impact their futures. The parental influence on these students gave them the confidence they needed to pursue these advanced science courses, which would likely lead to their choice of science-related careers for most (75%) of them. Whiting asserted that Black male students needed to set realistic educational goals, understand the importance of high grades and the benefits of taking challenging courses, in order to reach their future goals. Interview data supports the concept that parents and teachers had a strong influence on these males, corroborating Whiting's focus. Parents conveyed the importance they attached to schooling and academic achievement through their participation at school events as well as monitoring activities outside of school, this positive parental support was similar to what was found by Steward (2008). The data collected supports the claim that parental involvement likely influences achievement indirectly through its impact on students' activities,

motivation, and perceptions of the school environment. Parental involvement was a powerful influence on students' beliefs, choice of school related activities, motivation and academic success; this was true even if the parents have not themselves attained the goals they sought for their sons.

For most of the students in this study, at least one of their parents (58%) was college educated, and with this came high expectations for academic achievement. But high expectations were also expected from the parents who did not have a college degree. All of the students in this study had very supportive parents with high expectations for their sons' futures. The findings of this study supported the research by Maton & Hrabowski (2004) on African American students, which suggested that strong parental efforts attributed to the successes and strengths among these students. This success was due partly from the African American males being raised in families characterized by determined parental academic engagement, strictness, child-focused love and community connectedness.

Having a positive school environment including the teachers and other school personnel can have a profound effect on the students. The findings of this current study concur with the research by Stewart (2008; 2007) in which student performance among African American students was enhanced when they believed their teachers were helpful and supportive. Interview and observation data from this current study also showed that students knew when their teachers were genuinely interested in them and their success, as did the students in this study. As was found by Britner and Pajares (2006; 2001), when students

perceived their teachers as caring, providing quality instruction, and praise them for their efforts, they were more likely to be achievers.

Historically, African American males have been characterized as having a sense of academic inferiority to their peers, low self-esteem, and low expectation (Archer-Banks & Behar-Horenstein, 2012; Ogbu, 2004). However, this was not the case in this current study; instead, these males had a sense of academic excellence, high self-esteem, and experienced high expectations from their science teachers, similar to what was described as beneficial by Bryan et al. (2011) and Eccles (2009).

The underachievement of African American males has been well noted by researchers, policy makers, educators, and parents (Joe & Davis, 2008; Mickelson & Greene, 2006). Rather than focus on negative stereotypes, the males in this current research chose to work against these stereotypes and excel in school with future plans to pursue science careers. Research by Joe and Davis suggested that students' academic achievement was significantly influenced by their parents' level of education, ethnicity, SES, and the student's environment. Wiggan (2008) suggested a possible negative impact of low SES on students' access to experiences and academic achievement. Although most of the students in this study were from two parent homes, professional homes, they did not describe lacking any of the necessities for school. Certainly, their parents significantly influenced their academic paths, an especially important factor for African American males (Brooks-Gunn & Markman, 2005) in preparing their children for success in school. Parents also played a critical role in motivating their children in preparation and aspirations for STEM careers although; they may

lack the necessary skills to do so (Hill & Tyson, 2009). The combination of the parental and teacher influences seemed to work in tandem in supporting these young African American men's aspirations.

The students in this study described their past experiences in science as positive, which consisted of grades earned, gender role beliefs, and the behavior and goals of their socializers, peers, and their personal choices (Roth, 2006). The parents interviewed during this study described the support and motivation they provided their sons in preparation for their academic success, consistent with research by Hill and Tyson (2009).

Because learning is shaped by influences on the students, there needs to be discourse among students that allow connections to be made between the relevancy of science and potential personal benefits for students (Kozoll, 2004). When students can make connections between science and their daily lives, they can make meaning of science, allowing them to better understand who they are and what they want to be in relation to science. The males in this research study were presented with such opportunities in class with their peers and were able to make connections between science and its relevancy to their daily lives.

Researchers (Robinson & Ocho, 2008) found that students specifically requested more labs and hands-on activities to provide relevancy to science to potentially stimulate an increased interest in science for them. Similarly, the twelve African American males in this study expressed their sentiments about what they liked about their advanced science classes and provided them with good reasons for taking advanced science classes beyond the minimal science requirements. The males in this study clearly had high quality instruction

that was helping them to succeed, keeping them from the student failure or poor performance described by Wiggan (2008) as a result of poor instruction.

Russell and Atwater (2009) found that under-represented groups can be marginalized in the science classroom, often feeling inferior to their teachers and White students because of their gender, ethnicity, and social class. However, for the students in this research study, this was not the case. These students did not express feeling inferior to anyone; they wanted to thrive within their learning environments and prepare themselves for their futures. There were other studies that found that non-White students felt they had to change their social identities in order to succeed in science, often at the cost of being berated by their own peer groups (Ogbu, 2004; Elmensky & Selier, 2007). The twelve African American males in this current study did not express any negative aspects of being in advanced science courses, nor did they mention any incidents of having to “act White” to be accepted in their classes. The majority of the students in their advanced science courses were African American. These students explained how they wanted to present themselves, as successful and professional Black males. They discussed how they liked the feeling of being perceived or described as “being smart” because of the grades they earned and the courses they were in.

