Factors Influencing African American High School Students in Career Decision-Making Self-Efficacy and Engineering Related Goal Intentions

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Chandra Yvette Austin

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Abstract

A current challenge in the United States is to increase African American pursuit of engineering careers. Minority students generally tend to be under-represented in such careers, as indicated by the National Academy of Engineering, in The Engineer of 2020-Visions of Engineering in the New Century. This study explores the career decision self-efficacy (Lent, Brown & Hackett, 1993) and Engineering related goal intentions of African American high school students. There are a variety of reasons explaining the lack of choice of engineering as a career, and these were investigated. This study assessed the effect of specific influences (ethnic identity, demographic factors, ability, school factors, Math/Science confidence, Math/Science self-efficacy, Math/Science interest, and family support) on career decision self-efficacy and engineering related goal-intentions. Data from a survey of 396 African American students' grades 9-12, low-middle income level, in a southeastern school were used in the study. Results show that career decision self-efficacy among students studied is influenced by: Math/science confidence, ethnic identity, family relations, school factors, and socioeconomic status. Factors influencing engineering related goal intentions were very similar but each variable did not contribute the same amount of variance. Results also show that gender was not significant in either dependent variable. Other implications and recommendations relating to the variables are presented.

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Chapter I

Introduction

The idea of disproportionate education is not a recent phenomenon. This concept has been around for decades, stemming from what some call involuntary citizenship as a result of the African slave trade. “In the past, black Americans, for example were given inferior education by formal statutes in the South and by informal practices in the North” (Ogbu, 1987, p.318). Parents were taught by oppressors to say to their children that there were certain spheres into which they should not go, because they would have no chance for development (Woodson, 1933). However, during an era of segregation came a well-known case, Brown vs. Board of Education. Ideally this legislation was supposed to be the solution that ended inequality in education, but that has not been the case. Inequality in education along racial lines persists (Oakes, 2005). Although schools have become integrated, the content students learn and achievement outcomes are still differentiated by race and class (Braddock 1990; Gamoran, 2001; Lucas & Berends, 2002; Oakes & Guiton, 1995). This differentiation follows students into the labor market, influencing the choices they make.

Institutional racism, a relic of slavery, has affected the educational system. It features a hierarchical conception of intellectual ability (Denbo and Beaulieu, 2002), resulting in practices such as academic tracking. When tracking is done it is often as a result of individual and cultural characteristics (Oakes, 2005). Shaffer, Ortman, and Denbo (2002) state that to fully understand African American student achievement, it is

essential to take into consideration the historical context of racial oppression and also consider the current conditions of schools. Longstreet (1978) notes that ethnic groups vary in several ways some of which include; verbal and non verbal communication, social value patterns, and intellectual modes. Thus education must be created to include cultural diversity (Davenport, 1981). But even within ethnic groups there exists educational disparity. For example, urban students have less access to a variety of educationally important resources, such as small class sizes, highly qualified teachers, computers, advanced level courses, and other curriculum supports (Darling-Hammond, 1997). Middle-class African American students are an example of students who, although they are equipped with more resources, may feel that excelling in school while their lower income counterparts are not, is betraying their true identity (Shaffer, Ortman, and Denbo, 2002). Regardless of what the disparity may be Apple (2004) agrees that schools contribute to the imbalance of power in society by communicating society's economic, political and cultural knowledge to students.

African Americans have participated in vocational education since the times they were slaves (Gordon, 2008; Moody, 1980). Some may say this has created a hazardous cycle particularly because this reinforces the idea that they are better suited to manual rather than academic pursuits. The United States is becoming more diverse (Phinney & Alipura, 1996), and globalization has made it disadvantageous for there to be inequality of educational opportunity along ethnic lines. The National Academy of Engineers (2004), an organization of engineers that advises the government on issues concerning engineering stated that if the U.S is to maintain economic leadership and be able to

sustain its share of high-technology jobs, it must prepare for a new wave of change. This new wave of change refers to the education of more minorities as the minority population increases, in order to ensure global competition (NAE, 2004). One notable field where countries compete is engineering. There historically has been widespread shortages of minorities, especially African Americans in the various engineering fields (George, Neale, Van Horne, & Malcom , 2001; Lam, Srivatsan,,Doverspike, Vesalo, 2005).

African Americans and Engineering

It is important here to reflect on the post Civil War period and the views of Booker T. Washington and William E.B. DuBois. It is informative to study these two particular authors because their debate about education, pre-dated the exchanges between Dewey (1916) and Snedden (1910), but related specifically to African Americans. Both Washington and Du Bois recognized the value of education and of the necessity of black participation in skilled trades (Wharton, 1992). The controversy came in the differences of philosophies regarding black higher education.

Booker T. Washington was born a slave and did not begin his formal education until after the Civil War when he was freed. He thought in order for people to gain satisfaction in education that they must give service to others. One way he implemented this belief was while president of Tuskegee Institute he required that students do some form of manual labor as a part of the curricula. Unfortunately many believed that Washington's views forestalled the involvement of African Americans in engineering by almost three decades, because it was felt he condemned bright young minds to vocations

beneath their ability, thus reinforcing inferiority (Wharton, 1992; Hinman, 2005; Moore, 2003). Washington's educational philosophy was not designed to produce individuals who would be able to compete with whites for jobs, which is one of the reasons Du Bois denounced his work. He did this by promoting black worth and giving inspiration to those who wanted to pursue engineering as well as other academic careers. Du Bois created a notion referred to as the "talented tenth"--the percentage of blacks he felt were endowed with talents and brains to lead the race to self-sufficiency. He insisted that the college-trained elite could lift the lower class. He felt success would come from the development of mental faculties.

Despite their debate, both Washington and DuBois can be viewed to have enhanced the African American population in their own way. Engineering is believed to be a vocation which combines the characteristics of science, art, and business. It involves knowledge of the forces and materials of nature, an understanding of men, and a understanding of economic and social relations (Dowing, 1935). But the early curriculum in American colleges of engineering was still considered an alternative to what was viewed as the traditional classical discipline. In early America, unlike the fields of medical and legal, engineering education was never under the exclusive domination of a professional group, the curriculum was created strictly by educators (Grayson, 1980). Therefore those who were not engineers and knew little to nothing of the content it entailed had enormous input to shaping the field of engineering. As a result, the early engineering curriculum contained little technique of engineering practice. Prior to WWI few opportunities existed for African Americans to work in engineering fields. But some

Historically Black schools (such as Howard University, North Carolina Agricultural & Technical State University, and Hampton University) began offering engineering majors. These schools continue to be at the forefront of the education of African American engineers.

The importance of educating all Americans including African Americans was identified in the 1930's and is still being restated here in the 21st century. The US has lost some technological ground and will continue to do so if everyone is not provided an equal opportunity to advance in all areas. Some have gone so far as to say that African Americans are not well educated in the field of engineering because the information they are obtaining is not relevant. Woodson (1933) concurs by stating that since African Americans were told what to learn by another race for so long, they must now be taught to think and develop something for themselves. Or some may go further back to say that during slavery African Americans developed a negative identity and now it is their responsibility to interpret, and come to terms with, their collective traumatic past and their relationship to that past (Eyerman, 2001). In doing this they can make strides to change their present identity. Regardless of what the source of this disparity in education all would agree that it is something that needs to be reconciled.

Vocational Ideals

In an attempt to further evaluate the vocational ideals that have existed in Americans thus far, we are led to examine the educational works of John Dewey and David Snedden. Dewey coming from an anthropological background believed that the

individual is only a meaningful concept when regarded as an intricate part of his or her society, and the society has no meaning apart from its realization in the lives of its individual members. “Dewey believes the environment in the school and classroom should promote such a mode of life by enabling teachers and students to enact it day by day, even moment by moment” (Hansen, 2002, p.267). One way he concluded that an individual could be important in society is through vocational education. Dewey also believed that one of the primary purposes for learning was so that one could in turn use that knowledge to survive and better society. In vocational education the learning of various subjects often includes community influence as well as a construction of one’s own knowledge. Brown (1984) asserted that within the community when reference is made about community support; parents, the business community, and the nation as a whole are concerned with the quality and contribution of vocational education to society.

The idea that humans have a tendency to become what they do is something that Dewey believed in. When people become a part of their work he believed that they would inherently learn things better and absorb the knowledge they obtain better. Oftentimes people think that when you become a part of something you have to sacrifice a piece of you to truly conform especially when one works in a group. Dewey was opposed to this thought rationalizing that an “intelligence created by all people” was indeed the answer. Lawrence Cremin a well known historian also agreed saying, “It takes a whole culture of people to put together the narrow curriculum and made expectations that present-day Americans use to stage, worry about, and interpret what happens in schools” (McDermott & Raley, 2007). Not only did Dewey believe in community contribution to education he

also believed in the structure of education. He contended that without structure no intelligent connection could be made between liberal subjects such as history, English, and math. To help provide structure teachers had to be mindful of the environment in which the child learns. Thus "the only way in which adults consciously control the kind of education which the immature get is by controlling the environment in which they act, and hence think and feel. We never educate directly, but indirectly by means of the environment" (Dewey, 1916).

Although Snedden agreed vocational education to be a good thing, he also believed that academic and vocational instruction should be taught in separate environments (Gordon, 2008). Vocational education was viewed as having a societal, not just an individual impact. Historically vocational education has not included liberal subjects but purely apprenticeships and learning of a specific trade, but historical methods of apprenticeship came to be viewed by Dewey and others as inappropriate for new industry. Knowledge of some liberal subjects (for instance mathematics) appeared to be needed in order to practice particular vocations. Still some do not agree that a mechanic should take an English class when he/she will be working on automotives, but basic skills are still necessary regardless of profession.

One may ask how does the Dewey/Snedden debate relate to African Americans. More so, how does the historical context of vocational education and engineering affect the current status quo. The answer is that Dewey and Snedden engaged in an academic discourse that originated with their predecessors Washington and DuBois. Dewey held

the belief that education should be universal, aimed at citizenship. He was of the view that Snedden's conception of vocational education would deny the under-classes the right to education so conceived. For Dewey vocational education should be offered only if it was liberally conceived.

Rationale

The National Science Foundation (NSF) in 2006 reported that 5.2% of engineering degrees were awarded to African Americans. Although schools today are not deliberately designed to achieve classist or racist ends, research finds that there is a contradiction in reality (Apple, 2004).Research shows that the current education of African Americans is unequal to that of White students (Norman et al., 2001). However, there is an absence of literature focusing specifically on the field of engineering. The career decision self-efficacy and engineering related goal intentions of African American students are not well understood. I hoped to gain insight on why African American students are absent in the field of engineering. From this insight the educational field will be able to gain a better understanding of how to enhance educational efforts intended to prepare African Americans for the field of engineering. In addition some motivational factors may be gleaned based on what the students view as their perceived needs in order to prepare for careers in this field. Lastly, if the factors that influence engineering career decisions are identified then educators will better understand how to foster and develop a culturally responsive environment for African American students. In such environment students may be more inclined to engage in the study of engineering. Knowing the

variables that enhance career decision efficacy and engineering-related goal intentions among African American students can lead to interventions that enhance their choice of engineering as a career.

Statement of the Problem

This study intends to fill a gap in knowledge as to why African American students are not entering engineering. Little is known about the career decision self-efficacy and engineering related goal intentions among African American students. Specifically, predictors of career decision self-efficacy and engineering related goal intentions are not well researched amongst African Americans. Currently there is a lack of studies that examine African American students' perspectives on factors impacting their choosing of engineering careers. Underutilization of minorities in science and engineering is a problem of national scope (Leslie et al, 1998). If the United States is striving to maintain its global competiveness in the world, the country must try to remove the barriers that prevent minorities from choosing engineering as a career.

Purpose of the Study

The purpose of this study was to understand how African American students perceive their ability to successfully enter engineering careers. Due to the current challenge in the United States to increase the number of African Americans pursuing engineering, research must be further on factors that are perceived to foster and to hinder the entrance of minorities into this field.

Theories

There are a number of theories explaining adolescent career decision making. The first is the Self-Efficacy Theory developed by Albert Bandura. Bandura's (1977) theory makes the assumption that personal self-efficacy is based on four major sources of information: performance accomplishments, vicarious experiences, verbal persuasions, and physiological states. This theory is viewed important because a number of studies have found a link between self-efficacy and the ability of adolescents to make decisions about careers (Lent et al., 1986; Lent & Hackett, 1987; Taylor & Betz, 1983). A second and equally important theory that will be used-- a by-product of the Self-Efficacy Theory (Bandura, 1986) is the Social Cognitive Career Theory (SCCT) developed by Lent, Brown, and Hackett (1987). This theory is deemed essential because its main purpose is to construct connections between variables that may influence career development (Brown & Lent, 1996).

A third theory employed in this study was Super's developmental Self-Concept Theory of Vocational Behavior. In this theory Super (1953) asserts that people attempt to apply their self-concept by choosing a career that permits self-expression. He goes on to make the claim that a person's career behavior reflects his/her life stage (Osipow, 1983). Super's theory is vital because self-concept and vocational development have proved to be important factors and could enhance the creation of more compatible curriculum for African American students. A fourth theory is Holland's (1959) Career Typology Theory of Vocational Behavior. In it Holland contends that career choices represent an extension

of an individual's personality (Osipow, 1983; Sauermann, 2005). He states that people identify their views of themselves by an occupational title. Holland's theory is influential to this study particularly because of his suggestion on how people choose careers. If in fact people choose careers where they believe they will be surrounded by people like themselves, then the education field needs to develop a strategy to intrigue African American students about engineering. The conclusion could be easily drawn that African American students do not enter engineering because they cannot identify with the field. Although these theories are regarded as important, few of them have been applied to minority populations. This study sought to do this by examining African American student's orientation to engineering careers.

Important Studies

Some of the important studies that were drawn upon to develop variables for this research study are reviewed in this section. Navarro, Flores, and Worthington (2007) used a modified version of the Social Cognitive Career Theory to examine whether socio-cognitive variables explained math/science goals in Mexican American middle school students. Although this study was done at the middle school level, it is still beneficial to the current study in that it observes an underrepresented minority group. Also Navarro et al.(2007), found that within this population math/science interest and goals could be predicted by math/science self-efficacy and outcome expectations. Fouad and Smith (1996) also conducted a study using middle school students and found interest had a relationship with self-efficacy, outcome expectations, and intentions. At the end of their

study they note that more research is needed to test the influence of race and ethnicity as an influence on self-efficacy. Gushue (2006) examined the relationship between ethnic identity, career interest and outcome expectations among Latino/a students. This was identified as a key study because it involved minority students and it studied career decision self-efficacy as a key variable. He found that ethnic identity had a direct and positive relationship with career decision self-efficacy. A connection between race/ethnicity and career aspirations/decision making was also found by Flores et. al, (2006) and Kenny et al.(2007).

Hargrove et al. (2002) explored the relationship between family interaction patterns, vocational identity and career decision self-efficacy. The researchers found that family interaction patterns play a significant role in the promotion of self-confidence as it relates to career planning. The study also found that family interaction patterns play a role in the formulation of career goals. Lent, Lopez, & Bieschke (1991) and Betz & Hackett (1983) are long time researchers using socio-cognitive variables. Their studies examined the relationship between math self-efficacy and science-based college majors. From the results they were able to conclude that math self-efficacy was significantly related to choosing a science based major. They then went on to assert that the selection of this major directly resulted in the career choice within the same field.

Research Questions

There are two dominating research questions that guide this study. They are:

1) To what extent do exogenous factors (school, math/science interest, ethnic identity, math/science confidence, family relations) and endogenous factors (demographic and ability) influence career decision self-efficacy?

2) To what extent do exogenous factors (school, math/science interest, ethnic identity, math/science confidence, family relations) and endogenous factors (demographic and ability) influence math/science related goal intentions?

Research Approach

This study uses a quantatitive approach, specifically a survey instrument, to accurately describe variables that influence career choice. The survey technique allowed the researcher to examine the factors individually and their correlations with each other. Multiple regression was used to answer the two overarching research questions fot this study. A more detailed explanation of the survey instrument and statistical methods will follow in Chapter 3.

Significance of the Study

The problem of inequality in education will continue to persist if we do not find ways to reach out to underrepresented populations. To date many studies have examined career decision self-efficacy using predominately white students (Germeijs and Verscherren, 2007; Peterson, 1993; Taylor and Betz,1983; Taylor and Pompa, 1990;

Gloria and Hird, 1999; Luzzo,1993; Blustein, 1989;) and very few researchers have studied this same variable among minority students (Brown et al., 1999; Tang et al., 1999; O'Brien et al. 2000).This study is an attempt to find knowledge and make further progress in order to serve African American youth. The findings of this study will provide information that could be used in a number of ways to resolve current inequalities. Schools would be able to provide intervention strategies to improve the factors that are found to have a relationship with career decision self-efficacy and math/science related goal intentions. The results may also serve as a voice for African American students to express their felt needs and perceived barriers in relation to career decision self-efficacy and math/science related goal intentions.

Variables and their measurements

The researcher after examining previous studies accumulated a small number of factors believed to have a relationship with career decision self-efficacy and math/science related goal intentions. The first factors that will be discussed are the independent variables. One of these factors is ethnic identity. Ethnic identity is not a trait that is frequently accommodated in school. Baker (2005) notes that students are usually presented with school programs where their cultural identities are not supported and their personal qualities disregarded because they don't fit the traditional curriculum. The lack of support for one's identity may prove to have a negative impact on career decision self-efficacy. In this study this variable was measured using the Racial Ethnic Identity Scale by Oyserman, Bybee, and Terry (2007). Researchers also believe that school factors such

as teacher expectations and student's attitude towards school are highly influential in career choice. Studies show that teachers' expectations have a more powerful influence on African American students than they do on white students (Ferguson, 1998; Winfield, 1986). The school factors research variable was measured using questions developed by the researcher as well as questions used by Ford & Harris (1996) and Masters & Hyde (1984). A third factor is interest. Basu & Barton (2007) make the assertion that in low-income urban communities in particular, students do not like science because it is not connected to their interests or experiences. Since mathematics and science are believed to relate this assertion is also assumed to hold true about mathematics. Interest was measured by the Math Science Interest Scale developed by Fouad and Smith (1996). A fourth independent variable is math/science self-efficacy. Gainor and Lent (1998) indicate that African Americans are statistically underrepresented in the Mathematics career field. This underrepresentation is a result of low self-efficacy in this subject area. Math/science self-efficacy was measured by the Math/Science self-efficacy (MSSE) scale developed by Fouad, Smith, & Enchos (1997).The fifth independent variable is family relations. Lopez and Andrews (1987) state there are certain family interactions that enhance certain behaviors and discourage others. This study attempts to identify some of those interactions and their relationship with the dependent variables if any. Family relations was measured using a combination of researcher developed items, and items developed by Donna Ford (Ford, 1991).The last two independent variables are ability and demographic factors. Demographic factors were measured using researcher question pertaining to background information on the student such as grade level, gender, SES,

etc. Ability was measured using questions pertaining to GPA of the student, performance in math class, and performance in science class.

The two dependent variables are career decision self-efficacy and math/science related goal intentions. Ojeda et al. (2006) make a claim that career decision-making self-efficacy can be predicted by the confidence level of a person. This variable was measured using the Career Decision Self-Efficacy Short from (CDSE-SF) developed by Betz, Klein and Taylor(1996). Math/science related goal intentions will be used in this study as a proxy for engineering related goals intentions, because math and science are the core underpinning disciplines of education and since they are the subjects in which high school students must excel if they are to enter engineering careers. The Math/Science Goal Intentions Scale developed by Fouad, Smith, and Enchos (1997) was employed for this. A more detailed connection between these proposed variables will be outlined in the next chapter.

Definition of Terms

Ability: The performance level in math and science classes as measured by grades.

Career decision self-efficacy (formally career decision-making self-efficacy): Confidence in the capability to engage in educational planning and career decision-making (Taylor & Betz, 1983; Peterson & DelMas, 1998).

Math/science related goal intentions: The intent to pursue or persist in engineering relates courses and future careers.

Ethnic Identity: One's sense of belonging or association to an ethnic group that involves one's cultural heritage including values, traditions, and often language (Phinney, 1990,1996; Phinney & Alpuria,1996; Phinney & Ong, 2007; Tajfel, 1981).

Family Relations: The relationship between family influences/factors and a student's ability to make appropriate vocational decisions (Blustein et al., 1991; Hargrove et al., 2002; Lopez, 1989).

Interest: The inner state of a student that relates to the characteristics of a learning situation (Hansen, 1999).

Math/Science self-efficacy: Confidence in the capability to successfully perform math or science related problems (Hackett & Betz, 1989).

School Factors: Teacher and curriculum influences upon student confidence and career decision making.

Summary

This study builds on the literature which asserts that a relationship exists between career decision self-efficacy and a variety of socio-cognitive variables among high school students. Additionally the intent of this research is to go a step further and examine factors related to Math/science related goal intentions among African American high school students. Few prior studies have evaluated variables such as math/science self-efficacy in specific relation to African American students (Betz & Hackett, 1983).

A review of the literature is conducted in the next chapter. This review consists of an exploration into variables that influence career decision self-efficacy and Math/science related goal intentions. Chapter Three will describe methods employed in the design and conduct of the study. Chapter four presents the data analysis and findings. Chapter five presents conclusions and recommendations.

Chapter II

Review of Literature

This chapter will examine the relationship between career decision self-efficacy, math/science related goal intentions, and a number of independent variables that may affect them. Within the review, theory and issues relating to career decision making among high school students, particularly minority students will be explored.

Ethnic identity

Identity is not something a person is born with but yet a set of characteristics and values that are formulated over time (Phinney & Ong, 2007). Erikson (1968) says that the formation of identity is a developmental process. However, there is much argument between researchers about when identity is formed. Some researchers assert that the critical time when identity is formed is specifically during the adolescent years and identity continues to increase in development through the adult years (Chavira & Phinney, 1991; Erikson, 1968; Phinney, 1989; Phinney & Chavira, 1992; Phinney & Alipura, 1990; Spencer, Swanson, & Cunningham, 1991). Umaña-Taylor, Yazedjian, and Bámaca-Gómez (2004) maintain that since the U.S. is an ethnically conscious society it is imperative issues surrounding ethnic identity be addressed. Ethnic identity is known to be an integral part of one's overall identity. Furthermore, membership in an ethnic minority group may result in increased sensitivity to identity issues among minority adolescents and a higher overall level of identity development (Phinney & Alpuria, 1990). When evaluating the methods or models which focus on ethnic identity there are two that are

widely used to describe its importance and basis, they are social identity theory and ego identity theory.

Social Identity Theory

Tajfel (1981) argues that ethnic identity is an aspect of social identity. Thus, in short, he defines social identity as the part of the individual's self concept which derives from his/her knowledge of his/her membership of a social group. The sense of identity is heightened when one considers in-group membership compared to outer groups. Comparison with other groups can affect how a particular social group identifies with society as a whole and their place in this society. It has been proposed that persons with a strong sense of ethnic identity, particularly when they belong to a minority group, may see barriers to career development as challenges to be overcome (Leong & Chou, 1994). Social identity is based on the simple motivational assumption that individuals prefer a positive to a negative self-image. Tajfel & Turner (1986) state this theory is concerned with individual's identification with social groups and the affective processes associated with membership. In a study by Clark and Clark (1947) African American children were shown two dolls and asked questions about them. These children often preferred to play with white dolls than black, and to identify these dolls as being pretty and good, where they identified black dolls as black or ugly. Clearly African American identity is a complex issue, especially because societal conceptions of blacks have tended to be negative.

Ego Identity Theory

Perron, Vondracek, Skorikov, and et. al. (1998) joined the argument that ethnic identity is related to ego-identity development, psychological adjustment, ego development, and self-esteem. The formation of ethnic identity is often compared to ego identity in that it takes place as people make decisions about the role ethnicity plays in their lives (Phinney, 1990). Erik Erikson (1968) describes ego identity as a subjective feeling of sameness and continuity that provides individuals with a stable sense of self and serves as a guide to choices in key areas of their lives. Erikson goes on to say that ego identity is focused on the development of personal identity, and the central crisis of development comes in adolescence when individuals have to resolve the conflict between developing an identity and identity confusion. After Erikson, a study by James Marcia (1980) put forward the concept that identity formation takes place through two processes, namely exploration and commitment. These processes are used to define four identity statuses: identity diffusion, foreclosure, moratorium, and identity achievement. The four statuses are based on the presence or absence of identity search or commitment (Phinney & Chavira, 1992). Marcia's theory is relevant though it does not specifically speak to ethnic identity (Phinney & Ong, 2007). Drawing on Marcia's theory, Phinney and Chavira (1992) contend that ethnic identity development occurs in a progression from diffusion/foreclosure, through exploration to ethnic identity achievement.

One of the dynamics that helps to form a person's identity is their specific ethnicity. Ethnic identity is only meaningful in situations in which two or more ethnic

groups are in contact over a period of time. Fouad, Kantamneni, Smothers, et al. (2008) found when studying Asian American students ethnic identity that their view of the host or dominant culture may strongly affect career choice processes and outcomes, but more research is needed to understand these factors. For this reason the concept of ethnic identity is very important to schools since it is rare that American schools are entirely homogeneous. The idea of ethnic identity is important in student education because it contributes to a student's belief in themselves and the career choices they make. Research found that adolescents with high ethnic identity had higher self-esteem than those with a low ethnic identity (Chavira & Phinney,1991; Phinney, 1996). Low ethnic identity comes about when students are unable to associate themselves as a member of a particular group with similar characteristics. When students feel that their particular identity is not being incorporated into school they may become detached in that environment. Detachment among even a slight number of students in one ethnic minority may result in increased detachment of students of that same ethnicity.

Phinney (1990) notes that if the dominant group in a society holds the traits or characteristics of a minority ethnic group in low regard, then the ethnic group members are potentially faced with a negative social identity. In the United States, African Americans tend to be viewed stereotypically. As indicated earlier in this study, African American children tend to be discouraged from enrollment in high academic classes and pushed into low status classes. This sort of action by schools could lead African American children believing that as a group they are incapable of pursuing careers that require high academics. If African American students surround themselves with ethnic

peers who do not believe they are capable of academic accomplishment, that belief can contributes to lower individual self-efficacy.

One undertaking in school in which ethnic identity may play a part is the area of vocational choice. Many students participate in vocational training in school but their vocational maturity varies. Vocational maturity is defined by the extent to which an individual succeeds in mastering the tasks appropriate to his/her stage of career development (Super & Thompson, 1979). It is measured using the variable of self-knowledge, occupational information, involvement in decision making, and independence in decision making. Thus far little is known about the combined development of vocational maturity and ethnic identity during the adolescent years (Perron et. al.,1998).However, Phinney (1990) and Supple et al. (2006) did assert ethnic identity is comprised of different components, including self-labeling, a sense of belonging, positive evaluation, preference for the group of ethnic interest and knowledge, and involvement in activities associated with the group. Any of these components or combinations may contribute to the development of vocational maturity.

A number of studies state that attitudes toward one's group membership tended to be derived from parents or from society rather than reached independently (Phinney, 1989; Phinney & Chavira, 1992).There have also been questions to whether in addition to parents influence, ethnic identity is related to acculturation especially in a group that is not dominant (Phinney, 1990). The results on the effects of ethnic identity have been rather mixed. Clark, Kaufman, and Pierce (1976) found that within Mexican and Asian-

Americans it was a variety of factors including but not exclusive to ethnic identity that contributed to acculturation. Conversely, Ting-Toomey (1981) found that among ethnic identity appeared to affect the acculturation of Chinese-American students into America. Regardless of how ethnic group membership is formed there are factors that have shown themselves consistent within each ethnic minority. For example, Phinney (1989) says that virtually all ethnic minority groups have been subjected to discrimination, and negative in -group attitudes, leading to the desire to belong to the dominant group.

Although a number of emotional and social characteristics have been found to have varying affects on ethnic identity in adolescence some of the contributing factors seem to be demographic. Garcia and Lega, (1979) say this demographic difference does not extend to neighborhoods, but they agree that adolescents within the same neighborhood most often have the same ethnic identity. In relation to the importance of ethnic identity, Hackett, Betz, Casas, and Rocha-Singh (1992) found that ethnicity was a significant predictor of both occupational and academic self efficacy. Ethnic identity among African American students as a factor in their career orientation clearly requires further examination.

School factors

Teacher and curriculum influence are important because both can provide insight into the problem of inequality in education. Crano and Mellon (1978) asserted that teacher assessment and child achievement are related. There has been debate as to whether teacher expectations can actually cause student achievement or if student

achievement causes what a teacher will expect from students. In the 1978 study done by Crano and Mellon.(1978),they found that teacher expectations are causal factors of achievement rather than vice versa. Good (1981) and Payne (1994) go on to say that students need to feel that teacher expectations are positive in order to have successful achievement results. If negative attitudes and stereotypes are demonstrated to the student, then the student may become resistant personally and educationally. Furthermore, if teachers strongly believe that students can learn they are less likely to engage in negative instructional practices (Payne, 1994). Some of the characteristics teacher's exhibit that can be viewed as negative are, seating students further from the teacher, criticizing them more often, providing them with less feedback, and overall paying less attention to them (Good, 1981; Rist 1970).

When looking at the teaching of minority students, Cabello and Burstien (1995) state that teaching is challenging for those who have no familiarity with the background of students. Winfield (1986) notes that some research does indicate that a teacher's expectation of student performance may be a result of the student's race or social class. Regrettably there is a trend of minority students especially those of a lower socio economic status becoming the victims of misperceptions about achievement levels, being subject to negative attitudes, and getting less encouragement than other students (Diamond, Randolph, & Spillane 2004; Good, 1981; Payne, 1994; Roscigno & Ainsworth-Darnell, 1999). When lower encouragement levels are received from teachers' often times the students exert less effort in school (Rist, 1970).

At other times teachers and administrators choose to handle behavioral or social problems by placing minority children, especially African Americans, in non-college bound tracks (Gamoran & Mare, 1989; Lewis & Cheng, 2006; Payne, 1994). Unfortunately the most common trend is for students who have become low achievers in school to be discounted and ignored. These students are most often discounted by being placed in vocational rather than academic tracks.

Teachers of African American students need to reflect upon the beliefs and attitudes that influence the decisions they make about these students, since their actions could possibly contribute to the educational gap between minorities and their white counterparts. Diamond et al. (2004) and Roscigno & Ainsworth-Darnell (1999) say that African American students are often times rewarded less for their cultural capital than their white counterparts because of low teacher expectations and race-based tracking. This means that teachers need to ignore stereotypes and prior beliefs about minority students if they ever want to effectively educate them. These beliefs and stereotypes have been known to affect the level of expectation teachers hold. Although studies have shown that teachers have a strong influence on educating minorities little is known about the actual experiences they have encountered when educating minority students. When teachers do not come into the classroom with preconceptions or stereotypes the way they teach will reflect this. The attention they provide to students will be greater than when they hold stereotypes. Also, students often respond better to the respect and rapport teachers show them when preconceptions are not involved (Payne, 1994).

Brookover, Schweitzer, Schneider, and Beady (1978) concluded that school climate makes a difference is school achievement. Variables that are most often used to describe school social systems are the school's academic norms, expectations, and beliefs. The researchers hypothesized that students would likely have trouble thriving within schools where the climate is not consistent with their identities (Brookover et al, 1978). Another aspect of the school that has been shown to affect adolescents is the curriculum. Curriculum is a fundamental part of schooling (Page & Valli, 1990). Perceptions of relationships between ability, socioeconomic status, and ethnicity continue to play a part in curriculum assignment (Alexander, 2002; Kershaw, 1992). But, school context should not play a role in the type of curriculum students are offered (Alexander, 2002). A history of racism and discrimination has led to distrust of school systems by African American parents (Gamoran, 2001; Lareau & Horvat, 1999).

Another school factor that has presented itself in a few research studies is the relationship between students and role models or mentors (Bell, 1970; Gibson, 2004; Linnehan, Weer, & Uhl, 2005; Zeldin & Pajares, 2000). Gibson (2004) defines a role model as the "construction based on the attributes of people in social roles an individual perceives to be similar to him or herself to some extent and desires to increase those similarities by emulating those attributes" (p.136). Role models and mentors are believed to be important because they help strengthen individual growth. Zeldin & Pajares (2000) found that when women were asked about significant factors in their lives, they consistently recalled an influential person who helped them develop their beliefs about their capabilities. When African American students' relationship with mentors was

studied the findings suggested that in early stages of ethnic identity development they prefer to be affiliated with the white community (Linnehan, Weer, & Uhl, 2005). Mentors are also important when talking about types of classes African American students take. Grantham and Ford (2003) note in relation to African American students in gifted programs that mentors are important because they help empower students by causing them to improve their decision-making skills and their ability to clarify goals for the future in a way that provides a sense of direction and purpose. Linnehan (2001) found that students who participated in a mentorship program for more than half the academic year showed a significant, positive improvement in their grade point averages and attendance rates. Research on mentoring suggests that a mentoring relationship can be especially useful to minorities because when looking at higher education or employment mentors can provide access to the informal power structure, which currently excludes minorities (Hall & Allen, 1982).

Family relationships

Research has demonstrated that family background is critical to students' achievement (Mehan, 1992; Roscigno & Ainsworth-Darnell, 1999). Reasons for the family's importance is that the family background is more likely to affect the school a child attends, the curriculum track in which the child is placed, expectations the teacher holds for that child, and resources that child will be provided (Gamoran & Berends, 1987; Rist, 1970; Roscigno, 1998; Roscigno & Ainsworth-Darnell, 1999). Families can be highly instrumental to the science and math related aspirations and commitment of their

children (Leslie et al., 1998). Parsons, Alder, and Kaczala (1982) argue an important point in their research of parental influence when they assert that parents exhibit behaviors which children imitate and later adopt as part of their own repertoire. They go on to contend that as a result parents beliefs are causally related to children's self-concept.

Schulenberg, Vondracek, and Couter (1984) found that parents tend to reinforce certain behaviors in males that they do not reinforce in females. Parents may convey these expectations in messages relating to beliefs about their children's abilities, difficulty of task achievement, and importance of activities. Parents may think that a subject such as math is hard for their children and that their children are not good at it. As a result these children begin to possess a low concept of their ability equivalent with their parents (Parsons et al., 1982). Lopez (1989) and Whiston (1996) go on to state that the family is regarded as a dynamic network that at any given moment exerts functional constraints on the behavior of individual members. Therefore, Parsons et al. (1982) stress that it is imperative for parents to establish a positive relationship and provide encouraging expectations for their children's achievement in order for their children to reflect actual positive behaviors.

When examining the relationship of family and careers, researchers found that the quality of relationships in the family of origin is associated with career development in college (Kenny, 1990; Kinner, Brigman, & Noble, 1990; Penik & Jepsen, 1992). Lopez and Andrews (1987) also speculated that vocational development and career indecision

may be enhanced or affected by a dysfunctional family relationship. Eigen, Hartman, and Hartman (1987) found that chronically undecided students were more likely to describe their family situations as too tight or too loose, there was no pattern of a middle ground. However, in school settings Palmer and Cochran (1988) demonstrated that when parents were instructed to be supportive in the career development process, this proved to be positive in enhancing vocational maturity of high-school aged adolescents.