### **Utility of the expectancy-value model**

In this study, the researcher took a quantitative model and used it qualitatively to understand the African American males enrolled in advanced level science courses. This researcher wanted to see if the expectancy-value model (Eccles 2009; Eccles et al., 1983) would work for qualitative analyses by taking the categories of the EVT and coding student’s

statements into those categories. After initial coding, it was clear that the students' foci were on goals, expectations of success, science identity, and influences of key socializers. This study had a select population of all African American high school males; some factors were salient as there was already a special group of interest. Therefore, the EVT model was graphically reorganized with some of the categories merged to capture the data from the interviews. The cultural milieu, key socializers, and perceptions and interpretations of experiences, individual's reactions and memories of previous personal experiences were collapsed into one category. The other categories were future goals (self-concept and self-schemata), individual and collective identities, expectation of success, subjective task value (interest, attainment value, utility value, relative cost/benefits), and task, activities and behavioral choices. The flow of the model moves from left to right with each category influencing the other and being affected by the previous category. According to Eccles (2009), these factors influence who you are, the choices you make, and reinforce your identity.

The graphical representation of the expectancy-value theory of achievement related choices (Eccles, 2009; Eccles et al., 1983) used for this study was able to allow the researcher to code all of the data provided through a wide variety of qualitative sources, and make sense of how the African American males in this study were identifying with science. It helped to gain a sense of the factors that were most salient for this group of individuals, and helped to clarify the critical role of students' goals, identity, and key socializers. Case studies of each of the individual males in the study also allowed the researcher to distinguish

between individuals, yet see patterns between them. Therefore, although the EVT was developed using survey data as a predictive model for key factors underlying students' achievement motivation, it worked well in explicating what was happening with the twelve males in this study. As such, its use was beneficial. Students are influenced by these social interactions and judge the viability of their science identities and aspirations to that of others; their self-efficacy is also affected by their pursuit of their goals (Eccles, 2009; Wigfield & Eccles, 2000), and the degree to which there are successful influences in their science identities. This model proved to be useful in understanding the African American males enrolled in advanced high school science courses, based on interpretation of qualitative data.

### **Summary**

When the students were describing themselves, it was important to them that they convey the right message to others. They dressed in a professional manner with a clean cut look. It was important to them to be neatly dressed and not to buy into the negative images portrayed by others about African American males. It did not seem to matter whether these students were from single or two parent households, or if they had professional or non-professional parents. Their parents and families all wanted the same things for their sons, to earn good grades, graduate from high school, and be successful in their futures. Most of the students from this study identified strongly (seven) with science, some moderately (two) and three had weak/no identification with science. Although these differences existed in their science identities, the males in this study enjoyed their science classes, teachers, and the learning environments in their classes. The males in the study downplayed the costs of taking

these classes and focused on the benefits of being prepared for their entrance into college and their potential careers. All the males had strong support from their parents, teachers, and peers. Some also identified their coaches as being influential in their lives. All of the African American males in this study felt they had been adequately prepared by their science teachers to pursue their future careers.

## CHAPTER SIX

### CONCLUSIONS AND IMPLICATIONS

#### **Introduction**

African American males succeed in school despite the many obstacles they may face; however, according to Stewart (2008) too little is known about the factors that contribute to their success. Few studies have focused exclusively on the experiences of African American student achievement and those that have focused on the African American family and have failed to recognize the positive role that the African American family plays in the development of their children (Gushue & Whitson, 2006). Too much emphasis has been placed on school failure, academic differences and test scores between African American and White students which contribute to the negative images of African American students (Watt et al., 2006).

This study explored factors using the expectancy-value theory of achievement motivation (Eccles, 2009; Eccles et al., 1983) to gain better insight into why African American males enroll in advanced science courses. Consistent with the work of Eccles et al., identification with science was a critical aspect of the intention to pursue science beyond high school. Interestingly, teachers played a major role in the experiences students had with science, and the extent to which they could experience science in ways that mirrored scientific practices (Chinn & Malhotra, 2002). These experiences helped students identify their skills, and connect them to scientists or scientific fields. This study adds to the

literature by focusing on African American males, who are commonly missing from the advanced science courses in high school (Stinson, 2006). Students often connected their personal interests (such as sports) to future possible careers (e.g. sports medicine). Similar to findings of Maltese and Tai (2011), students' science interest and in this case, interest in particular teachers, compelled them to enroll in advanced courses. Findings from this study suggest that high quality experiences in science courses, and supportive, demanding teachers, could assist students in identifying with science, even without a college educated parent. This study provides more insight into and support for the critical role that teachers play in the students' course decisions in the advanced sciences, particularly when one of the teachers is a Black male.

Identifying positive factors underlying science course enrollment and STEM career interest can potentially place educators and policy makers in a better position to intervene and reverse negative trends among African American students, particularly African American males (National Science Foundation, 2009; Ogbu, 2004). Identifying these factors can be used to modify how learning and development occur and become influential in students' pursuit of STEM careers. Whiting (2006) contends that self-confidence and self-efficacy contribute to a scholar identity of African American males. Seeing themselves as scholars can help influence a more meaningful educational experience for African American high school males.

### **African American males in advanced science courses**

There were twelve African American males enrolled in two advanced level science courses, and case studies were compiled for each of these students, based on individual interview data, and interviews with their teacher(s) and for seven of them, their parents. The students focused on the benefits of being in advanced science courses (interests/enjoyment, attainment value, utility for their futures) rather than the costs of these decisions (hard work). The study included students with various levels of identification with science; strong, moderate, and weak/no identification. These males could see themselves as being excited about science, many sharing some key characteristics with scientists, and some having had past experiences in summer camps, museum visits and a strong interest and aptitude for science. While some of the students came from two parent households, and some had at least one professional parent, they all had support within these advanced science classes. These males in these classes had high expectations and had strong involvement from their parents, pushing them to be successful in class. All of these African American males were motivated to succeed in these advanced science classes, regardless of their science identities.

### **How African American males in advanced science courses identify with science**

This study highlighted the students' level of identification with science. Nine of the students who strongly or moderately identified with science have intentions of pursuing science in their futures. While only three of these students had a parent in a science field, this study found that students did not have to have a college educated parent in order to enroll in the advanced science courses, or aspire to have a science career. These young men who

most strongly identified with science identified their positive characteristics (e.g. inquisitive, imaginative, and knowledgeable) as similar to those of scientists. This study also highlighted how students who had weak/no identification with science, could see themselves as successful students, but not necessarily sharing the characteristics of scientists.

### **The value and relative costs of choosing an advanced science course**

The students who strongly or moderately identified with science were those most likely to stress the value of the advanced science courses(s), in terms of enjoyment, utility for their futures, and importance, and to downplay the work involved. The students who had weak/no identification with science also stressed the social enjoyment of the course including the fun activities, the teacher and sometimes addressed the difficulty of the course. However, all of the students in this study stressed the value of the course(s) in preparing them for their futures as college students, regardless of their science intentions.

### **Social factors that influence academic course choices and future goals**

The information learned from this study highlighted the important role of supportive parents (key socializers) who had high expectations for their sons. The students attributed their enrollment in the advanced science courses to their science teachers, which included the positive relationships, hands-on learning in class, and the inviting and encouraging learning environment. In addition, other family members and coaches played important roles in the lives of these African American males. Because of the influences, the students focused on what the course(s) would do for them (utility value) such as preparing them for their futures in college.

## **Significance & Recommendations**

African American males are commonly missing from the advanced sciences in high school. The focus here is to scrutinize the reasons why these African American males from an urban high school are enrolled in the sciences, what influenced them, and to use this information to address the shortage of African American males in these courses, college science majors, and STEM careers

The results from this study highlights content that could be important for pre-service teacher training and professional development, including how student investigations and activities can be used as an invaluable tool in scaffolding students' understanding and interest in science concepts. Teacher pedagogy is vastly influential in encouraging African American males to enroll in advanced science courses and possibly pursue STEM careers. College methods instructors and professional development organizers could focus on the methodology teachers use to engage African American males in discussions around the evidence they collect through their classroom investigations. This includes what teachers should look for in student responses and how to promote students' conceptual understanding towards future careers in science. Teachers need authentic examples from active classrooms on how their strategies are effective and how to enhance the student's learning experience particularly for African American males.

Secondary classroom teachers must pay close attention to the students' learning preferences of the African American male students in their classes. This may offer some solutions for the current challenges of African American males shying away from

science. Such attention could create meaningful classroom experiences and interactions for these students. Teachers must recognize the hands-on approach to science learning, real world, relevant examples, and understanding for these males. Students need to feel that they have been provided with adequate physical and social resources inside the classroom. Primary consideration should be given to the importance of the relationship of the student to the teacher. Also noteworthy is the critical relationship that can form between an African American male teacher and his students. Strong consideration should be given to the availability of additional social resources outside the classroom, which could possibly be augmented by college counselors and science mentors and tutors.

It is important that science classroom teachers use community resources to promote science instruction. Emphasizing such resources may increase the males' interest in pursuing science especially if local mentors are a part of the process. It is recommended from this study that pre-service science teachers as well as current science teachers gain a deeper understanding of the African American male population in their science classrooms to improve teacher pedagogy by understanding the students whom they teach. While some science courses are required for high school graduation in some states, this could serve as the platform to encourage students to pursue higher level science while still in high school. Future conversations may lead to shared strategies for increasing students' interest and engagement in their science classes to further promote students' interest in advanced science, in preparation for STEM careers.

Teachers could potentially use professional development to cultivate ideas of how advanced science courses, such as Physics and Anatomy & Physiology, are applicable to their daily lives, and learn to listen to their students and synthesize their students' ideas. Perhaps they could include activities in which the students create products such as, PowerPoints about their advanced classes that could be shared with younger students, thus using them as recruitment tools for future science courses. Perhaps developing an enriching specialized course (at the pre-service level or school district level) in teaching in diverse cultures could make possible connections between the teacher, the learners and the content. In conclusion, more research is needed in the area of motivating African American high school males to enroll in advanced level science courses.