Middleton & Loughead (1993) state that parents can have a significant influence on student career direction as they move from adolescence to adulthood. The effect could be positive or negative. Schulenberg et al. (1984) state that within research relating to females and careers it is especially likely that if their mother was employed outside the home, they will be also. It should also be noted that having a parent who has a science or engineering occupation adds to the likelihood that one will major in science or engineering (Leslie et al., 1998). Hargrove, Creagh and Burgess (2002) suggest that the ability to make appropriate vocational decisions for young adults may be directly influenced by the quality of family interactions, boundaries, and emotional interdependencies perpetuated within the family. Blustein et al. (1991) found that as it relates to vocational identity the most prominent family predictors for males were different from predictors for females. Lopez (1989) found that for males conflictual independence from their mother and the absence of marital conflict were important factors whereas for females it was conflictual independence from the father that was deemed important in deciding about careers.

Bratcher (1982) developed the Family Systems Theory which reinforces the crucial role that family plays on students' decisions. Whiston, (1996) describes the family systems theory as the family operating as a unit where patterns of interacting evolve and are maintained. She went on to find that there are family dimensions related to career indecision and career decision-making self-efficacy. She also found that career decision-making self-efficacy was related to the personal growth dimension of the Family Environment Scale. This dimension is made up of the independence, achievement orientation, intellectual-cultural orientation, active recreational orientation, and moral-religious emphasis subscales.

There have long been arguments over the effect that parents and families have on adolescents. Blustein et. al (1991) point out that adolescent-parent relationships are especially important in late adolescent development. Regardless of the support given it is well recognized that at least some degree of support is needed to provide a secure foundation from which the adolescent chooses to engage in the task of committing to a career choice (Kenny, 1990). Roe (1956) described family interaction patterns as the primary determinants of occupational behavior. Fouad et al. (2008) confirmed in their findings that parental expectations were salient influences on adolescents choosing a particular career or attaining an advanced education. Research has been particularly widespread when covering the influence that the family has on adolescents educational and career goals. It is believed that there are certain family interactions that specifically encourage career decision making, and others that promote career indecision (Lopez &Andrews, 1987). Penick & Jensen (2002) looked at the type of family system in which

an adolescent lives as a predictor of how a student views vocations. Whiston (1996) says that since family interactions have an influence on socialization, including school, examining the family interaction of people and their career decision self-efficacy might offer additional theoretical insight.

From a parent's perspective there are several factors that may mitigate against productive involvement in school such as; lack of time and minimal opportunities for involvement (Hoover-Dempsy, Bassler, & Brissie, 1987; Lightfoot, 1981; Moles, 1982). Hoover- Dempsy et al. (1987) stress the need to improve parent-teacher relationships to enhance the education abilities of the children that are involved. Herman and Yeh (1983) found that parental participation was positively related to the relationship between parent and teacher. Regardless, studies have long shown that parental belief systems, expectations, styles, and behavior patterns are related to academic success (Grolnick & Ryan, 1989; Parsons, Adler, & Kaczala, 1982). Stevenson and Baker (1987) reported a positive association between parental involvement in school activities and student's school performance. Thus it may be assumed that students with highly involved parents have more academic motivation. For this reason, Herman and Yeh (1983) assert that parental involvement has become a focal concern of American schools. Some of these reasons could be because parental involvement may help schools formulate programs more suited to their children or parents in general could just become more familiar with the formal education setting.

Interest

Bandura (1986) suggested that perceived efficacy in people fostered the growth of intrinsic interest which would remain consistent as long as those interests engaged their personal feelings and offered satisfaction. Previous research has shown a pattern of minorities being placed in lower academic tracks, based on the inadequate estimations of career guidance personnel (Boyer, 1983). These are not conditions that foster intrinsic interest, and they may help account for shortages of the minority population in fields such as science and mathematics (Babco, 2001). Hansen (1999) describes interest as the inner state of a student that relates to the characteristics of a learning situation. A lack of interest in learning science and engineering may come about if one is not seeing science or math as fields into which members of one's community enter. In the Parsons (1997) study of African American females she found that 11 of the 20 interviewees saw a scientist as a white, unattractive, nerdy male. Their image described the male as having a secondary social life with a perfect family. The image they described did not represent what most African American students see on a daily basis. According to Super's theory (1953) individuals search for congruency between how they view themselves and the image they have of persons of a particular occupation when making a career choice. Post, Stewart, and Smith (1991) found that the academic interest level for African American males and females is approximately equal. He also found that the inhibition of interest within African Americans may be attributable to lack of encouragement and poor academic preparation.

It should be noted that the interest students hold may be different across demographic areas for a variety of reasons. Basu and Barton (2007) asserted one reason students from low income communities are not interested in science is that there exists a disconnection between school and home. They also noted that currently little research offers solutions on how to sustain these students' interest. However in their study there appeared a strong relationship between sustained interest in science and science learning environments in which students were able to cultivate relationships with people reflecting their same values. In some cases the relationship was with a family member such as a mother, in other cases the relationship was with a peer. Such a finding may indicate that even if there is disparity between school and home a positive role model may be a link to sustaining interest. Another finding by Basu and Barton(2007) was that sustained interest in science was related to whether their identity, beliefs, experiences, and conceptions of the future were built in the science they studied. For example if the science was pertaining to biology and the student was interested in helping find a cure for a disease that affects a family member, he or she may sustain that interest because it has a greater meaning. Carlone and Johnson (2007) found that in their study the interest in science and/or science-related fields had less to do with the subject of science than with the effect that their scientific competence would have on the world. The participants in their study were interested in humanitarian work such as health care-- things that would change the world in a positive way.

Hansen (1999) theorized that there are three aspects that may have an impact on the interest in science education: the topic or theme to be learned, learning context, and

type of learning activity. Topic or theme refers to a single subject such as chemistry or an area as big as Newtonian Laws, but they are believed to embody characteristics, such as simplicity or relative difficulty that can stimulate interest. Learning contexts refer to the aspects that make science topics meaningful to the student's everyday life. Learning activities refer to the levels or types of learning, types of recognition involved, or teaching methods. Results in the study done by Fouad & Smith (1996) suggest that there is a relationship between math/science interest and (age and gender). A prime time to influence the development of interest in minority youth and girls is during the middle school years. Interests along with self-efficacy and outcome expectations predict intentions which in turn lead to choice behaviors including those about careers (Lent et al. 1994; Waller, 2006). Waller (2006) also found that non-traditional African American students' math self-efficacy and outcome expectations, directly predicted their math interest.

But, there are still few studies that look at interest as it relates to vocational careers and African American students. Expressed vocational interest was assessed by Lease (2006) in 166 African American high school students. She noted that barriers related to family or discrimination decreased interest in schooling, directly affecting the attainment of goals. Lent, Hackett and Brown (1999) added to this by showing that even if there is a strong interest in something, if another option is viewed as more attainable that will be the one to which a student will strive. In addition to these findings Fouad & Smith (1996) found that self-efficacy has a large influence on students' interest. Math and

science self-efficacy are included in those factors that influence students' interest as it relates to engineering.

Self-efficacy

Self-Efficacy as defined by Bandura (1977) refers to the beliefs about one's ability to successfully perform a given task or behavior. Various studies have struggled to ascertain which efficacy beliefs of Bandura's theory contribute to career development and to what extent. The four major components of self-efficacy are: performance accomplishments, vicarious experiments, verbal persuasions, and physiological states. Personal performance accomplishments, include one's pattern of successes and failures at particular tasks or activities; Vicarious learning, refers to the observation of other peoples' performance attainments; Social persuasion, involves the encouragement or discouragement that one receives from significant others for engaging in particular activities; and physiological states and reactions, include the pleasant or unpleasant emotional and physical sensations (Bandura, 1986).

Lent, Brown, and Larkin (1986) state that expectations of personal efficacy are hypothesized to influence one's choice of behavioral settings and activities. Bores-Rangel et al. (1990) go on to say that self-efficacy is likely to influence people's choice, effort, persistence, and achievement, assuming they have sufficient abilities and incentives to choose or perform the relevant activities. Lent, Brown, and Larkin (1984) assert that student's beliefs about their educational ability to complete the educational requirements of various science and engineering fields are predictive of academic performance.

Hackett & Betz (1981) recommended that self-efficacy could assist in the understanding of career development. Tang, Fouad, & Smith (1999) found that self-efficacy was a considerable determinant in career choice. In relation to self-efficacy Ginakos (1999) claims that when past behaviors lead to successful and desirable outcomes, a person develops strong self-efficacy insights for the behaviors and persists in them.

Math-science self-efficacy

Math and Science are two important foundational subjects that have quite a bit of overlap with the field of engineering (Lent, Larkin, & Brown, 1989; Meece, Parsons, Kaczala, et al., 1982). Both subjects provide information that is included in the field of engineering, therefore they are considered very vital if one wants to enter engineering. Gainor and Lent (1998) assert that math course enrollment patterns help determine one's range of career options. Zeldin, Britner, and Pajares (2007) observe that individuals from ethnic and racial minorities continue to be underrepresented in science and math related fields, and self-efficacy researchers should focus on this issue. Schunk (1984) found that the rich avenue of inquiry into educational attainment and career development has been opened by the self-efficacy perspective on achievement behavior. As the self-efficacy perspective was originated by Bandura and has since provided understanding to certain career developmental aspects.

What influences mathematics self-efficacy? A study done by Betz & Hackett (1983) indicated that mathematics self-efficacy is significantly correlated with attitudes toward mathematics and the extent in which it was chosen as a major. A key aspect that

influences students to go into a field is motivation. Schunk (1991) says that motivation is enhanced when a student senses progress in a subject, thus he or she attempts to become more skillful, enhancing self-efficacy for performing well. Bandura (1989) postulated that the best predictor of behavior in a specific situation is the self-perception individuals hold. Therefore when evaluating subjects such as math and science, it is important to remember that even though the two are intrinsically related an individual may hold a self-concept for one that may not be consistent with the self-concept they hold for the other (Schunk, 1991). The variance in self-concepts may also contribute to the underrepresentation in careers related to either subject.

When exploring the subjects of math and science the effect of gender has to be considered. Research has hypothesized that women and men differ not only in subjects they take in school, but also in performance in the subjects. Ernest (1976), Fennema (1974) and Meece et al.(1982) found that not only do female students take significantly fewer mathematics courses than male students; they also choose classes that are less rigorous. Betz & Hackett (1983) found that math self-efficacy expectations of college females were lower and weaker than those of college males. Zeldin et al.(2007) considered the notion that derogatory statements about one's competence in a particular area have detrimental effect on those who already lack confidence in their capabilities. Other causes for these gender differences in subjects also include identity formation, math anxiety, ability, and lack of role models (Erikson, 1968; Ernest, 1976; Betz & Hackett, 1983; Zeldin et al., 2007). Lau & Roeser (2002) found that among high school students, science self-efficacy predicted science related career interest. If this finding

holds true across ethnicities, it could be validly argued that the next step in career development for science is to begin fostering science self-efficacy. The importance of this finding comes at a time when our nation is dependent on science and technological fields more than ever.

Along with gender as a variable for math/science self-efficacy beliefs is ethnicity. Carlone and Johnson (2007) used science identity to examine the experiences of women of color. Their model of science identity is based on the assumption that one's ethnic identity affects one's science identity. Carlone and Johnson (2007) found that some participants' chances for recognition were disrupted because they were qualified by their race rather than their ability as science students. Their finding also suggest that because some scientists have difficulties in recognizing darker-skinned or more ethnically different students as capable science students it may deter minority students. Research has stated that African American students are underrepresented in math career fields (Gainor & Lent, 1998). However, more African Americans enroll in courses involving different content in mathematics and science than do white students (Davenport, Davison, Kuang, et al., 1998; Reyes & Stanic, 1985;Jones, 1984; & Powell, 1990). One reason may be the lack of role models (Gibson, 2002) in those specific fields resulting in minority children not being able to see themselves in such career roles. Another causal factor that has surfaced in research is fear .In Shiber (1999) students reported fear of the subjects prevented math and science participation and enrollment. A fear often results in missed career opportunities where math and science are the dominant requirements. Betz and Hackett (1983) concluded that a low math self-efficacy will result in more students

wandering away from career choices that include math. Research shows that African American students receive poor preparation in these subjects and therefore experience repeated failure to master basic mathematical and scientific concepts early in their school careers (Hall and Post-Kramer, 1987). Low mathematics self-efficacy and avoidance of math-related coursework may explain the underrepresentation of women and minority students in science-based careers (Betz & Hackett, 1983; Gibson 2002). By gaining a better understanding of influences on math and science self-efficacy, counseling psychologists will be able to develop and provide effective interventions that promote the subjects to adolescents (Fouad & Smith, 1996).

Math/science related goal intentions

Math/science related goal intentions refer to the strong probability that a student has of entering the engineering field or some aspect of it. No existing studies were found that examined engineering goal intentions. However a few studies were found using Math and Science goal intentions so that and outcome expectations will be used synonymously. Gainor and Lent (1998) found a significant correlation between self-efficacy, interests, and outcome expectations to aspects of goal intentions. However their findings showed interest mediated the relationship between intentions and the other variables. Navarro, Flores, & Worthington (2007) found that math/science self-efficacy and math/science outcome expectations were positive predictors of math goal intentions. Furthermore, they found that among Mexican American students perceived social support from parent and teachers did not significantly predict math/science goal intentions.

The Social Cognitive Career Theory (SCCT) was the first to propose a relationship between outcome expectations and other behavior factors such as self-efficacy and interest. A number of studies have made a correlational connection between outcome expectations and self-efficacy (Fouad & Smith, 1996; Gainor & Lent, 1998). Hackett et al. (1992) found that outcome expectations were more positive when self-efficacy was high. Thus, it can be concluded that the more a person feels that he/she is capable of performing a task, the more likely they will be successful at it. There have been few studies that have looked at this correlation with a predominantly minority population. Gushue (2006) studied the relationship between outcome expectations, identity, and self-efficacy within minority students. His findings were consistent with prior studies in that a direct effect between identity and outcome expectations was not established. But the study did show that identity associated with a particular ethnic group did influence their beliefs to engage in career exploration.

Since there is a dearth of studies on goal intentions specifically related to the field of engineering and African American students this study will attempt to find specific answers to questions relating to this population and content area.

Career decision self-efficacy

Career decision self-efficacy (previously named career decision-making self-efficacy) refers to the extent in which a student has confidence in his/her ability to engage in occupational and educational decision making (Peterson & DelMas, 2001). Originally defined by Taylor and Betz (1983), career decision self-efficacy is measured using the

task domains of accurate self-appraisal, gathering occupational information, goal selection, planning, and problem-solving (Chaney, Hammond, Betz, & Multon, 2007). Quality exploration of career development is the basis for career decision self-efficacy (Gianakos, 1999). Research has taken the Social Cognitive Theory (SCCT) and outcome expectations in order to better predict behavioral influences on careers. Ojeda et al. (2006) found that career decision self-efficacy research reveals that high levels of confidence are related to positive career behaviors and outcomes. Thus, there is no debate that behavior strongly influences career decision self-efficacy. The interest comes when one measures the transferability among ethnicities. Gloria and Hird (1999) state that minority students experience lower career decision self-efficacy than their white counterparts. When specifically looking at African American students little research shows what causes this negative level of career decision self-efficacy. However, O'Brien et al. (2000) and Bores-Rangel et al. (1990) note that for students of color, low career self-efficacy has been associated with students being limited to vocational alternatives.

Existing studies suggest that firmly held career goals, characterized by choice certainty, decidedness, and commitment, may promote the likelihood of choice entry behavior (Germeijs & Verschueren, 2007; Lent et al, 1994). Germeijs and Verscheren (2006) postulated that there were six core aspects of the career decision making process: orientation of choice (awareness of the need to make a decision and motivation to engage in the decision making process), self exploration (gathering information about oneself), broad exploration of the environment (gathering general information about career alternatives), in depth exploration of the environment (gathering detailed information

about a reduced set of career alternatives, and commitment (strength of confidence in the attachment to a particular career alternative). They studied if all or some of the stages in this process affected the decision of choice. Stages were shown to affect decision making but they did not explore the confidence about the choice the students made. O'Brien et al. (2000) found that students who lack career decision self-efficacy may avoid exploratory activities, give up easily, and fail to reach their occupational potential. From this Germeijs and Verscheren (2007) show that in depth exploration during the decision making process is strongly correlated with the commitment of career choice.

In Brown, Darden, Shelton, et al. (1999) the findings suggest that rather than ethnicity strictly determining career decision self-efficacy their participants seemed to show different levels of career decision self-efficacy based on their minority group status. By this the authors mean that students who were shown to be in the numeric minority group (i.e. having fewer African Americans in class than Whites) exhibited lower levels of career decision self-efficacy. From this research and preexisting studies Brown et al. (1999) and O'Brien et al. (1999) suggested that interventions for numeric minorities and students in at-risk environments may result in increasing levels of career decision self-efficacy. When research was done in relation to vocational decisions interesting findings arose. In a study examining vocational indecision Taylor & Pompa (1990) found that career decision self-efficacy predicted vocational indecision in college students. Alternatively Blustein (1989) found that career decision self-efficacy plays a prominent role in career exploration.

School-To-Work Transition

School-to-work (STW) refers to the period of time between completion of general education and the beginning of vocational education or of gainful employment (Barabasch & Lakes, 2005; Ng & Feldman, 2007; Phillips, Bustein, Jobin-Davis, et al, 2001). One reason the school-to-work transition is important especially in youth is that it helps develop youth who are at different stages. The school-to-work programs are focused on skill development and formation. Researchers have struggled first to define skill then to focus on teaching skill. When looking at different ways skills are taught we find specific models that are often referred to, especially in the realm of vocational education. Ashton, Sung, and Turbin (2000) state that there are currently three educational models; the schooling model which incorporates most forms of the formal educational system, currently in the US, Canada and Japan; the dual model which is distinguished by a highly developed apprenticeship area associated with West Germany, Switzerland, and Austria; and the mixed model where greater importance is assigned to the non-formal sector, associated with the UK.