This study identified the teacher as being critical to the science experiences of African American males. These high school teachers' planning and implementation of interactive science lessons fostered interactions between students and the curriculum, their peers, and their science teachers. When these students matriculate into college, the mentoring and support should continue for African American males. These students, who have thrived with the personal relationships from a good science teacher, will likely need or benefit from supportive mentoring programs that can assist them as they pursue STEM majors leading to STEM careers. Some suggestions as to the types of programs that could exist in college include various mentoring programs specifically designed by and for African American males. Graduate students or Black professors could serve as mentors to these science students and provide mentoring, counseling, and weekly support sessions. These

mentors could provide students with information and assistance in study strategies, obtaining science internships, scientific writing, resume writing, tutoring, or shadowing a science professional on campus or in the community such as the Meyerhoff Program at the University of Maryland, Baltimore County for African American students (Maton & Hrabowski (2004).

College professors could also promote a science speakers bureau for these students, support an early partnership to college science programs (a bridge program for potential science majors), insist on specifically focused science visits to the college, encourage undergraduate science majors to serve as peer mentors, and provide additional study aids for these students. Parents could be kept informed of their son's progress and invited to celebration activities and other social functions to help build relationships with the college or university. These programs could be used to ensure the success of these African American males in their pursuit of science based careers especially for those who may not have the strong parental support at home. However, even with support and ability, the students may be entering a science culture at the college or university level that has not fostered the development and success of Black males (Watkins, Green, Goodson, Guidry & Stanley, 2007). Therefore, it is critical to figure out ways to insert culturally relevant supports for these promising Black, male scholars. The college professors also could identify students from his/her class who would likely benefit from the additional mentoring and support services. With additional support and mentoring programs, it is likely that more students of

color, particularly underrepresented Black males will not become a statistic, but rather will pursue STEM majors and careers.

### **Future Studies**

While the findings of this study have emphasized the significance of knowledgeable teachers and supportive parents in their son's success, future studies like this one could be conducted with a larger sample. In high schools with large African American populations, perhaps a team of researchers could observe more students in each of the advanced science courses offered within the high school. Additional high schools, in different states, could be sought for such a study to investigate as many students as feasible. An additional study could also be conducted with African American males by converting the interview questions into a survey with Likert type responses having the students to complete it online in an attempt to gain more participants from multiple sites. Or by taking past surveys of Eccles et al., (2009) and focus on this population. Further studies could be replicated with African American males by narrowing the focus and concentrating on one or two aspects of the EVT such as subjective task value or task choices. Students could be given a pre and post survey both before and after enrolling into an advanced level science course. Similar studies could track students once they enroll into college to see if they continue to pursue science areas of interest.

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## APPENDICES

## APPENDIX A

### North Carolina State University INFORMED CONSENT FORM for RESEARCH – Students

**Title of Research Study:** Understanding factors underlying African American students' enrollment in advanced level science courses and their development of science identities at an urban high school

**Principal Investigator:** Diane Johnson, Doctoral Candidate

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#### **What are some general things you should know about research studies?**

You are being asked to participate in a research study. You have the right to be a part of this study, to choose not to participate or to stop participating at any time. The purpose of research studies is to gain a better understanding of something, in this case, influencing factors and reasons that contribute to your decisions to enroll in advanced level science courses in high school. Participating in a study does not guarantee you benefits but you may find it interesting or exciting. In this consent form, you will find specific details about the research in which you are being asked to participate. If you do not understand something in this form you have the right to ask the researcher to explain more about the study or obtain written information. A copy of this consent form will be provided to you. If at any time you have questions about your participation, do not hesitate to contact the researcher, Diane Johnson.

#### **What is the purpose of this study?**

The purpose of this research study is to gain insight into the influencing factors and reasons that students have for enrolling in advanced level science courses and how this information can be used to help prepare students for possible career interest in science, technology, engineering or mathematics.

#### **What will happen if you take part in the study?**

If you agree to be a part of this study, in your science class, you will be asked to answer survey questions that ask you about your science interest, science self-efficacy, the support you receive in science, and your motivation that influenced your decision to take this science class. You will also be asked to participate in the creation and presentation of a Power Point activity as a part of your regular science class activities. The preparation session for your PowerPoint will be audio-taped and the final Power Point presentation videotaped. You will be asked to participate in an audio-taped interview, during school time, as a follow up from the survey questions. The interview data will be transcribed verbatim. Your class grade will not be affected by your participation in this study. All students in the class will be asked to participate in the surveys and Power Point presentations. If your informed consent form is not returned, your data will not be used in the study.

#### **Risks**

There are no known risks to the students for participating in this research. You may feel a little strange taking part in the survey that will be used for research, but that is likely to lessen given the personal relationship you have with your teacher.

#### **Benefits**

There are no benefits to the student for participating in this study however, information gained from this study will hopefully aid in improving the understanding about how students learn science and the factors that influence their decisions when deciding to enroll in advanced level science courses.

#### **Confidentiality (Privacy)**

All survey and interview responses will be kept confidential. All data will be stored confidentially by the researcher and no identifying information will be used in reports or research papers as pseudonyms will be used. The audio-recorded data, the video-taped data, and the transcripts will be stored securely in the home of the researcher and destroyed within five years of the start of this study.

**Compensation**

The student will not receive any compensation for participating in the study.

**What if you have questions about this study?**

If you have questions at any time about the study or the procedures, you may contact the researcher, Diane Johnson at dwjohns3@ncsu.edu.

**What if you have questions about your rights as a research participant?**

If you feel you have not been treated according to the descriptions in this form, or your rights as a participant in research have been violated during the course of this project, you may contact Deb Paxton, Regulatory Compliance Administrator, Box 7514, NCSU Campus (919/515-4514).

**Consent to Participate**

Dear Parent or Guardian,

Please review this form with your child to make sure they have read it and understand what they are giving permission for. "I have read and understand the above information. I have received a copy of this form. I agree to participate in this study with the understanding that I may withdraw at any time." I agree to be interviewed.

**Minors' signature** \_\_\_\_\_

**Date** \_\_\_\_\_

**Parent/Guardians' signature** \_\_\_\_\_

**Date** \_\_\_\_\_

## APPENDIX B

### North Carolina State University INFORMED CONSENT FORM for RESEARCH – Teachers

**Title of Research Study:** Understanding factors underlying African American students' enrollment in advanced level science courses and their development of science identities at an urban high school

**Principal Investigator:** Diane Johnson, Doctoral Candidate

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#### **What are some general things you should know about research studies?**

You are being asked to participate in a research study. You have the right to be a part of this study, to choose not to participate or to stop participating at any time. The purpose of research studies is to gain a better understanding of something, in this case, influencing factors and reasons that contribute to students' decisions to enroll in advanced level science courses in high school. Participating in a study does not guarantee you benefits but you may find it interesting or exciting. In this consent form, you will find specific details about the research in which you are being asked to participate. If you do not understand something in this form you have the right to ask the researcher to explain more about the study or obtain written information. A copy of this consent form will be provided to you. If at any time you have questions about your participation, do not hesitate to contact the researcher, Diane Johnson.

#### **What is the purpose of this study?**

The purpose of this research study is to gain insight into the influencing factors and reasons you perceive students as having for enrolling in advanced level science courses and how this information can be used to help prepare students for possible career interest in science, technology, engineering or mathematics.

#### **What will happen if you take part in the study?**

If you agree to be a part of this study, you will participate in an audio-recorded interview during which you will be asked questions about some of your students' science interest, science self-efficacy, and the support and motivation they receive in science. All audio-recordings will be transcribed verbatim and available for your review. You will also be asked to help distribute and collect the student surveys and consent forms.

#### **Risks**

There are no known risks for participating in this research. You may feel a little strange participating in the interview that will be used for research, but that is likely to lessen once the study is underway.

#### **Benefits**

There are no benefits to the teacher for participating in the study however, information gained from this study will hopefully aid in improving the understanding about how students learn science and the factors that influence their decisions to enroll in advanced level science courses.

#### **Confidentiality (Privacy)**

All interview responses will be kept confidential. All data will be held confidentially by the researcher and no identifying information will be used in reports or research papers as pseudonyms will be used. The audio-recordings and transcribed data will be stored securely in the home of the researcher and destroyed within 5 years of the start of this study.

#### **Compensation**

The teacher will not receive any compensation for participating in the study.

#### **What if you have questions about this study?**

If you have questions at any time about the study or the procedures, you may contact the researcher, Diane Johnson at [dwjohns3@ncsu.edu](mailto:dwjohns3@ncsu.edu).

#### **What if you have questions about your rights as a research participant?**

If you feel you have not been treated according to the descriptions in this form, or your rights as a participant in

research have been violated during the course of this project, you may contact Deb Paxton, Regulatory Compliance Administrator, Box 7514, NCSU Campus (919/515-4514).

**Consent to Participate**

I have read and understand the above information and have received a copy of this form. I agree to participate in this study with the understanding that I may withdraw at any time. I agree to participate in an audio-recorded interview.

**Teachers' signature** \_\_\_\_\_ **Date** \_\_\_\_\_

## APPENDIX C

### North Carolina State University INFORMED CONSENT FORM for RESEARCH – Parents/Guardians

**Title of Research Study:** Understanding factors underlying African American students' enrollment in advanced level science courses and their development of science identities at an urban high school

**Principal Investigator:** Diane Johnson, Doctoral Candidate

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#### **What are some general things you should know about research studies?**

You are being asked to participate in a research study. You have the right to be a part of this study, to choose not to participate or to stop participating at any time. The purpose of research studies is to gain a better understanding of something, in this case, influencing factors and reasons that contribute to your child's decision to enroll in advanced level science courses in high school. Participating in a study does not guarantee you benefits but you may find it interesting or exciting. In this consent form, you will find specific details about the research in which you are being asked to participate. If you do not understand something in this form you have the right to ask the researcher to explain more about the study or obtain written information. A copy of this consent form will be provided to you. If at any time you have questions about your participation, do not hesitate to contact the researcher, Diane Johnson.

#### **What is the purpose of this study?**

The purpose of this research study is to gain insight into the influencing factors and reasons you perceive your child as having for enrolling in advanced level science courses and how this information can be used to help prepare students for a career interest in science, technology, engineering or mathematics.