History shows that despite progress there is still an inequality between members of society according to social status. Owens (1992) noted that individuals from the upper social classes were more likely to attend college, whereas members of the lower social classes were more likely to transition directly to work. Findings suggest that students were being tracked into certain programs according to their position in society based on their parents' socioeconomic status. "It is argued that tracking actively reproduces

inequality across generations, with lower-class children being placed in tracks that inhibit their already slim chances of going to college and entering socially desirable occupations" (Arum and Shavit, 1995). Most often students who do not perform well in liberal education are steered along a vocational track. What Dewey suggested was if you provide individuals with social settings that are conducive to their particular style of learning, there will be no inequality among people. He stressed that workers regardless of race or religion need to be educated in a broader setting, more liberal subjects, so that they will perform better at whatever it is they do.

Fortunately the current status of school-to-work contains ideas held by both Dewey and Snedden. So the current status of school-to-work transition has not come far from its origins. The major sub-population that participates in the school-to-work programs in the United State are those students of the lower socioeconomic status. These are students that teachers don't ever foresee going to college and therefore do not encourage higher education. The United States has offered some "mediators" to improve the school to work transition. Within the high schools the curriculum offers a tech prep program. Within this program students are still taking some regular high school classes but their electives are focused on a specific vocation or training. Again these classes are mainly populated with minority students of low socioeconomic status. But, the core of this program is to try and get students out of school with at least some technical skills so that they will become productive citizens. Bragg and Layton (1995) believe that tech prep and the related idea of academic and vocational integration may help overcome the racial and class separation currently existing in the American school system.

The U.S. attempted to address the concerns relating to school-to-work transition through the School-to-Work Opportunities Act of 1994. This legislation established a national framework for the development of school-to-work systems in all 50 states. The legislation provides funding for these particular programs to assist in the transition and offering of vocational skills. It also enhances the relationship between high schools, community, educational institutions, and families (Worthington & Juntunen, 1997). Another one of the ideas that the U.S. has tried is the creation of Technical or Community Colleges. Unlike the traditional four year college these colleges focus heavily on specific career preparation, though focus is not so specified that it excludes general education programs. Students are required to take English and Math courses , though not as intensely as in four year college. A third idea is the middle college notion. This idea involves allowing high school students who have possibly dropped out of the traditional high school or been kicked out of school to still have a chance at education. Not all students fit the mold of the "traditional high school student". Although these students may be just as capable of succeeding, they have become disinterested in education. The students are typically based on a college campus. Some of them take classes taught by college professors. The middle college program tries to promote the idea that regardless of past or present circumstances, college is still an option and is still accessible.

Regardless of the perceived benefits there are some current problems with the school-to-work transition. First there is a high unemployment rate among youth that the current school-to-work program misses. Second, with young students not going into four year colleges there is an increasing chance of youth going into poor jobs increasing the

poverty level. “Under the conditions of the risk society certification and the skills acquired through kinds of employment experience become increasingly important in maintaining a position in the adult labor market” (Bynner and Parsons, 2002). Currently there are 36.5 million people in poverty and over half of this number are those who do not graduate high school or who do not go on after high school. The school-to-work program does not always offer the best opportunity for students. For those who enter the transition program some of the jobs they find are low-wage that do not allow them to adequately provide for themselves or family. People are going into school-to-work programs with instability in their lives. Some people enter the program out of pure necessity and this is not always a good thing. A current trend is that females are starting to have babies at earlier ages with no sustainable way to take care of them. Thus a cause and effect relationship develops where early motherhood disrupts the educational progress, which limits their future educational and employment opportunities due to lack of preparedness (Fergusson & Woodward, 2000).

High school graduates who do not go on to college face more challenges when looking for jobs and also trying to change jobs (Blustein, Chaves, Diemer, et al., 2002). When comparing the effect of school-to-work between students of different socioeconomic statuses there is also a variation. These variations range from differences in their motivation to work, support received from their parents, and relationship between their job and vocational interest. Swanson and Fouad (1999) state that school -to -work could have positive or negative results depending on the quality of the program. One suggestion for students who enter work directly from high school is to find a way to

obtain the knowledge of self and work then develop a strategy for fitting the two together. This trial and error technique is usually a skill that is learned in post secondary education but is valuable to all students.

In summary, although school-to-work has proven to be beneficial to some it still provides a hindrance for others. By pushing this program the odds of increasing equality in a field such as engineering decreases. School-to-work may be viewed as a cyclical way to continue not to encourage students of African American descent and lower socioeconomic status not to push themselves in rigorous courses. Thus students who are at a stage where they believe engineering is possible may give up and take an alternative route.

Career Development

Concerns have been addressed that traditional career theories tend to minimize the role of culture and structural barriers in the career experiences of people from racial/ethnic minority groups (Gainor & Lent, 1998; Hackett & Lent, 1992). Lent et al. (1994) argue that career interest and intentions develop partially as a result of self-efficacy and outcome expectations. Times have greatly changed in the area of students making a decision about their future career. There was a time when students did not have as much opportunity to change majors or to prolong their education once started. Now education affords students many more career options, which is the reason some researchers believe that career decision making should be put off until the post secondary level.

Tang et al. (2007) found that for Asian American students acculturation, family background, and self-efficacy were factors affecting occupational choice. The factors that play a role in determining students' career choices cannot be understood solely in terms of their effect on academic choices (Dick and Rallis, 1991). Meece et al. (1982) developed a model where a student's career goal shapes his/her perception of both the intrinsic and extrinsic value of academic tasks. From the model he concluded that the value of a certain task reflected the academic choice, performance, and persistence of that student in a particular subject. Mortimer, Zimmer-Gembeck, and Holmes (2002) state that the choices students make about school and work take place within the context of institutions, organizations, and structured labor markets. Unfortunately, many students lack basic information about how much education is needed for the occupations they are considering. When students do choose to enter vocational fields their influence stems from parents, teachers, coaches, friends, or personal experience in employment.

What range of career exploration do adolescents even experience? A study by Grotevant, Cooper, & Kramer, (1986) found that adolescents who explore a breadth of career possibilities will choose careers that are similar to their personality. Fouad & Bingham (1995) say that within this exploration of career development cultural awareness and societal influence must be included. In addition to societal and cultural arguments there have been discussions about the difference among genders as it relates to career development. Osipow (1983) and Betz &Hackett (1981) note that there exists a significant difference in career development patterns among men and women. More specifically the career development of women warrants further study and most theories

are dominantly based upon men. There is evidence that students still pursue occupations based on sex typing or traditional gender occupations (Betz & Hackett, 1981). Indirectly these findings result from personal expectations and self-efficacy these students hold. Similar to this idea is the effect parent's relationships have on males and females career development. The idea that the closeness of students to parents affects career formation and commitment for the most part is to be noted (Lucas,1997; Schulthesis & Blustein,1994) and needs to be further explored.

Summary

A richer theoretical lens is needed as it relates to African American students and their relationship to engineering. It has been found that the attitudes of teachers and parents often reflect cultural stereotypes regarding the *alleged* ability of children (Leslie et al, 1998; Meece et al., 1982). Landis (1976) postulates that adequate preparation for engineering study involves course selection patterns that begin in the eighth or ninth grade. Backman (1972) found that the relationship between socioeconomic status and patterns of mental abilities showed a very moderate level of statistical significance. When looking at ability, Leslie et al.(1998), found that mathematical performance declines earlier and steeper among girls despite initial high capability in these subjects. Another notion is that African American students may not be entering math and science fields because of lack of role models (Waller, 2006; Post et al., 1991; Powell, 1990). Matthews (1984) considered environmental factors to be a determinant of black students entering math courses. Studies have suggested that if students of color are made aware of social injustices that may serve as an empowerment tool to reject stereotypes and achieve

academically (Diemer & Blustein, 2006; Fine et al., 2004). The study to be reported here is informed by complex issues. The aim is to understand better why African American high school students shy away from considering engineering-related careers.

Chapter III

Methods and Procedure

This chapter reports on the methods and procedures used to address the two research questions that have guided this study of engineering as a career choice among African American high school students. These questions were:

1) To what extent do exogenous factors (school, math/science interest, ethnic identity, math/science confidence, family relations) and endogenous factors (demographic and ability) influence career decision self-efficacy?

2) To what extent do exogenous factors (school, math/science interest, ethnic identity, math/science confidence, family relations) and endogenous factors (demographic and ability) influence math/science related goal intentions?

The chapter includes a description of the research design, population and sample, instrumentation, the Institutional Review Board process, pilot testing the survey, data collection, and data analysis.

Design of the Study

The design of this study was quantitative using correlational methods. A survey instrument was developed that reflected the variables of the study. Using research surveys in a quantitative design has a number of advantages (Boyer, Olson, Calatone, & Jackson; 2002) especially within schools and large populations. Surveys are viewed as reliable instruments that are easy to administer. They are also more familiar to high school students in that most of the tests they are administered are in this form. Survey

research also allows the researcher to investigate relationships between multiple variables (Lin, 2006).

Population and sample

District

The population for this study were students enrolled in two schools within Richland County School District One in South Carolina. Richland County School District One serves one of the largest African American student populations in the City of Columbia. It is South Carolina's sixth-largest school district, and they educate more than 24,000 students at 28 elementary schools, nine middle schools, and seven high schools. None of the schools has an open enrollment system so the populations within the schools are formed by neighborhoods and zones. The schools in Richland One stretch over more than 480 square miles encircling urban, suburban and rural communities. The students within the school district represent over 30 countries and languages. Due to modern advancement in technology students have access to high-school and college courses through a video-conferencing center located on the campus of each high school. The researcher has a personal link to this population in that she attended a school within the district, however she did not attend either participating schools.

School One- W.J. Keenan

A portion of the population for this study is students who attend W.J. Keenan High School in Columbia, S.C. This is one of seven high schools in the metropolitan area of Columbia. It meets many necessary requirements the researcher viewed to be

invaluable for this study. The first criterion was that Keenan has an almost completely African American population (at 99%). This is based on the 2007-2008 9th grade enrollment report. Second, Keenan is a good match because the researcher is concerned with having a diverse level in socioeconomic status. The school reports having a little over 50% of the students who receive free/reduced price lunches. The enrollment for the year 2008 was 843 students. This number is based on grades 9-12.

Keenan has become known for its commitment to improving and furthering education. The school reports that more than ninety-five percent of the freshmen arrive at basic or below-basic achievement levels, as indicated on their eighth grade PACT test results. After just one year of high school at Keenan, a number of the students pass their High School Achievement Program (HSAP), which South Carolina requires every student in the state pass before graduation. As first-time takers of the exam, students pass with an almost eighty percent grade in English/Language Arts and sixty-five percent in math. Following graduation approximately sixty-five percent of Keenan graduates further their education through the colleges and universities of their choice, to include West Point and Harvard University. This number is above the average graduation for the state of South Carolina, which is about fifty-six percent (Education Week, 2008).

In addition to demonstrating district excellence, Keenan received good and excellent ratings on the state's report card and has met Annual Yearly Progress (AYP) for the past two years, as defined by No Child Left Behind (NCLB). During the 2004-05 school-year, Keenan High School won the Palmettos Finest High School Award. The

S.C. Association of School Administrators (SCASA) and Carolina First Bank present the award each year to two elementary schools, one middle school and one high school that offer the best in innovative, effective educational programs. The Carolina First Palmetto's Finest Award, is one of the most coveted and respected awards among educators in South Carolina. The award selections are based on extensive evaluations by fellow educators. The application process includes elements on student achievement, faculty training, program goals and delivery systems, office practices, and community involvement. The school has received the Palmetto Silver and Palmetto Gold Awards in subsequent years for increased student achievement.

Although there are numerous reasons why Keenan has received many awards, a primary one is their advancement of innovative projects. One of these is the Raider Engineering and Academic Leadership (REAL) Project. This project stems from a partnership between Keenan and the Engineering School at the University of South Carolina (USC). The REAL project is designed for students who want to challenge themselves through technology, math, and science. The curriculum consists of AP and honors level courses, along with college courses in engineering. The project is designed in such a way that at least one certified engineer teaches courses with the Project Lead the Way certified teachers. The number of students from this school that participated in this study was 222, 56.1% of the sample.

School Two- Columbia High

Columbia High School is the second school in the study. Similar to W.J. Keenan this school has a high population of African American students. The 2007-2008 9th grade enrollment report shows this population to be 94%. Columbia High school reports indicate that 54% of students receive free/reduced price lunch. The enrollment in grades 9-12 for the year 2008 was 879 students. The researcher had access to grades 9-12.

Columbia High has been a multiple recipient of the Palmetto Gold Award for academic achievement. Beginning in the 2008-09 year it school became a STEM (Science, Technology, Engineering and Math) theme school. It implemented new Academies to complement existing components of study. Each of the Academies is a four-year program that provides students with extensive real-world experience. Students begin coursework as 9th graders. Five credits must be earned for successful completion including a 160-hour summer internship between the Junior and Senior years. The specific Academies are: the Academy of Biomedical and Health Science, the Academy of Information Technology, the Academy of Engineering, the Academy of Mathematics and the Academy of Finance.

Columbia High exposes students to advancing technology. During the 2009-2010 school year the school will add an Aerospace Engineering program to their Engineering academy. Currently programs such as Computer Aided Drafting (CAD), Project Lead the Way (PLTW), general technology, and pre-nursing are offered. The courses within the PLTW curriculum that are offered are: Principles of Engineering (POE); Introduction to

Engineering Design (IED); Digital Electronics (DE); and Engineering Design and Development (EDD). Students participating in the Engineering Academy must complete the prescribed curriculum with an overall GPA of 3.0 and pass a mandated test each year to receive college credit and a special diploma. In addition, they must also complete a community service class or approved project. The number of students from this school that participated in this study was 174, 43.9% of the total sample.

Instrumentation

A six page survey containing 135 items within eight sections was developed for this study. The items were drawn primarily from existing instruments used in prior research studies (see Table 3.1). The school factors and family relations subscales were modified by the author to be of relevance to the current study. Where necessary permission from the original developers to use their scales was obtained (see Appendix B-D). The Cronbach's alpha for each of the original scales are outlined in Table 3.2.

Table 3.1 Components of Survey Instrument

Variable	Instrument	Author/s	# of Items	# of Items (after adaption)
Demographic Factors	Background		15	15
School Factors (SF)	SF (named by researcher)	Ford & Harris (1996); Masters & Hyde (1984)	79	19
Ethnic Identity (EI)	Racial Ethnic Identity	Oyserman, Harrison, Bybee (2007)	12	12
Math/Science Expectations(MSE)	Math/Science Goal Intentions	Fouad, Smith, Enochs (1997)	15	12
Math/Science Confidence(MSC)	Math/Science Self-Efficacy	Betz & Hackett (1983); Fouad, Smith (1996)	12	10
Math/Science Interest(MSI)	Math/Science Interest	Fouad, Smith (1996)	20	20
Career Decision-making Self-efficacy(CDSE)	Career Decision Self-Efficacy	Betz short form	25	25
Family Relations (FR)	Family Relations	Ford (1991)	22	22

Table 3.2: Reliability of Questionnaire (Cronbach's Alpha) (n= 396)

Variable	Cronbach's Alpha	Number of Items
School Factors	.74	19
Ethnic Identity	.86	12
Math/Science Expectations	.88	12
Math/Science Confidence	.87	10
Math/Science Interest	.94	20
Career Decision Self-Efficacy	.96	25
Family Relations	.91	22

Demographic Data

Section I contains twelve items based on students personal information such as their gender, grade level, and engineering course completion. In addition, students completed items about their parent's education and occupation, and living situation. Finally they were asked information about the grades they have received, and science and math courses they had taken/intended to take. As suggested by Hollinghead (1975) parental information such as education, marital status, and occupation, was used to derive the student's socioeconomic status (SES).

A number of researchers feel that demographic measures are important to include in research involving adolescent development (Entwisle & Astone, 1994; Hauser, 1994).

Social constructs such as race, ethnicity, gender, and socioeconomic status (SES) are important when looking at social processes within families and schools, since they may influence students overall persona. Entwisle & Astone (1994) and Hauser (1994) state that there are three factors that are optimal in determining socioeconomic status in youth, namely, parental education, parental income, and the extent to which children are connected to the larger world by people with whom they share a household. To this Hauser, 1994 added parental occupation. Hollingshead (1975) suggests that people who possess different levels of education tend to exhibit different behavior patterns. Sirin (2005) adds that parental education is an indicator of parent's income because in the U.S. they are highly correlated. Parents are the basis for the financial capital the children receive; most children are not independent therefore where their finances come from will help explain their SES (Entwisle & Astone, 1994). For this study, a four-factor index suggested by Hollingshead (1975) was used to measure SES.

The survey was distributed to a total of 500 students among the two schools. Of those 396 (79%) were used is the analysis and 104 (21%) of the surveys were omitted from the analysis because they were incomplete (missing over 50% of data) or student's were shown to have an ethnicity other than African American. These students were identified by the lack of completion of section two (ethnic identity), which non-African American students were explicitly told to skip. The participants consisted of 46% males and 54% females. Twenty-five percent of the students were in 9th grade, while 19% of the students were in the tenth grade. Within the higher grades 18% of the students were in the eleventh grade, while 38% reported being in the 12th grade. (Table 3.3)

Since the study wanted to focus specifically on factors that influence entrance into engineering careers the researcher thought it was appropriate to evaluate the number of students that enter engineering programs at the high school level. The question focused on students who had completed a minimum of one engineering course. The engineering program was also the basis for the particular schools being chosen. Although both schools had engineering focused programs in the school only about 21% of the students between the two schools took advantage of this program (Table 3.3).