#### **What will happen if you take part in the study?**

If you agree to be a part of this study, you will be interviewed and asked questions about your child's science interest, science self-efficacy, and the support and motivation they receive in science. You are agreeing to be audio-recorded during this interview. The audio-recording will be transcribed verbatim for review.

#### **Risks**

There are no known risks to the parents for participating in this research study. You may feel a little strange participating in an interview that will be used for research, but that is likely to lessen once the study is underway.

#### **Benefits**

There are no benefits to the parent for participating in the study however, information gained from this study will hopefully aid in improving the understanding about how students learn science and factors that influence their decisions to enroll in advanced science courses.

#### **Confidentiality (Privacy)**

All interview responses will be kept confidential. All data will be held confidentially by the researcher and no identifying information will be used in reports or research papers as pseudonyms will be used. The audio-recordings and transcribed data will be stored securely in the home of the researcher and destroyed within 5 years of the start of this study.

#### **Compensation**

The parents will not receive any compensation for participating in the study.

#### **What if you have questions about this study?**

If you have questions at any time about the study or the procedures, you may contact the researcher, Diane Johnson at [dwjohns3@ncsu.edu](mailto:dwjohns3@ncsu.edu).

#### **What if you have questions about your rights as a research participant?**

If you feel you have not been treated according to the descriptions in this form, or your rights as a participant in research have been violated during the course of this project, you may contact Deb Paxton, Regulatory Compliance Administrator, Box 7514, NCSU Campus (919/515-4514).

**Consent to Participate**

I have read and understand the above information and I have received a copy of this form. I agree to participate in this study with the understanding that I may withdraw at any time. I agree to be audio-recorded during the interview.

**Parent/ Guardian signature** \_\_\_\_\_ **Date** \_\_\_\_\_

## APPENDIX D

### Student Interview Protocol

#### Student Interview Assent Script

The following narrative will be read to all student participants. A signed agreement form must be obtained before proceeding with data collection.

The purpose of this interview is to examine your science experiences in your school. You have been identified as successful student in high school science. This is not a test and, there are no right or wrong answers to the following questions. The interview will be audio recorded and you may use a pseudonym for your name. No one at your school will hear the recording.

Your parent/guardian has given their permission for you to participate in this research study, and I am making sure that you are willing to participate. You may decide at any time to withdraw from this study. This will not affect you in any way if you do not want to participate. The interview should take approximately 30 to 45 minutes to complete.

Do you have any questions? Then I will begin by asking you some questions.

#### Science Identity Interview Questions

##### **I. INTRODUCTION ESTIMATED TIME:** Less than 5 minutes

Hello! My name is [*name of interviewer*]. Thank you for agreeing to meet with me today! I would like to audio-record this conversation so that I can focus on what you have to say without having to write everything down, but I will turn off the recorder at any time you wish. (*TURN RECORDER ON*)

I am going to ask you some questions about your experiences in school, your interests and activities outside of school, and your perceptions of science and other careers or jobs. There are no right answers—I am interested in all of your thoughts and experiences. Our conversation is confidential, and I will not share what we talk about with anyone in a way

that would directly identify you. Before we begin, do you have any questions for me?

**II. ACADEMIC AND EXTRACURRICULAR BACKGROUND ESTIMATED TIME:** (Less than 5 minutes)

1. Let's start with your typical school day. Which classes are you taking this Semester?
2. Which is your favorite class? What about it do you really like?
3. Which is your least favorite class? What about it do you not like?
4. Now I'd like to get a sense of what you do outside of school. Can you tell me a little bit about how you spend your time when you are not at school and which kinds of things you are involved in?

Probes: Are you involved in clubs, groups, or sports teams after school? Which ones? How long have you been involved in these activities? Are these activities different from last year? What got you interested in these activities? Which groups or activities do you like best? Why? What do you do in the evenings and on weekends? Do homework? Do chores? Talk on the phone? What do you do for fun, to relax and get your mind off things?

**III. SCIENCE BIOGRAPHY ESTIMATED TIME:** (5-10 minutes)

5. How would you describe your science class experiences this year?
6. How do you feel about your science class this year?
7. How have your feelings about science class changed from last year?
8. Why have your feelings changed?

Probes: How would you describe your science teacher this year? What kinds of things are you learning? Do you enjoy your science class? What specific things about your science class do you really like or really dislike? Do you feel like you are doing well in your science class this year? Are the things that you are doing in science class more or less important to your future goals this year as compared to last year? Why? How? Did other subjects become a lot more interesting to you this year? Which ones? What got you interested in these other subjects?

9. (a) How about your involvement in science activities outside of school? What kinds of things are you doing this year?  
(b) Are you involved in any new science activities this year as compared to last year? Which ones?  
(c) How do you feel about these activities?  
(d) How have your feelings about these activities changed from last year?  
(e) Why have your feelings changed?

Probes: Whom do you do these activities with? (*friends, family, youth, groups, alone, etc.*) What got you interested in these activities? Are these science activities more or less important to your future goals this year as compared to last year? Why? How?

10. (a) Can you think of any experiences that you've had in school that made you think you could be a scientist? Can you tell me about that experience?

*[If student can't think of an experience]* Can you think of any experiences that you've had in school that made you think you could not be a scientist? Can you tell me about that experience?