Table 3.3: Descriptive Statistics (Gender, Year in high school, and Completion of an engineering course).

	Characteristic	N	%
Gender			
	Male	182	46
	Female	214	54
	Total	396	100
Year in High School			
	9th	100	25.4
	10th	76	19.3
	11th	69	17.6
	12th	148	37.7
	Total	393	100
Completed Engineering Course			
	No	297	79.2
	Yes	78	20.8
		375	100

School Factors

The second section of the instrument related to *school factors* and contained nineteen questions. As stated previously school factors pertain to teacher expectation, curriculum, and achievement. Questions in this section (Appendix K) are formed using

interview questions from two different instruments, the Attitude-to-School questionnaire developed by the Research Branch of the Education Department of Western Australia (Masters & Hyde, 1984), and a questionnaire developed by Donna Ford in 1981 as a part of her doctoral dissertation, and that is the basis of a study by Ford & Harris (1996). As stated previously questions in these instruments that were not specifically related to school were not used. Ford & Harris (1996) included an instrument consisting of seven subscales that totaled 54 Likert-type items related to students' perceptions of school, achievement, and other educational variables. Internal consistency for the seven subscales ranged from .42 to .80.

Ethnic Identity

The third section measured the student's sense of ethnic identity. This section contains previously validated subscales within the Racial Ethnic Identity (REI) scale that pertain to students' social identities (Oyserman, Harrison, & Bybee, 2001). For consistency in this study the researcher changed "Black" to "African American". Oyserman expresses REI as connectedness, awareness of racism, and embedded achievement using a twelve item scale. The three subscales each contain 4 items that are designed to measure the correlation between social identity and group behavior (Oyserman, Brickman, & Rhodes, 2007). Oyserman uses this scale under the assumption that ethnic group behavior influences individual student behavior. Oyserman, Gant and Ager (1995) sample items include "I feel a part of the African American Community" (connectedness), "Because I am African American, others may have negative

expectations of me" (awareness to racism), "I have a lot of pride in what members of my community have done and achieved" (embedded achievement).

The Cronbach alpha for each sub-scale is as follows: connectedness = .74; awareness of racism = .62; and embedded achievement = .65 (Oyserman et al., 2001). Validity has already been found using Confirmatory Factor Analysis (CFA). Results prove that the scale structure was in fact similar across different ethnic groups (Oyserman, Brickman, & Rhodes, 2007).

Math/Science

The Math/Science Self-Efficacy scale (MSSES) was developed to study ethnic minority group attitudes to math and science careers. It drew upon the math self-efficacy scale developed by Betz and Hackett (1983), and its reliability and validity were shown by Fouad and Smith (1996), and Fouad, Smith, & Echnos, (1997). The scale contains 12-items on a 5-point Likert type scale; 1=very low ability, 2=low ability, 3=uncertain, 4=high ability, 5=very high ability. An example question is, "I am confident in my ability to earn an A in Math". In two studies with predominately Hispanic middle school samples, researchers obtained a Cronbach alpha of .84 for scores on the MSSES (Fouad & Smith, 1996; Fouad et al., 1997; Navarro et. al, 2007). Fouad and her colleagues also provided criterion-related validity evidence by demonstrating the scale's ability to detect changes in students' mathematics/science self-efficacy due to intervention.

The Math/Science Outcome Expectations (MSOE) and Math/Science Intentions (MSIGS) scale were developed by Fouad and Bingham (1995). The MSOE and MSIG

scale scores were correlated with the Career Decision Making Outcome expectancies subscale resulting in a discriminant validity coefficient of .71 and .66 respectively (Fouad et al. 1995). Fouad and Smith found Cronbach alphas of .80 and .81 for both the MSOE and MSIG (Navarro et al., 2007). For both, Lent et al. (1991) found an internal consistency of .90 for their 10 item scale with college sample and a 2 week retest reliability of .91. Fouad and her colleagues provided concurrent validity evidence for the MSOE by demonstrating the scale's power in predicting math and science related interest and intentions. The scale consists of 13 items on a 5-point Likert type scale; 1= strongly disagree, 2=disagree, 3= uncertain, 4=agree, 5= strongly agree. Sample question, "If I learn math well, then I will be able to do lots of different types of careers." They also provided evidence of construct validity for the MSIGS by finding a moderate relationship between the MSIGS and intentions and goals for career decision making. The scale consist of six items on a 5-point Likert type scale 1=strongly agree, 2=agree, 3= uncertain, 4=disagree, 5= strongly disagree sample, "I intend to enter a career that uses science". For this particular study Math/Science Outcome Expectations and Intentions is abbreviated as Math/Science Expectations (MSE).

The Math/Science Interest scale (MSIS) was developed by Fouad and middle school teachers (Fouad, Smith, & Enchos, 1997). The reliability of this scale was .90. Fouad and Smith (1996) supported the MSIS's validity by demonstrating its predictive power of math/science intentions. Navarro et al. (2007) found a Cronbach alpha of .91 using this scale. The MSIS consists of 20 items on a 3-point Likert type scale; 1=like, 2=

not sure, 3=dislike. A sample question would be to indicate the degree to which you like or dislike a particular activity (i.e. solve math problems).

Career Decision Self-Efficacy

Section seven of the questionnaire is the career decision self efficacy (CDSE) short form (Betz & Taylor, 2006). This section contains 25 items measured on a 5-point Likert type scale, with questions ranging from 1= no confidence at all, 2=very little confidence, 3= moderate confidence, 4=much confidence, 5=complete confidence. The CDSE was developed by Taylor and Betz (1983) and the original 50 item scale was based on a 10-point Likert scale. The purpose of the scale is to measure an individual's belief that he or she is capable of making successful career decisions. The scale is based on five career maturity competencies developed by Crites (1978). In keeping with those competencies the short form is based on five sub-scales, namely 1) accurate self appraisal; 2) gathering occupational information; 3) goal selection; 4) making plans for the future; and 5) problem solving (Betz & Taylor, 2006).

Brown et al., (1999) state that the CDSES was originally validated on 346 students in a private liberal arts college and 193 students in a large public college. Taylor and Pompa (1990) reported an alpha coefficient of .97. Congruently, a prior study using a sample of high school students indicated a Cronbach alpha of .97 (Carns et al. 1995; Flores, Ojeda, et al., 2006). Additionally, Luzzo's (1993) comprehensive review of the CDSES's psychometric properties provides evidence of its reliability and validity. Taylor and Betz (1983) also reported a Cronbach alpha of .97. Reliabilities calculated for the

five subscales of goal setting, occupational information, problem-solving, planning, and self-appraisal yielded respective values of .87, .89, .86, .89, and .88. Validity estimates were provided by Taylor and Pompa (1990). Robbins (1985) found that validity estimates for CDSE scores were moderately related to scores on measures of self-esteem, career decidedness, and vocational identity.

Family Relationship

The final section, section eight, pertained to questions about the relationship between the students and their family. These questions derived from two different sources, namely the work of Donna Ford reported in Ford & Harris (1996), and items developed by the author. Examples of questions from Ford & Harris (1996) were; "People in my family have been treated mean or unfairly by other people" and "My parent(s) think being in a gifted program is important". Examples of the questions developed by the author were: "My parent(s) encourage me to do well in mathematics" and "My parent(s) take me to the public library to obtain math/science related materials". Items in the Family relationship scale were measured on a 5-point Likert type scale (1= strongly disagree, 2= disagree, 3= uncertain, 4=agree, 5= strongly agree).

IRB

As a requirement for the University of Minnesota this study was reviewed and approved by the Institutional Review Board. Thus a Social and Behavioral Science application form was submitted for expedited review in August 2008. See Appendix A for a copy of the form that was be submitted. Due to the nature of the study, involving

minors, a consent and assent form was used (See Appendix H and I). Letters informed both the students and parents about the nature of the study and benefits of being involved in it. No potential risks were anticipated, and student anonymity was preserved. In addition to the survey instrument, the proposal for the study was submitted to the IRB. Prior to the application for IRB consent, the researcher received a letter of approval to conduct research in one the schools. Approval from the second school followed.

Pilot test

The instrument was pilot tested in Minneapolis, MN among African American students of the same age groups as the intended South Carolina sample. In 2007 the selected school reported having 86.1% students of color (44.6% AA) and 73.9% of the students received free and/or reduced price lunch (Minneapolis Public Schools). A small sample of 13 students was solicited containing both engineering and non-engineering students. In the days prior to the distribution of the survey, parental consent letters were sent home with students who wished to participate in the study. The letter explained the survey and gave parents the ability to restrict their child's participation.

Through this pilot test students helped identify questions that were confusing or poorly worded. In addition, the pilot test allowed the researcher to gauge the length of time students required to complete the survey. A classroom teacher was asked to pass out consent forms and surveys during their homeroom period to those students with parental consent. The teacher was asked to time how long the students took to complete the survey. After completion of the surveys the teacher collected them, placed them in a

sealed envelope, and passed them on to the researcher. The teacher also asked participants their opinion of the wording to check for understandability of the questions. Those questions were also passed on to the researcher.

Data Collection

Data collection began in October 2008. Prior to data collection the final survey instrument was sent to the principals as agreed for their review. The survey was also sent with a recruitment letter in effort to solicit teacher's participation. The letter to the teachers' explained the study and asked for their cooperation in the distribution of the surveys. A copy of the letter is included in Appendix F. In order to obtain the proposed number of surveys 8 teachers were asked to have their classes participate at each site in addition to a lead teacher recruited. The teachers were able to pick the day of the week they wished to hand out the surveys.

Survey packets were assembled, each containing 30 surveys, based on the average class size. The lead teacher was given extra surveys should they be needed. The survey packets included parental consent and child consent/assent forms, along with a script explaining the survey. In the script explaining the survey, the teacher was instructed to first explain the child consent/assent form to the participants. This was done by reading the form aloud to the student, or letting the students read silently and then pose questions for clarification. A separate package included gift cards for the participating students and teachers.

Data Analysis

This study sought to examine the relationship between selected variables and career decision self-efficacy and Math/science related goal intentions among African American high school students. Two research questions were set forth as follows:

1) To what extent do exogenous factors (school, math/science interest, ethnic identity, math/science confidence, family relations) and endogenous factors (demographic and ability) influence career decision self-efficacy?

2) To what extent do exogenous factors (school, math/science interest, ethnic identity, math/science confidence, family relations) and endogenous factors (demographic and ability) influence math/science related goal intentions?

The researcher used SPSS 17.0 to analyze the data after the necessary coding was performed. Although some of the students did not complete all of the questions on the survey, missing values were replaced with mean values for dependent and independent variables. The researcher understood that in some instances replacing missing data for dependent variables does have the potential to produce questionable data. However the researcher is assuming that data were missing at random (MR) (Rubin, 1976). Batista and Monard (2003) showed that replacing data with the mean still obtained good results and showed a low error rate. Descriptive data were generated for all variables, and further, relationships between variables were explored. The researcher questions were explored through stepwise multiple regression analysis.

Summary

This chapter began by reiterating the purpose of the study which is to evaluate variables that may influence career decision self efficacy and Math/science related goal intentions among African American High school students. A description of the two schools from which the sample was drawn was provided. Scales that were used in the researchers' instrument were explained, and their psychometric properties discussed. The IRB process was next outlined, which is required for all university research. A description of the purpose and implementation of the pilot test then followed. Next, a synopsis of the procedures that were followed throughout the distribution of the study was explained. In the chapter that follows data analysis procedures are set forth and findings are presented.

Chapter IV

Data Analysis

The purpose of this chapter is to present the findings of this study. Descriptive results are set forth first, followed by analysis of the research questions. The latent structures of scales used in the study are also examined.

Demographic Factors

Living situation

Table 4.1 presents data on demographic variables. It shows that a high percentage of students live with their mother only (43%). Although 43% of students lived with their mother only, when living situation was compared to scholastic achievement categories (such as overall GPA, grade received in math, and grade received in science) the results showed that these students had no higher percentage than any of the other students. As it relates to cumulative G.P.A however, of students who were shown to live with both parents, 49% of them had a 3.5 or better. This is significantly different from any other living situation except those who lived with a father and female. Of these students 50% of them were shown to have 3.5 overall G.P.A. or better. A detailed summary of the student's overall G.P.A based on their living situation is located in Table 4.2. The student's G.P.A. was compared based on living situation because some prior research reports a difference academically in those students raised in nuclear homes rather than single parent homes.

Table 4.1: Student's Living Situation

With Whom do you live	n	%
Mother and Father	114	29.0
Mother and Male Guardian	35	8.9
Father and Female Guardian	8	2.0
Mother only	169	43.0
Father only	14	3.6
Mother and sometimes father	14	3.6
Other relatives	36	9.2
Other adults	3	.8
Total	396	100

Table 4.2: Student's Living Situation by G.P.A

Current G.P.A.	Mother and Father		Mother only		Father only		Mother and some father		Mother and Male		Father and Female		Other relatives		Other adults	
	N	%	N	%	N	%	N	%	N	%	N	%	N	%	N	%
>4.0	10	11.8	4	3.6	0	0	0	0	1	4	0	0	0	0	0	0
3.5- 4.0	32	37.6	25	22.3	1	20	1	12.5	1	4	3	50	3	12.5	0	0
3.0 -3.49	18	21.2	39	34.8	2	40	2	25	10	40	0	0	6	25	0	0
2.5- 2.9	15	17.6	21	18.8	1	20	0	0	8	32	2	33.3	5	20.8	0	0
2.0 - 2.49	9	10.6	15	13.4	1	20	5	62.5	3	12	0	0	7	29.2	0	0
1.5- 1.9	1	1.2	5	4.5	0	0	0	0	2	8	1	16.7	2	8.3	0	0
1.0 -1.49	0	0	3	2.7	0	0	0	0	0	0	0	0	1	4.2	1	100
Total	85	100	112	100	5	100	8	100	25	100	6	100	24	100	1	100

Parents/Guardians Educational Level

Students were asked to identify their parent's education level. Literature has increasingly shown that students who have parents with high levels of education attain a higher level of achievement. Table 4.3 shows that 48.7% of students reported their fathers highest level of education was completion of high school, similarly 39.7% of mothers completed the same education. High school education was shown to be the highest level of parent education for most students. For mothers a four year degree was the next highest education received (22.5%) and the same holds for fathers (15.9%). A complete summary is located in Table 4.3.

Table 4.3: Parent's Education

Highest Education Level	Female Head		Male Head	
	N	%	N	%
Did not complete high school	24	6.3	48	13.6
High school or GED	150	39.7	172	48.7
2-year college degree	73	19.3	44	12.5
4-year college degree	85	22.5	56	15.9
Graduate degree (master's)	37	9.8	24	6.8
Graduate degree (Phd, JD,MD)	9	2.4	9	2.5
Total	378	100.0	353	100.0

Socio-economic status

The Hollingshead Four factor score was used to determine the student's socioeconomic status (SES) shown in Table 4.4. This score is determined using four factors, namely education, occupation, sex, and whether student's live in a single or two-parent home. The education factor is measured on a seven point scale, with the lowest being less than seventh grade (1) going to the highest which is graduate professional training(graduate degree)(7). The occupational factor is determined in a number of ways. First there is a list of occupations according to the U.S. Census Bureau with assigned Census codes. The total calculation is figured by taking the occupation factor (Census score x factor weight (5)) than taking the education factor (scale score 1-7 x factor weight (3)). Finally the two totals are added together for the final SES scores. After that calculation the total is determined depending on the marital status reported of the parents. The total is left as is for a single parent home and for a two parent home the total would be divided by two. According to Hollingshead (1975) computed scores range from a high of 66 to a low of 8. It is assumed that the higher score of a family or nuclear unit, the higher the status of its members. Table 4.4 shows that the two highest reported SES using Hollingshead is that 28.6% of the students would be classified as; unskilled laborers, menial service workers, machine operators, and semiskilled workers and 25.8% of the students are classified under; medium business, minor professional, technical strata.

Table 4.4: Hollingshead Socioeconomic Scores

Score	N	%
55 – 66	31	9.4
40 – 54	85	25.8
30 – 39	70	21.3
20 – 29	49	14.9
0 – 19	94	28.6
Total	340	100

Eighth Grade Math/Science Scores

Table 4.5 shows that among 8th graders a majority of students reported receiving the grade of "C" or higher in math or science. More importantly ~ 44% of them received a "B" in math and almost 50% of students received a "B" in science. This is important signifying that students were above average in these core courses.

Table 4.5: 8th Grade Math and Science Scores

8th Grade Math	n	%
A	67	17.6
B	165	43.4
C	123	32.4
D	23	6.1
F	2	.5
Total	380	100.0
8th Grade Science		
A	65	17.2
B	183	48.3
C	102	26.9
D	27	7.1
F	2	.5
Total	379	100.0

Current G.P.A.

Table 4.6 shows that the majority of students (29.1%) reported having between a 3.0-3.49 G.P.A. In addition to the previous number 24.6% of students report having between a 3.5-4.0, which shows over 50% of the students had a 3.0 G.P.A or above.

Table 4.6: Reported Overall G.P.A.

Current G.P.A.	n	%
>4.0	15	5.6
3.5- 4.0	66	24.6
3.0 -3.49	78	29.1
2.5- 2.9	52	19.4
2.0 - 2.49	41	15.3
1.5- 1.9	11	4.1
1.0 -1.49	5	1.9
Total	268	100

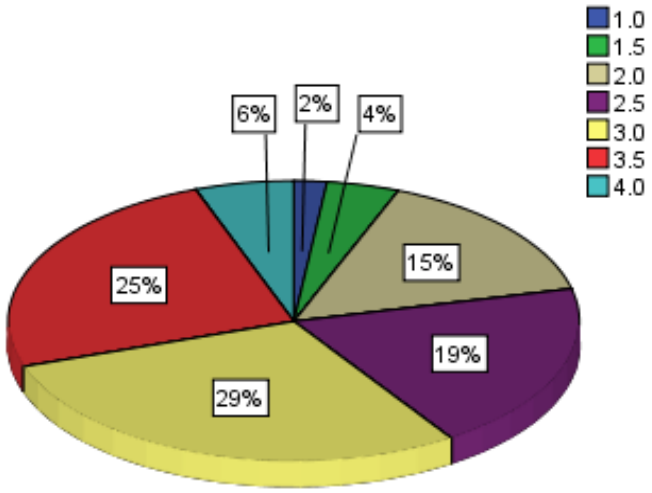
When separating students by gender and grade level (Table 4.7), 12th grade males and 9th grade females have the highest overall GPA. The second overall highest G.P.A. with both males and females appears in the 9th grade, (Mean=2.79) and 12th grade females (Mean=3.26).

Table 4.7: Reported Overall G.P.A. by Gender

GRADE	Male			Female		
	Mean	SD	N	Mean	SD	N
9	2.79	.93	16	3.38	.38	17
10	2.71	.66	19	2.96	.90	29
11	2.70	.71	20	3.08	.60	32
12	2.87	.64	66	3.26	.67	67

Figure 4.1 is a graphic representation of the range of current GPA's for the students within the study. As demonstrated earlier in the Table 4.6 this figure shows that most of the students earn an overall G.P.A. between 3.0 and 4.0. The mean G.P.A. is shown as being 3.0 for the 268 students who answered this question in the survey.

Figure 4.1: Reported G.P.A.



Mean Ranks

School Factors

Each independent variable was classified and ranked by the total mean score. The mean ranking helps identify how students felt about the questions in each variable. Table 4.8 shows the results of School factors--what students viewed as most important to contributing to their advancement in school. The factor that students agreed upon the most was “School is important to me”. Second was, “I want to go to college when I graduate”. The item receiving the least support was “If you are an African American, going to school is a waste of time”. In general, the responses of students to school factors were positive.

Table 4.8: Responses to School Influences

School Factors	Items/Statements	Mean	Std. Deviation	N
SFa	School is important to me	4.56	.74	394
SFe	I want to go to college when I graduate	4.49	.94	385
SFj	I am responsible for my own academic success	4.33	.95	391
SFq	I do better in school when I feel my teacher understands me	4.02	.94	390
SFc	My teachers help me learn.	3.96	.80	392
SFd	In most lessons I feel I learn a lot.	3.75	.80	389
SFp	Teachers in my school expect African American students to go to college	3.74	1.07	393
SFg	I get along well with my teachers	3.73	.96	392
SFr	My school emphasizes math and science	3.69	.95	395
SFs	Teachers or counselors encourage me to take challenging classes	3.64	1.17	395
SFi	The classes in my school are challenging	3.47	.92	389
SFo	Teachers in my school are highly qualified	3.44	.97	384
SFb	People who drop out of school can still get a job	3.30	.89	393
SFm	I would be interested in learning about African American engineers and inventors	3.19	1.13	394
SFf	Most children in my school will go to college	3.10	.90	391
SFh	Teachers hold the key to my success	3.03	1.09	392
SFl	African American people who do well in school may still not get good jobs	2.76	1.20	396
SFk	I worry a lot about kids teasing me for getting good grades	1.64	1.03	392
SFn	If you are an African American, going to school is a waste of time	1.46	.95	392

Ethnic Identity

Table 4.9 displays the ranking of the twelve items relating to ethnic identity. The results show that students agreed most with the item “I have a lot of pride in what members of the African American community have done and achieved”. There was a tie in the next highest agreeable statement between, “I feel that I am part of the African American community” and “It is important for my family and the African American community that I succeed in school”. The least agreeable statement within this section was “People might have negative ideas about my abilities because I am African American”. Overall there was solidarity with ethnic identity items.

Table 4.9: Ethnic Identity

Ethnic Identity	Items/Statements	Mean	Std. Deviation	N
EIc	I have a lot of pride in what members of the African American community have done and achieved	4.29	.92	394
EIb	I feel that I am part of the African American community	4.23	.93	394
EIf	It is important for my family and the African American community that I succeed in school	4.23	.92	391
EIa	It is important to me to think of myself as African American	4.19	1.04	396
EIe	If I am successful it will help the African American community	4.02	.98	390
EIh	As an African American, the way I look and speak influences what others expect of me	3.89	1.03	391
EId	I feel close to others in the African American community	3.83	1.01	389
EIj	It helps me when others in the African American community are successful	3.78	1.03	394
EIl	If I work hard and get good grades, other African Americans will respect me	3.66	1.06	395
EIi	Things in the African American community are not as good as they could be because of lack of opportunity	3.56	1.01	395
EIg	Some people will treat me differently because I am African American	3.45	1.13	386
EIk	People might have negative ideas about my abilities because I am African American	3.43	1.13	386

Math/Science Expectations

Math/Science Expectations is one of the dependent variables. Table 4.10 displays the ranking of the twelve items in order of importance. The results show that students agreed most with the statement about their expectations in Math and Science, “If I get good grades in math, then my parents will be pleased”. The next most agreeable

statement was, “If I learn math well, then I will be able to do lots of different types of careers”. The statement students found least agreeable with was, “I intend to take a lot of science classes in high school”.

Table 4.10: Math/Science Expectations

Math/Science Expectations	Items/Statements	Mean	Std. Deviation	N
MSEd	If I get good grades in math, then my parents will be pleased	4.20	.91	387
MSEb	If I learn math well, then I will be able to do lots of different types of careers	3.95	.92	394
MSEf	If I do well in science then I will be better prepared to go to college	3.73	1.03	389
MSEa	If I take a lot of math courses, then I will be better able to acheive my future goals	3.65	1.08	393
MSEc	If I take a math course then I will increase my grade point average	3.64	1.00	389
MSEj	I intend to enter a career that will use math	3.56	1.10	387
MSEi	I am committed to study hard in my science classes	3.51	.98	388
MSEk	I am determined to use my science knowledge in my future career	3.48	1.17	393
MSEg	I plan to take a lot of math classes in high school	3.39	1.12	389
MSEl	I intend to enter a career that will use science	3.32	1.31	392
MSEe	If I get good grades in math and science, my friends will approve of me	3.16	1.18	386
MSEh	I intend to take a lot of science classes in high school	3.14	1.11	389

Math/Science Confidence

Table 4.11 displays the ranking of the ten items in Section V of the survey by order of importance. The results show that students agreed most with the statement "Get an A in science in high school". There was a tie between the second most agreeable statements about their ability was, "Determine the amount of sales tax on clothes I want to buy" and "Develop a hypothesis about why kids watch a particular TV show". The least agreeable statement about confidence was the ability to "Predict the weather from weather maps".

Table 4.11: Math/Science Confidence

Math/Science Confidence	Items/Statements	Mean	Std. Deviation	N
MSCb	Get an A in science in high school	3.75	.99	391
MSCc	Determine the amount of sales tax on clothes I want to buy	3.69	.99	386
MSCj	Develop a hypothesis about why kids watch a particular TV show	3.69	1.13	390
MSCa	Get an A in math in high school	3.64	1.03	391
MSCe	Figure out how long it will take to travel from Columbia to Charlotte driving at 55 mph	3.57	1.10	390
MSCf	Design and describe a science experiment that I want to do	3.53	1.09	389
MSCd	Collect dues and determine how much to spend for a school club	3.52	1.05	384
MSCg	Classify animals that I observe	3.51	1.08	386
MSCi	Construct and interpret a graph of rainfall amounts by state	3.27	1.17	388
MSCh	Predict the weather from weather maps	3.16	1.15	391

Math/Science Interest

Table 4.12 displays the ranking of the twenty items in Section VI of the survey by order of importance. The results show that the activity the students related to most about a Math/Science activity was, “Using a calculator”, the second most agreeable statement about their interest in an activity was, "Inventing”. The least agreeable statement about an activity that interested them was in “Joining a science club”.

Table 4.12: Math/Science Interest

Math/Science Interest	Item/Statements	Mean	Std. Deviation	N
MSIh	Using a calculator	3.81	1.03	390
MSIs	Inventing	3.52	1.19	386
MSIg	Creating a new technology	3.47	1.25	388
MSIq	Taking classes in math	3.43	1.23	388
MSIc	Solving computer problems	3.31	1.14	388
MSId	Solving math puzzles	3.29	1.23	386
MSIk	Working in a medical lab	3.28	1.22	385
MSIi	Working with plants and animals	3.27	1.21	385
MSIr	Working with a chemistry set	3.25	1.17	388
MSIn	Working in a science laboratory	3.22	1.24	384
MSIa	Visit a museum	3.21	1.14	394
MSIe	Touring a science lab	3.19	1.21	387
MSIj	Taking classes in science	3.14	1.14	390
MSIo	Learning about energy and electricity	3.09	1.19	389
MSIt	Watching a science program on TV	2.99	1.24	392
MSIl	Reading about science discoveries	2.98	1.21	388
MSIm	Participating in a science fair	2.96	1.30	385
MSIp	Working as an astronomer	2.78	1.23	385
MSIb	Listening to a famous scientist talk	2.71	1.18	388
MSIf	Joining a science club	2.65	1.19	391

Career decision self-efficacy

Table 4.13 displays the ranking of the twenty-five items on the questionnaire that reflected career decision self efficacy, the second dependent variables in the study The results show the amount of confidence a student has in his/her ability to make career decisions. The statement where students reported having the highest confidence is, “Use the internet to find information about an occupation that interests you”. The second highest statement in which students had confidence was, “Define the type of lifestyle you would like to live”. The statement reported where student had the least confidence was the ability to, “Make a career decision and then not worry about whether it was right or wrong”. Generally, the results show high confidence overall.

Table 4.13: Career Decision Self Efficacy

Career decision self-efficacy	Items/Statements	Mean	Std. Deviation	N
CDa	Use the internet to find information about occupations that interest you	4.14	.97	392
CDv	Define the type of lifestyle you would like to live	4.11	1.00	383
CDt	Choose a major or career that will fit your interest	4.08	.99	384
CDj	Choose a career that will fit your preferred lifestyle	4.07	.97	385
CDb	Select one major from a list of potential majors you are considering	4.07	.94	388
Cdi	Determine what your ideal job would be	4.03	.97	386
CDs	Talk with a person already employed in a field you are interested in	4.00	.99	384
CDc	Make a plan of your goals for the next five years	4.00	1.02	384
CDw	Find information about graduate or professional schools	3.96	1.03	386

CDn	Decide what you value most in an occupation	3.95	.98	386
CDg	Determine the steps you need to take to successfully complete your chosen major	3.95	.94	383
CDf	Select one occupation from a list of potential occupations you are considering	3.93	.90	387
CDo	Find out about the average yearly earnings of people in an occupation	3.91	1.05	385
CDh	Persistently work at your major or career goal even when you get frustrated	3.90	.1.00	387
CDx	Successfully manage the job interview process	3.88	1.01	389
CDe	Accurately assess your abilities	3.87	.91	390
CDy	Identify some reasonable major or career alternatives if you are unable to get your first choice	3.86	1.03	387
CDl	Prepare a good resume	3.82	1.05	385
CDr	Figure out what you are and are not ready to sacrifice to achieve your career goals	3.81	.98	385
CDu	Identify employers, firms, and institutions relevant to your career possibilities	3.79	1.02	386
CDd	Determine the steps to take it you are having academic trouble with an aspect of your chosen major	3.77	1.00	390
CDq	Change occupations if you are not satisfied with the one you enter	3.77	.99	383
CDm	Change majors if you did not like your first choice	3.73	.99	385
CDk	Find out what the employment trends for an occupation over the next ten years	3.72	1.04	384
CDp	Make a career decision and then not worry whether it was right or wrong	3.51	1.10	385

Family Relations

Table 4.14 displays the ranking of the twenty-two items that reflected students' family relations. The statement with which there was strongest agreement is, "My parent(s) believe(s) that going to school is important. The second highest ranked statement in which students agreed was, "My parent(s) tell me that if I want to be successful, I must work hard in school". Student's often tended to disagree with the statement that "In my family we believe science and math are not worthwhile subjects".

Table 4.14: Family Relations

Family Relations	Items/Statements	Mean	Std. Deviation	N
FRd	My parent(s) believe(s) that going to school is important	4.41	.94	373
FRb	My parent(s) tell me that if I want to be successful, I must work hard in school	4.39	.92	382
FRk	My family is proud of me when I do well in school	4.37	.92	376
FRl	My parent(s) encourage me to do well in mathematics	4.16	.97	378
FRc	My parent(s) and teachers get along well	3.88	.97	378
FRo	My parent(s) think that math is one of the most important subjects to study	3.83	1.07	375
FRa	My parents think being in a gifted program is important	3.80	1.12	379
FRm	My parent(s) help me in any way they can to progress in science and math	3.75	1.09	381
FRs	My parent(s) show great interest in math and science grades.	3.73	1.05	368
FRv	My parent(s) is(are) happy with their job.	3.73	1.14	379

FRn	My family encourages me to take advanced math or science courses	3.63	1.17	378
FRj	My family encourages my to participate in extra-curricular activities in school such as science fairs and academic bowls.	3.47	1.23	380
FRe	Family members talk to me about what I learn in science/math class	3.41	1.19	380
FRr	My family encourages me to pursue a career in math or science	3.37	1.22	374
FRt	People in my family have been treated mean or unfairly by other people	3.05	1.35	367
FRp	My parent(s) hold the key to my success	3.04	1.24	375
FRg	My parent(s) take me to the public library to obtain math/science related materials.	3.04	1.28	381
FRu	People in my family complain about not having good jobs	3.00	1.34	375
FRf	Family members attend school sponsored events such as science fairs, academic bowls, field trips.	2.99	1.24	379
FRh	A family member checks my homework to make sure it is done properly	2.86	1.29	380
FRi	My parent(s) volunteer at my school	2.74	1.32	376
FRq	In my family we believe science and math are not worthwhile subjects	2.62	1.37	375

Correlations

Correlation analysis was conducted among the dependent variables and independent variables used in this study. The results from the correlation analysis are presented in Table 4.15.The highest significant correlation (.51) within the entire table was between Math/science Confidence and Math/science Interest. Career Decision self-efficacy had a high significant correlation with Math/science Confidence (.47). This

finding suggests that as there was an increase in student's self-efficacy to make a career decision their confidence in Math and Science also increased. Another significant correlation was between Career Decision self-efficacy and Ethnic Identity. These two variables were correlated at (.45). Potentially this correlation implies that students with high self-efficacy tended to have pride in and value their African American heritage.

Math/Science expectations correlate significantly with Family relationships (.45), Math/science confidence (.43), Career Decision Making Self-Efficacy (.37), and Math/science Interest (.47). The correlation table was done excluding pairwise cases therefore the N differs because it is based on the number of each specific response.

Table 4.15: Inter-Correlation of Selected Variables Table

Items	N	1	2	3	4	5	6	7	8	9	10
1. Gender	396										
2. Year in high school	393	.067 **									
3. Completed an engineering course	375	.264 **	.213 **								
4. Socioeconomic Status Code	340	.036	-.037	.080							
5. Current GPA	268	-.261 **	.045	.070	.195 **						
6. Grade received in 8th grade Mathematics	380	.066	.002	.019	-.026 **	-.264					
7. Grade received in 8th grade Science	379	.072	-.147	-.096	-.044 **	-.351	.346 **				
8. SchoolMean	396	.023	-.088	-.025	.026	.042	-.067	-.011			
9. IdentityMean	396	.072	-.031	-.034	.161 **	.037	-.037	.038	.415 **		
10.M/SExpectMean	396	.006	.049	-.022	.050	.069	.039	.032	.402 **	.388 **	
11. M/SConMean	396	.062	.047	.018	.098	.025	-.057	.003	.296 **	.297 **	.429 **
12.M/SInterMean	396	-.028	-.057	-.038 **	.037	.019	-.021	.053	.282 **	.186 **	.467 **
13.CareerDMean	396	.057	-.002	.033	.197 **	.092	-.044	.063	.372 **	.447 **	.367 **
14.FamRelMean	396	-.074	-.058	.010	.130 *	.004	-.022	.021	.387 **	.393 **	.446 **

** Correlation is significant at the 0.01 level (2-tailed)

* Correlation is significant at the 0.05 level (2-tailed)

Table 4.15: Inter-Correlation of Selected Variables Table (cont.)

Items	N	11	12	13	14
1. Gender	396				
2. Year in high school	393				
3. Completed an engineering course	375				
4. Socioeconomic Status Code	340				
5. Current GPA	268				
6. Grade received in 8th grade Mathematics	380				
7. Grade received in 8th grade Science	379				
8. SchoolMean	396				
9. IdentityMean	396				
10.M/SExpectMean	396				
11. M/SConMean	396				
12.M/SInterMean	396	.510 **			
13.CareerDMean	396	.474 **	.348 **		
14.FamRelMean	396	.367 **	.463 **	.411 **	

** Correlation is significant at the 0.01 level (2-tailed)

* Correlation is significant at the 0.05 level (2-tailed)

Dependent Variable Summary

CDSE Subscale

The Table 4.16 below breaks down the CDSE into its subscales as originally suggested by Betz, Klein & Taylor (1996).