(b) Can you think of (and tell me a story about) an experience outside of school (maybe at home, or with friends) that made you think you could be a scientist?

*[If student can't think of an experience]* Can you think of any experiences that you've had outside of school that made you think you could not be a scientist? Can you tell me about that experience?

#### **IV. PERCEPTIONS OF SCIENCE AND SCIENTISTS ESTIMATED TIME: 5-10 minutes**

11. Now I'd like to ask you some questions about science and scientists generally. In your opinion, what do you think science is mainly about? What do you think the goal of science is?

Probes: Where do scientists get their ideas? Why do scientists do experiments? How do they decide what experiment to do? How do you think science affects society? How do you think science affects our world?

12. In your opinion, what sort of people become scientists? Which kinds of personal characteristics make people more or less likely to go into science?

Probes: Do you think some people are born to be scientists, or that anyone can become a scientist? Why?

What kind of training do people need to have in order to become a scientist? What do people have to do after high school in order to become a scientist? How did you learn about becoming a scientist? How did you come to know that scientists have to do [x] as part of their training?

13. *[For students who are not interested in science, we can preface this question with something like "I know you're not interested in science, but..."]* Could you imagine having a job involving science one day? *[If student is firm that s/he cannot imagine having any job that involves science]* If not doing something related to science, what would you like to do? What do you dream about doing one day?

Probes: What sort of science job would you have? Why would you be this kind of scientist? What do you imagine yourself doing as a [X]? Which kinds of projects would you work on? How did you learn about this kind of job? Can you tell me a little bit about when you first got interested in this job? Have you talked to different people about having this job? Whom have you talked to? What do you talk about?

14. *[For students who can imagine a science-related job]* Which characteristics of being a scientist make this job seem like something you could do? *[For all students]* Which characteristics of being a scientist make science jobs seem like something you couldn't do?

Probes: What about science-related work seems like you? *[Alternately: What about science-related work doesn't seem like you? [If possible, have student explore which parts of him/herself are like/unlike science, rather than which parts of science are like/unlike student...good segue into next section].*

**V. SENSE OF SELF ESTIMATED TIME:** 10-15 minutes

15. Now I would like to ask you some questions about what it means to you to be a [male] in society. Do you have any feelings about what it means to be a [male] in society?

Probes: As a [male], do you think there are certain ways you are supposed to be or act in society? Which ways? How about in your family? How are you supposed to be or act as a [male] at home? How about in school? How are you supposed to be or act as a [male] in school? How are these ways the same as or different from how [females] are supposed to be? What do you think about the choices and opportunities available to you as a [male]? Are these the same as or different from the choices or opportunities available to [females]? How? Why?

16. If most of your friends shared your ethnic background, is it important to you that your role models or mentors share your ethnic background? Do you have any feelings about what it means to be [a Black male] in society?

Probes: *[If multiple backgrounds]* Which background do you consider yourself to be most? Why do you feel this way? Is your ethnic background important to your family? How? As a [Black male] person in society, do you think that there are certain opportunities or choices available to you and not to others? Or do you think that your choices or opportunities are mostly the same as others? How are these choices and opportunities the same or different? As a [Black male] person in society, do you think that there are certain expectations of you, of your future path and goals? Are these different from or the same as people of other backgrounds? How?

17. Now I would like to ask you about being a [male] and being [x (*student's ethnic background*)]. Do you have any feelings about what it means to be [male] in society? *[If multiple backgrounds, ask about each]*

Probes: In your opinion, how is this different from being a [female] in society? Do you think that the choices and opportunities are the same or different? How? Do you think that expectations of you in your family are different from expectations of [females]? *[Especially relevant if student has opposite sex sibling]* How? Why?

18. Okay, now let's think about all of this in relation to science. How does being a [male] relate to your experiences in science class?

Probes: a) Do you think that your experiences in science class are different from other students' experiences because of who you are or what your background is? How? Do you think this is true of other classes too, or just science? How? Do you feel like your ideas in science class are respected by your teacher? By your classmates? How or how not? [*Have student give concrete examples of respect or disrespect*] Do you think this is true of all students in your class? Why or why not? When you have an idea or question in class, do you feel like your science teacher and your classmates listen to what you have to say? Do you think that this is true of all students in your class? How? Is there anything about your science class—the way it is taught, or the topics you study, or the requirements, or the other students in your class—that does feel “right” or comfortable to you, or that does not seem like it's related to your life as a [male]? Is this true of just your science class or other classes too?

b) How does being a [male] affect or shape how you think about being a scientist? Do you think there are different opportunities available to you in science jobs or careers because you are a [male], compared to other students? Which kinds of different opportunities? How do you know these things? Do you talk to family/friends about these things? How do you think being a [male] would affect you being a scientist? Would you “do science” differently? Would you ask different questions? Or would you do the same kind of science that other people do? [*reference students' comments from “perceptions of science” section*] [*focus on students' gender and racial/ethnic identity here...how would being an African American male, for example, mean that students ask different kinds of questions than girls, either African American or not?*]

#### **VI. ROLE OF PARENTS, EXTENDED FAMILY, PEERS ESTIMATED TIME:** (5-10 minutes)

19. (a) What do your family members [*whomever student lives at home with*] expect from you in high school? How do you know they expect these things from you?