Table 4.16: Career Decision Self-Efficacy Subscale breakdown

Subscale-Title	Mean	Std. Dev
1-Self Appraisal (SA)		
Accurately assess your abilities.	3.87	.91
Determine what your ideal job would be.	4.03	.97
Decide what you value most in an occupation.	3.95	.98
Figure out what you are and are not ready to sacrifice to achieve your career goals.	3.81	.98
Define the type of lifestyle you would like to live.	4.11	1.0
2-Occupational Information(OI)		
Use the internet to find information about occupations that interest you.	4.14	.97
Find out the employment trends for an occupation over the next ten years.	3.72	1.04
Find out about the average yearly earnings of people in an occupation.	3.91	1.05
Talk with a person already employed in a field you are interested in.	4.00	.99
Find information about graduate or professional schools.	3.96	1.03

3-Goal Selection(GS)		
Select one major from a list of potential majors you are considering.	4.07	.94
Select one occupation from a list of potential occupations you are considering	3.93	.90
Choose a career that will fit your preferred lifestyle	4.07	.97
Make a career decision and then not worry whether it was right or wrong.	3.51	1.10
Choose a major or career that will fit your interests.	4.08	.99
4-Planning (PL)		
Make a plan of your goals for the next five years.	4.00	1.02
Determine the steps you need to take to successfully complete your chosen major.	3.95	.94
Prepare a good resume.	3.82	1.05
Identify employers, firms, and institutions relevant to your career possibilities.	3.79	1.02
Successfully manage the job interview process.	3.88	1.01
5-Problem Solving(PS)		
Determine the steps to take if you are having academic trouble with an aspect of your chosen major.	3.77	1.00
Persistently work at your major or career goal even when you get frustrated	3.90	1.00
Change majors if you did not like your first choice	3.73	.99
Change occupations if you are not satisfied with the one you enter.	3.77	.99
Identify some reasonable major or career alternatives if you are unable to get your first choice.	3.86	1.03

Factor Analysis

Factor analysis on the CDSE was also done using varimax with Kaiser normalization rotation to compare the number of subscales resulting among this sample as oppose to Betz, Klein, Taylor (1996). The Exploratory factory analysis in this study shows three factor coefficients rather than the suggested five (Table 4.17).

Table 4.17: Factor Table

	Items/Statements	Components			Communalities
		1	2	3	
		% of Variance			
		22.23	41.10	59.34	
CDt	Choose a major or career that will fit your interest	.744			.683
CDa	Use the internet to find information about occupations that interest you	.721			.605
CDv	Define the type of lifestyle you would like to live	.693			.613
CDs	Talk with a person already employed in a field you are interested in	.674			.630
CDb	Select one major from a list of potential majors you are considering	.617			.535
CDw	Find information about graduate or professional schools	.565			.590
CDf	Select one occupation from a list of potential occupations you are considering	.466			.512
CDk	Find out what the employment trends for an occupation over the next ten years		.700		.642
CDj	Choose a career that will fit your preferred lifestyle		.652		.661
CDl	Prepare a good resume		.632		.546

Cdi	Determine what your ideal job would be		.631		.648
CDd	Determine the steps to take it you are having academic trouble with an aspect of your chosen major		.606		.614
CDh	Persistently work at your major or career goal even when you get frustrated		.604		.633
CDg	Determine the steps you need to take to successfully complete your chosen major		.557		.637
CDe	Accurately assess your abilities		.528		.524
CDc	Make a plan of your goals for the next five years		.441		.547
CDp	Make a career decision and then not worry whether it was right or wrong			.720	.555
CDq	Change occupations if you are not satisfied with the one you enter			.697	.630
CDy	Identify some reasonable major or career alternatives if you are unable to get your first choice			.655	.636
CDm	Change majors if you did not like your first choice			.582	.574
CDn	Decide what you value most in an occupation			.577	.626
CDo	Find out about the average yearly earnings of people in an occupation			.543	.509
CDx	Successfully manage the job interview process			.524	.578
CDr	Figure out what you are and are not ready to sacrifice to achieve your career goals			.462	.540
CDu	Identify employers, firms, and institutions relevant to your career possibilities			.462	.566
Eigenvalues		5.56	4.72	4.56	

MSE Scale

Table 4.18 below shows the MSE scale by individual question and reports the mean and standard deviation.

Table 4.18: Math/Science Expectations

MSE	Mean	Std. Dev
If I take a lot of math courses, then I will be better able to achieve my future goals	3.65	1.084
If I learn math well, then I will be able to do lots of different types of careers	3.95	.920
If I take a math course then I will increase my grade point average	3.64	1.000
If I get good grades in math, then my parents will be pleased	4.20	.912
If I get good grades in math and science, my friends will approve of me	3.16	1.180
If I do well in science then I will be better prepared to go to college	3.73	1.034
I plan to take a lot of math classes in high school	3.39	1.118
I intend to take a lot of science classes in high school	3.14	1.105
I am committed to study hard in my science classes	3.51	.984
I intend to enter a career that will use math	3.56	1.100
I am determined to use my science knowledge in my future career	3.48	1.165
I intend to enter a career that will use science		

Research Questions

Research Question One

1) To what extent do exogenous factors (school, math/science interest, ethnic identity, math/science confidence, family relations) and endogenous factors (demographic and ability) influence career decision self-efficacy?

To answer this research question, stepwise multiple regression was employed. Missing values were replaced with a mean score in all of the independent variables. For research question one, 19% of the values in CDSE were replaced with a mean score. The regression was done by entering all of the background variables as well as each independent variable in a forward stepwise manner. This process yielded five models indicating five significant variables.

In model one Math/Science Confidence was the most significant predictor variable, $F(1,394)$ $p=.000$. The beta weight was $\beta= .474$, $p<.001$. The adjusted R^2 value was .22 (See Table 4.20). In model two the variable ethnic identity was added to Math/Science Confidence, yielding $F(2,393)$ $p=.000$. The adjusted R^2 value improved to .32. In model three Family Relations was added ($F(3,392)$ $p<.001$). The adjusted R^2 improved further to .35. Model four added the variable school factors ($F(4, 391)$ $p=.010$). The R^2 change again had only a slight increase of .01(1%) which brought the adjusted $R^2$for the model to .36(36%).

The final model added socioeconomic status (SES) ($F(5,390)$ $p=.015$) with a beta weight ($\beta= .100$, $p<.05$) in the model. All of the other variables remained significant with

beta weights as follows; School Factors (β= .127, p<.001), Family Relations (β= .148, p<.001), Ethnic Identity (β= .231, p<.001), and Math/Science Confidence (β= .304, p<.001). The R^2 change was slight (.01) which brought the adjusted R^2 for the model to .37 or (37% variance explained) in CDSE. A detailed summary of all 5 models is shown in Table 4.20.

Table 4.19: Career decision self-efficacy model summary

Model	R	R Square	Adjusted R Square	Change Statistics		
				R Square Change	F Change	Sig. F Change
1	.474[a]	0.22	0.22	.22	113.89	.000
2	.572[b]	0.33	0.32	.10	60.05	.000
3	.594[c]	0.35	0.35	.03	15.73	.000
4	.603[d]	0.36	0.36	.01	6.64	.010
5	.611[e]	0.37	0.37	.01	6.01	.015

a. Predictors: (Constant), Math/Science Confidence

b. Predictors: (Constant), Math/Science Confidence, Ethnic Identity

c. Predictors: (Constant), Math/Science Confidence, Ethnic Identity, Family Relations

d. Predictors: (Constant), Math/Science Confidence, Ethnic Identity, Family Relations, School Factors

e. Predictors: (Constant), Math/Science Confidence, Ethnic Identity, Family Relations, School Factors, Socioeconomic Status

Table 4.20: Career decision self-efficacy model showing contribution of each variable

Model		Unstandardized Coefficients		Standardized Coefficients	T	Sig.
		B	Std. Error	Beta		
1	(Constant)	2.279	.155		14.66	.000
	Math/Science Confidence	.460	.043	.474	10.67	.000
2	(Constant)	1.188	.202		5.88	.000
	Math/Science Confidence	.363	.042	.374	8.62	.000
	Ethnic Identity	.369	.048	.336	7.75	.000
3	(Constant)	.920	.210		4.39	.000
	Math/Science Confidence	.314	.043	.324	7.29	.000
	Ethnic Identity	.307	.049	.279	6.21	.000
	Family Relations	.195	.049	.183	3.97	.000
4	(Constant)	.531	.257		2.07	.000
	Math/Science Confidence	.300	.043	.308	6.94	.000
	Ethnic Identity	.269	.051	.244	5.25	.000
	Family Relations	.166	.050	.156	3.31	.001
	School Factors	.201	.078	.120	2.58	.010
5	(Constant)	.440	.258		1.71	.018
	Math/Science Confidence	.295	.043	.304	6.88	.000
	Ethnic Identity	.254	.051	.231	4.96	.000
	Family Relations	.157	.050	.148	3.16	.002
	School Factors	.213	.078	.127	2.75	.006
	Socioeconomic Status	.005	.002	.100	2.45	.015

Research Question Two

2) To what extent do exogenous factors (school, math/science interest, ethnic identity, math/science confidence, family relations) and endogenous factors (demographic and ability) influence math/science related goal intentions?

To answer the second research question another multiple regression analysis was performed. This regression was done to determine the association between Math/Science Expectations (MSE), the background information and five independent variables (school factors, ethnic identity, Math/Science confidence, Math/Science Interest, and Family relations). Missing values were replaced with a mean score for both the independent and dependent variables. For the dependent variable 9% of the values were replaced. Similar to research question one a forward stepwise approach was taken.

In model one Math/Science Interest entered as the most significant variable ($F(1,394)$ $p=.000$). Its beta weight was $\beta= .467$, $p<.001$, and the adjusted R^2 value was .22 (See Table 4.21). In model two ethnic identity was added to Math/Science interest, yielding $F(2,393)$ $p=.000$. The adjusted R^2 value improved to .31. In model three the variable school factors was added $F(3,392)$ $p=.000$. The R^2 change value showed a small increase of .03 which brought the adjusted R^2 to .34. In model four Math/Science confidence was added ($F(4,391)$ $p=.001$). The adjusted $R^2$for the model improved to .36(36%). In model five, family relations was added ($F(5,390)$ $p=.003$). The R^2 change had only a slight increase of .01(1%) which brought the adjusted R^2 to .37. In model 6-the final model-Year in high school was added ($F(6,389)$ $p=.000$). Although year in high school was shown to be statistically significant, it was not shown to be practically significant because it contributed not other variance to the dependent variable math/science expectations. This variable had a significant beta weight ($\beta= .085$, $p<.05$). Other beta weights for the total analysis were as follows: Family Relations($\beta= .149$, $p<.05$), Math/Science Confidence ($\beta= .141$, $p<.05$), School Factors($\beta= .167$, $p<.001$),

Ethnic Identity(β= .174, p<.001), and Math/Science Interest (β= .251, p<.001). The adjusted R^2 value for the final model was.37 or 37% of the variance in MSE. A detailed summary showing all six models can be seen in Table 4.22.

Table4.21: Math/Science expectations model summary

Model	R	R Square	Adjusted R Square	Change Statistics		
				R Square Change	F Change	Sig. F Change
1	.467[a]	0.22	0.22	.22	109.90	.000
2	.559[b]	0.31	0.31	.09	53.75	.000
3	.586[c]	0.34	0.34	.03	18.98	.000
4	.602[d]	0.36	0.36	.01	11.30	.001
5	.614	.38	.37	.01	8.87	.003
6	.619	.38	.37	.01	4.48	.035

a. Predictors: (Constant), Math/Science Interest

b. Predictors: (Constant), Math/Science Interest, Ethnic Identity

c. Predictors: (Constant), Math/Science Interest, Ethnic Identity, School Factors

d. Predictors: (Constant), Math/Science Interest, Ethnic Identity, School Factors, Math/Science Confidence

e. Predictors: (Constant), Math/Science Interest, Ethnic Identity, School Factors, Math/Science Confidence, Family Relations

e. Predictors: (Constant), Math/Science Interest, Ethnic Identity, School Factors, Math/Science Confidence, Family Relations, Year in HS

Table 4.22: Math/Science expectations model showing contribution of each variable

Model		Unstandardized Coefficients		Standardized Coefficients	T	Sig.
		B	Std. Error	Beta		
1	(Constant)	2.278	.126		18.042	.000
	Math/Science Interest	.404	.038	.467	10.483	.000
2	(Constant)	1.094	.200		5.465	.000
	Math/Science Interest	.353	..037	.409	9.601	.000
	Ethnic Identity	.346	.047	.312	7.331	.000
3	(Constant)	.367	.257		1.428	.154
	Math/Science Interest	.316	.037	.366	8.562	.000
	Ethnic Identity	.262	.050	.237	5.248	.000
	School Factors	.340	.078	.201	4.357	.000
4	(Constant)	.218	.258		.844	.399
	Math/Science Interest	.253	.041	.293	6.152	.000
	Ethnic Identity	.231	.050	.209	4.602	.000
	School Factors	.313	.077	.185	4.042	.000
	Math/Science Conf	.160	.048	.163	3.361	.001
5	(Constant)	.133	.257		.520	.604
	Math/Science Interest	.211	.043	.244	4.894	.000
	Ethnic Identity	.193	.051	.174	3.749	.000
	School Factors	.270	.078	.160	3.463	.001
	Math/Science Conf	.149	.047	.152	3.152	.002
	Family Relations	.158	.053	.147	2.978	.003
6	(Constant)	-.034	.268		-.126	.900
	Math/Science Interest	.217	.043	.251	5.045	.000
	Ethnic Identity	.193	.051	.174	3.775	.000
	School Factors	.283	.078	.167	3.631	.000
	Math/Science Conf	.138	.047	.141	2.924	.004
	Family Relations	.160	.053	.149	3.044	.002
	Year in HS	.049	.023	.085	2.117	.035

Summary

Research Question One

The first research question examined predictors of Career Decision-Making Self Efficacy (CDSE). The finding is that five variables in combination significantly influenced CDSE; they are math/science confidence (contributing the most variance), socioeconomic status, ethnic identity, school factors, and family relations.

Research question Two

The second research question explored predictors of Math/Science related goal Expectations (MSE)—a proxy for engineering-related goal intentions. The findings are that six independent variables predict MSE, math/science interest, ethnic identity, school factors, math/science confidence, family relations, and year in high school.

Shared Predictors

These findings show that a common set of factors predicted both dependent variables. These were math/science confidence, ethnic identity, family relations, and school factors.

Chapter V

Discussion

The purpose of this study was to gain knowledge about factors that influence Career decision self-efficacy and Math/science related goal intentions among African American high school students. A total of 396 students from two high schools in Columbia, SC responded to the survey that was used in this study. Regression analysis was used to answer the two research questions.

Chapter I established a framework for the study by describing the problem of shortages of African American in engineering fields. Historical roots of this were examined, along with the potential impact in a world of globalization. Chapter II reviewed the literature concerning perceived factors of entrance into math/science and engineering fields. Further, the views of theorists from the vocational and technical community were discussed. The chapter also examined previous studies on students' attitudes toward math/science related disciplines and engineering careers, and factors influencing their choices of such careers. Literature relating to all variables in the study was reviewed. Chapter III described the design of the research, and methods and procedures employed in conducting the study. The chapter outlined the methodology used in this study, including a discussion of the sampling procedures, IRB process, pilot testing, research design, instrumentation, data collection, and data analysis. Chapter IV reported the data analysis and its results. Descriptive statistics were first reported then the results of the regression analyses were described. The findings were then organized

around the two research questions. The present chapter will summarize the findings then provide discussion, conclusions, recommendations and implications.

Summary of Findings

The results of the stepwise regression model for question one indicated that five variables were significant in explaining career decision self-efficacy among students in the study. These five variables were found to contribute 37% of variance in CDSE: math/science confidence, ethnic identity, family relations, school factors, and SES. Such a finding suggests that those students who have a higher career decision self-efficacy have higher math/science confidence, ethnic identity, positive family relations, SES, and positive school factors. The results of the stepwise regression model for question two indicated that 6 independent variables were significant. These six variables contributed 37% of the variance in Math/Science Expectations. They were: math/science interest, ethnic identity, school factors, math/science confidence, family relations, and year in HS. These findings suggest that those students who have higher math/science expectations have higher math/science interest, ethnic identity, math/science confidence, stronger family relations, along with more positive school factors.

Discussion of the Findings

Of the background variables in this study only two were significant. For the first research question only socioeconomic status influenced career decision self-efficacy and for the second research question only year in high school influenced math/science expectations. The fact that the remaining demographic variables were not significant

within this study is not definitive proof that they are not contributors to the dependent variables in other circumstances. The variables that were not shown to add any value to the research questions were gender, completed an engineering course, current G.P.A., grade received in Math, and grade received in Science. These variables excluding the completion of engineering will be discussed as they relate to previous research in the next sections.

Career Decision Self-Efficacy

The results of the stepwise regression showed most background variables to have little influence on career decision self-efficacy. Similar to what was found in Brown and Lavish (2006) who studied another minority group, Native Americans, there was no significant gender differences as it related to career decision self-efficacy. Although there were no significant sex differences in this study consistent with Gianakos (2001) women reported having stronger levels of career decision self-efficacy overall.

An interesting variable within this study that was found to be significant was ethnic identity. Identity was used specifically for this study because previous studies led the researcher to believe that there was some connection between academic achievement and career decision with identity (Atlschul, Oyserman,& Bybee, 2006; Kerpelman, Schoffner, & Ross-Griffin, 2002; Oyserman, Gant,& Ager,1995). The findings here are also consistent with that of Nauta and Kahn (2007) who concluded that young adults' identity status is associated with career decision self-efficacy.

As stated earlier the most significant factor predicting CDSE was Math/Science confidence (self-efficacy). Consistent with the findings of the current study Gwilliam and Betz (2001) also found that, math/science confidence had significant influence on career decision making self-efficacy. The researchers go on to say that math/science self-efficacy remains important because minorities continue to be underrepresented in math, science, and technical occupations (Gainor & Lent, 1998; Gwilliam & Betz, 2001; Post, Stewart & Smith, 1991).