(b) What do your family members expect from you in the future, after high school? What do they think you should do? How do you know they expect these things from you?

Probes: Do they have strong feelings about classes that you should or should not take, either now or in high school? What are their feelings? Do your parents ever talk to you about going to college? What kind of things do they say? How do they feel about college? Where would they want you to go? What would they want you to major in? Why? Do you talk to your parents about jobs or careers? Which kinds of careers do you talk about with them? Do they give you advice? What do they say? What would you say is most important in terms of what your parents want for you and your future? What do your parents worry most about you?

20. Now let's talk a little bit about your friends this year. Do you have different friends this year than you did last year, or are they pretty much the same? [*If different*] Why did your friendship group change? What attracted you to your new friends? [*If same*] How have the

things that you do with your friends changed from last year to this year? Are there other ways that your friendships have changed since last year?

Probes: Whom do you consider to be your closest or best friends (you don't have to mention names if you don't want to)? What are they like? How would you describe their personalities? What are they interested in? Which kinds of things do you have in common with them? Do you like to do the same activities? Which kinds of activities? Do you have the same sense of humor? Do you share similar opinions? Which opinions?

21. Do you and your good friends have the same opinions about science and math, or different opinions? How do they feel about science and math? Do they enjoy it? Do they do well in it?

Probes: Are any of your good friends in your science and math classes? Is that important to you? Do you talk about science and math with your friends? Which kinds of things do you talk about?

22. (a) At this school, what are students' reactions to people who get really good grades in science and math? What are students' reactions to people who get really bad grades in science and math?

(b) How do you feel when other students find out what your grades are in school?

Probes: Do you and your good friends share your grades with each other? Do you help each other with homework? How do you help your good friends? How do they help you? Do you think people whom you might like more than just a friend would like you more or less if they knew what your grades were? Why? Do you ever feel like you have to keep your grades private? Why?

**VII. THE FUTURE ESTIMATED TIME:** (Less than 5 minutes)

23. What do you see yourself doing when you're all finished with high school?

Probes: What steps do you need to take to get to be a [x]? Will you have to go to college? What will you study there? Will you need any additional training after college? How did you get interested in this? How does your family feel about what you want to do? How about your friends? What are some things that might affect what you do? (*friends' choices and plans, financial assistance, etc.*) Whom do you feel comfortable talking to about your future? Is there someone whom you trust most to give you advice? Who is this person?

24. Can you think of someone who is very influential in your life, or someone whom you really look up to [*not a celebrity, but someone student knows*]? Who is this person? What is your relationship like with this person? [*If a student does not have a role model...?*] If you had to choose a role model or mentor, what kind of qualities would they have? What would make someone a role model for you?

Probes: Which kinds of things do you do with [x]? Which kinds of things do you have in common with [x]? Does [x] give you advice about things? Which kinds of advice? Do you ever talk about science with [x]? Which science topics do you discuss? Why is [x] your role model? Thank you very much for speaking with me today! Do you think there is anything else I should know about your experiences before we wrap up?

## APPENDIX E

### School Perceptions Questionnaire

Select one of the following factors in response to each statement.

Scale factors: strongly disagree, mildly disagree, neutral, strongly agree or mildly agree.

The questionnaire has 32 questions.

1. Being a good student is important to me. IA
2. School is important in life. VOS
3. I don't care whether I get good grades or bad grades. IA
4. School is one of my favorite places to be. SOB
5. I feel good about myself when I get good grades. IA
6. It is a mistake to drop out of school. SOB
7. I'd rather be anywhere but in school. SOB
8. When I work on homework I feel like I am doing something important. IA
9. I can talk to my teachers about anything. SOB
10. I think it is important to do well in school. IA
11. I want my friends to think of me as a good student. IA
12. If I do well in school I will get a good job. IA
13. School is very boring for me. VOS
14. I feel nervous or uncomfortable in school. SOB
15. When I am in school I feel like people are always judging me. SOB
16. I always put a lot of effort into the work I do for my teachers. IA
17. I get treated with respect in school. SOB
18. I participate in school activities. SOB
19. I would feel really bad if I got a bad grade on a test. IA
20. I enjoy learning new things. IA
21. I plan to go to college. IA
22. I feel like the things I do at school are a waste of time. VOS
23. How I do in school is really not important to me. VOS
24. School is only useful for getting a good job. VOS
25. I want my teachers to think I am a good student. IA
26. I would be really sad if people thought I wasn't a good student. IA
27. I am proud of being a student in this school. SOB
28. The things we do in class are useless. VOS
29. Teachers don't care about me. SOB
30. The people in my school are interested in me. SOB
31. School is a waste of time. VOS
32. I feel comfortable when I am in school, like I belong there. SOB

## APPENDIX F

### Twenty Statement Questionnaire

There are twenty I am... statements written. The students will complete each statement with their thoughts as it relates to their science class.

I am... \_\_\_\_\_

I am... \_\_\_\_\_

I am ... \_\_\_\_\_

I am... \_\_\_\_\_

I am... \_\_\_\_\_

I am ... \_\_\_\_\_

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I am... \_\_\_\_\_

I am ... \_\_\_\_\_