The family relations variable was also significant. This finding suggests that, as previously believed, family is important when students consider career related decisions. School factors within this study were shown to be significant, which further confirms that school is important when making career decisions. Interestingly there are a variety of the factors within a school that students feel are valuable. These factors range from teachers, counselors, peers, personal attitude, and the overall environment. Luzzo (1993) found a significant relationship between student's attitudes and CDSE which is similar to the top rated questions pertaining to school within the current study. Consistent with this study Bandura, Barbaranelli, and Caprara (2001) found that student's self-efficacy was influenced by their perception of what their teacher's thought of their ability to do something. These findings suggest that current practicing teachers and future teachers should be made aware of this knowledge so they can prepare to enhance student's self-efficacy.

In this study socioeconomic status (SES) was a predictor of CDSE. Prior research suggests that SES influences a number of aspects of a students' life such as educational

opportunities and the chance of a quality education (Fouad & Brown, 2000; Gilbert & Kahl, 1993; Maher & Kroska, 2002). Blustien et al. (2002) found that participants from high socioeconomic backgrounds reported more interest in work, greater access to resources, and more career adaptability than did lower social class participants. All of these aspects are indirectly related to career decision self-efficacy in aspect that they are all shown to be correlated with CDSE. Trusty, Robinson, Plata, and Ng (2000) found that SES was an important predictor of type of college major (grouped together by Holland codes) for adolescents. It is possible that if SES can predict a college major it indirectly predicts future occupations. A finding not consistent with this study was the results by Tang, Fouad, and Smith (1999) which found no significant relationship amongst career self-efficacy and SES.

Betz, Klein, & Taylor (1996) reported an alpha of .94 for total CDSE-SF scale; Self Appraisal (.73), Occupational Information (.78), Goal Selection (.83), Planning (.81), and Problem Solving (.75). In Hampton (2005) which consisted of 220 African American Students the reliability coefficients were as follows: (.91) for the total scale Self Appraisal (.78), Occupational Information (.74), Goal Selection (.78), Planning (.70), and Problem Solving (.70). This study found the following Cronbach Alphas for the five original subscales; Self Appraisal (.81), Occupational Information (.79), Goal Selection (.85), Planning (.83), and Problem Solving (.78). The alpha for each individual scale; Self Appraisal (.84), Occupational Information (.81), Goal Selection (.80), Planning (.85), and Problem Solving (.83) were higher in the present study for each scale except the GS scale

where it was found to be lower than those previously reported (Betz et al., 1996; Hampton, 2005).

The factor analysis results showed that different from the CDSE-short form (Betz & Klein, 1996; Betz, Hammond, & Multon,2005), which includes five subscales, the current study shows three. Previous research on the CDSE short form instrument using factor analysis suggests the existence of one or two broad factors rather than five (Betz & Luzzo, 1996; Peterson & del Mas, 1998). Other researchers using the same instrument found four-factor solutions in their sample (Chaney Hammond, Betz, & Multon, 2007; Taylor & Betz, 1983). However in the present study a three factor solution was found to initially work best. Hampton (2005) found consistent findings for Chinese students but the results showed some inadequacy based on the results of CFA. For South Africans the dominant factors (decision making) were Goal Selection and Planning (Creed, Patton, and Watson, 2002).

Math/Science Related Goal Intentions

Consistent with the findings in this study math/science self-efficacy and interests have been found to significantly predict math/science career-related behaviors (Byars-Winston & Fouad, 2008; Post, Stewart, & Smith, 1991). Previous research has shown that Math/science self-efficacy (confidence) related behaviors indirectly affect occupation possibilities because mathematics has long been recognized as a critical filter for entry into scientific and technical fields (Gwilliam & Betz, 2001;Sells, 1982). The current study is in keeping with this, as, math/science confidence was found to not only have a

significant relationship with career decision self-efficacy but also Math/science related goal intentions. In addition to career entry, Lent, Brown, and Larkin (1984,1986) reported that self-efficacy with respect to scientific and technical careers was significantly related both to performance and persistence in science and engineering majors.

This study looked at a variety of theories that contributed to development of career decisions and self efficacy. One of these was Social Cognitive Career Theory (SCCT) which asserted that when the outcomes expected of an action are tied to individuals' self-efficacy for the action, self-efficacy is presumed to be the stronger determinant of behavior (Fouad & Guillen, 2006). This is consistent with findings in the current study in that Math/science confidence significantly explained math/science expectations. Similar to this study, Gore and Leuwerke (2000) also showed an overlap between Holland's theory of career choice and SCCT.

Interest was shown to be a significant factor within this study, aligning with Gore & Leuwerke (2000) who found that in the absence of barriers, and in the presence of environmental support, interest will be translated into academic or career goals and ultimately, academic or career related behaviors. This finding is also consistent with prior research. In addition a correlation between outcome expectations and interest was found to be between .40 and.52 consistent with Lent, Brown, & Hackett,1994; Lent, Brown, Brenner, Chopra, & Davis, 2001; Lopez, Lent, Brown, & Gore,1997; and Fouad & Guillen, 2006. Also, Lent et al. (2001) using a different sample found a correlation between math outcome expectancies and interests. Leuwerke et. al, (2004) concluded that

it is not gender or ethnicity specifically but interests that affect motivation to pursue an engineering degree. In this case, it is important to examine factors that adversely affect interests in these fields such as lack of preparation, low self-efficacy for science and engineering, and lack of role models (Betz, 1997; Dunn & Veltman, 1989)

As the study relates to the family relation variable prior research found that parental influences such as career expectations and support have been found to predict career choice and outcome expectations for a diversity of populations (Byars-Winston & Fouad 2008; Tang, Fouad, & Smith, 1999; Ferry, Fouad, & Smith, 2000). This was consistent with the finding in this study as regards to stepwise regression and the family relations variable showed a moderate correlation with math/science expectations. One way this assertion maintains precedents is because it was found that parents communicate their career-related beliefs, encouragement, and expectations, which influence their children's interest and goal formation, perceptions about the relative value of pursuing given career pathways (Bandura, Barbaranelli, Caprar, & Pastorelli, 2001; Byars-Winston & Fouad, 2008).

There is extensive literature demonstrating that achievement is a key determinant of selection, grade performance, and success in the science and technology fields (Cross, 2001; Hackett, Betz, Casas, & Rocha-Singh, 1992; Lent Brown, and Larkin,1987; Leuwerke, Robbins, Sawyer, & Hovland , 2004). Within this study some of the measurements of achievement were GPA and scores in math and science. However, none of the achievement variables were shown to predict or even highly correlate with

Math/science expectations. Leuwerke et. al, 2004 concluded those individuals with the higher ACT Math (ACTM) scores were more likely to remain the major of engineering. But within the study this conclusion could be disputed because there was a negative correlation between Math score and Math/science expectations. However for future teaching one could argue that if educators could increase students math scores that there would be a higher probability of entrance into the field.

Conclusions

The goal of this study was to determine factors that influence both career decision self-efficacy and Math/science related goal intention among African American high school students. Based on the above findings, the conclusions are as follows:

(a) Among African high school students Math/science confidence has a relationship with career decision self-efficacy.

(b) Ethnic Identity is an important factor in examining the relationship African American high school students has in math/science related careers.

(c) Socioeconomic status is an important factor in shaping whether African students show interest in math/science related careers.

(d) Family relations help establish whether African American students will become interested in math/science related careers.

(e) Whether African American high school students have positive school experiences such as supportive environment, peer support, and teacher encouragement, relates to whether they will be interested in math/science related careers.

Recommendations and Implications

The findings and conclusions in this study lead to recommendations for educators, career counselors, and the African American community. First the tested variables only explained 37% of the variance in both CDSE and MSE so; other variables should be explored such as the correlation of role models and/or mentors on African American students. Second a larger sample of students actually participating in engineering programs may add some explanation to both of the dependent variables. A second recommendation surrounds the fact that 8th grade math scores was not significant and should be observed to see if there was a specific math class that contributed to its significance. The researcher recommends that in areas containing varying socioeconomic statuses for African American students, a wide range of career programs be developed. Specifically among those of lower SES who may not otherwise be exposed to or have access to the same resources of those of higher SES.

In relation to MSE the researcher recommends that school and programs continue to promote and foster programs that increase Math/science interest. The variable was shown to be more important so researcher should continue to look at students with access to those programs and some without for intervention ideas. Ethnic identity should continue to be fostered in math and science subjects since it was shown to be vital.

The results in this study could imply that the type of school (whether it be math or science focused) may result in positive responses to questions relating to math and/or science. The results of this study should also be used to initiate dialog regarding more correlative ways to contribute to career decision self-efficacy and allow ease of interest into engineering and math/science related fields for minorities.

Limitations

The primary limitations of this study are that it was conducted in two schools that were purposively chosen, and in which the curriculum deliberately promoted math and science learning, and engineering as a career. While this was a limitation, the sample also showed that when schools deliberately promote such studies among African American students, the results can be positive.

Summary

This study contributed to the research literature by first examining a population that has historically been absent in the field of engineering and related fields. The study then looked at African American students in high school and attempted to measure factors influencing those decisions. It also evaluated the relationship of career decision self-efficacy and factors that are theorized to contribute to it. The results from the current study indicated that Math/science confidence, school factors, and ethnic identity significantly influence both CDSE and MSE. In addition SES and 8th grade math score influenced CDSE and Interest influenced MSE. Although the variance accounted for was small, (about 39% for both), researchers, educators, community members, and policy

makers should be aware of those contributing factors. Although gender and year in high school had a low correlation with both of the dependent variables, they are still important to consider.

Findings from this study may be useful for those in predominantly African American schools, directors of Math and Science or Engineering afterschool or summer programs, and parents to help strengthen initiatives promoting not only the subject but the inclusion of the African American population. The results suggest that previously theorized variables such as SES Math/Science confidence, Math/science interest, and Ethnic Identity can significantly account for the variance in CDSE and MSE (Oyserman, Gant,& Ager,1995; Oyserman & Harrison, 1998; Lent, Brown, Brenner, Chopra, & Davis, 2001; Luzzo, Hasper, Albert, Bibby, & Martinelli, 1999).

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Appendix A

IRB Notice

Chandra Y Austin

RE: "Factors Influencing Career Decision Self-Efficacy and Engineering Related Goal Intentions among African American High School Students"
IRB Code Number: 0807P41081

Dear Ms. Austin

The Institutional Review Board (IRB) received your response to its stipulations. Since this information satisfies the federal criteria for approval at 45CFR46.111 and the requirements set by the IRB, final approval for the project is noted in our files. Upon receipt of this letter, you may begin your research.

The IRB would like to stress that subjects who go through the consent process are considered enrolled participants and are counted toward the total number of subjects, even if they have no further participation in the study. Please keep this in mind when calculating the number of subjects you request. This study is currently approved for 500 subjects. If you desire an increase in the number of approved subjects, you will need to make a formal request to the IRB.

For your records and for grant certification purposes, the approval date for the referenced project is August 5, 2008 and the Assurance of Compliance number is FWA00000312 (Fairview Health Systems Research FWA00000325, Gillette Children's Specialty Healthcare FWA00004003). Research projects are subject to continuing review and renewal; approval will expire one year from that date. You will receive a report form two months before the expiration date. If you would like us to send certification of approval to a funding agency, please tell us the name and address of your contact person at the agency.

As Principal Investigator of this project, you are required by federal regulations to inform the IRB of any proposed changes in your research that will affect human subjects. Changes should not be initiated until written IRB approval is received. Unanticipated problems or serious unexpected adverse events should be reported to the IRB as they occur.

The IRB wishes you success with this research. If you have questions, please call the IRB office at 612-626-5654.

Sincerely,
Felicia Mroczkowski, CIP
Research Compliance Supervisor
FM/egk
CC: Theodore Lewis

Appendix B

Permission to use Instrument

Racial-Ethnic Identity Scale

From: Daphna Oyserman

Sent: Thursday, May 29, 2008 10:20 AM

Subject: Re: Permission to use Instrument

I am delighted that you find the work useful. You can find the measure on my website along with other papers on racial-ethnic identity. In addition to the Altschul, Oyserman and Bybee (2006) piece, of particular use to you may be Oyserman, Brickman, Rhodes (2007).
http://sitemaker.umich.edu/culture.self/files/oyserman__brickman____rhodes__2007_.pdf

When you use the measure, you should cite the papers which present initial scale development, which are Oyserman, Gant, & Ager (1995)
http://sitemaker.umich.edu/daphna.oyserman/files/oyserman_gant_ager_1995.pdf

and Oyserman, Harrison, & Bybee (2001).
http://sitemaker.umich.edu/daphna.oyserman/files/racial_identity.pdf

To link individual identity processes like self-efficacy to social identity processes like racial-ethnic identity, your student might find the model presented in Social identity and self-regulation (2007) to be helpful.

http://sitemaker.umich.edu/culture.self/files/oyserman_social_identity_and_self-regulation_2007.pdf

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Professor Department of Psychology,
Edwin J Thomas Collegiate Professor School of Social Work
Research Professor, Institute for Social Research
Director, Michigan Prevention Research Training Program
University of Michigan
Institute for Social Research
426 Thompson Ave, room 5240

tel: 734-647-7622
fax: 734-647-3652

Oyserman homepage: http://sitemaker.umich.edu/daphna.oyserman
Prevention Research Training Program homepage: http://mprt.isr.umich.edu/

Appendix C

Permission to Use Instrument

Math/Science Self-Efficacy, Interest, and Expectations Scales

----- Original Message -----

From: "Nadya Fouad" <nadya@uwm.edu>
Sent: Thursday, May 29, 2008 8:54 AM
Subject: Re: Permission to use instrument

Certainly, but I have that file on an old floppy disk, and a new computer without a disk drive. So I'll need to get the copies scanned and put in a pdf. I'm heading out of town (actually to the Cities for the Accreditation Assembly) but can do it next week.

Nadya

Nadya A. Fouad
Department of Educational Psychology
PO 413 UW-Milwaukee Milwaukee, WI 53201-0413
414-229-6830 (phone)
414-229-4939 (fax)

Appendix D

Permission to Use Instrument

Subject: Re: Permission to use instrument
From: donna.ford@vanderbilt.edu
To: austi142@umn.edu
Subject: Permission to use instrument
Date: Mon, 14 Jul 2008 22:29:55 +0000

Hi. It is in my dissertation from cleveland state univ. 1991. I don't have a copy. You have permission to use it with appropriate citation. Best to you!!

------Original Message------
From: austi142@umn.edu
To: donna.ford@vanderbilt.edu
Subject: Permission to use instrument
Sent: Jul 14, 2008 3:22 PM

Dr. Ford,

My name is Chandra Austin and I am working on my doctoral degree at the University of Minnesota. My dissertation topic relates to the factors influencing African American students in Career decision-making self-efficacy and Engineering related goal intentions. Currently I am working on developing my survey instrument and have found some of your work very useful. One independent variable I am using is School factors (i.e. teacher's attitude, curriculum, peer relations, etc.). I am very interested in the instrument you used in the article "Perceptions and Attitudes of Black students toward School Achievement and Other Educational Variables". I would like to first have your permission to use this scale, and if granted could you tell me where it can be located. Thank you in advance.

Chandra Austin
NCETE Doctoral Fellow
University of Minnesota
1954 Buford Ave.
St. Paul, MN 55108

Email: austi142@umn.edu

Appendix E

Parent Consent for Pilot Survey

Dear Parent:

My name is Chandra Austin and I am a doctoral student at the University of Minnesota. I am also a native of Columbia, South Carolina where I attended school in Richland One School District. I am working with Dr. Theodore Lewis from the department of Work and Human Resource Education at the University of Minnesota on a project dealing with career decision self-efficacy and engineering related goal intentions among high school students. With the underrepresentation of minority students in rigorous fields such as engineering, math, and science there is a need to explore the causal factors more in depth. This study will examine possible causal variables as to why students are not entering these fields as well as suggest interventions to improve the enrollment.

Your child's school has been selected to participate in this study. In order to advance the knowledge of what is known about career decision self-efficacy and engineering related goal intentions, I will administer a four page survey. There is no risk involved. The study is divided into eight sections. Section I is a student demographic section, section II is designed to measure how students feel different school factors affect their decisions, section III is designed to measure the student's sense of ethnic identity, section IV - VI is designed to measure math/ science interest and goal intentions, math/science beliefs of capability, section VII is designed to measure the students ability to make decisions about potential careers, and section VIII is designed to measure the perceived effect family relations has on students. Participation in this study is voluntary therefore your child may choose not to participate. Your child will not give his or her name on the survey it will remain completely anonymous. For compensation purposes they will be asked to sign a separate sheet of paper once they turn the survey into the teacher .The survey should take 30-45 minutes to complete. Your child may choose not to answer any question he or she feels uncomfortable with. The results of the survey will be reported in aggregate form, thereby ensuring complete anonymity of the survey respondent.

If you decide not to have your child participate in this study, simply inform him or her not to fill out the survey the day it is handed out. The survey will be handed out during the month of September. Again there is no penalty for non-participation.

I deeply appreciate your cooperation and support. If you have any questions regarding this survey, please contact either Dr. Theodore Lewis at (612) 624-4707 or Chandra Austin at (803) 528-8021. You may also contact the University of Minnesota Institutional Review Board if you have any questions or concerns regarding this study and would like to talk to someone other than the researcher, you are encouraged to contact the Research Subjects' Advocate Line, D528 Mayo, 420 Delaware St. Southeast, Minneapolis, Minnesota 55455; (612) 625-1650.

Thank you,

Chandra Y. Austin

Appendix F

Pilot High School Student Letter

Dear High School Student:

Your are invited to participate in a research study entitled Factors influencing African American Students Career decision self-efficacy and engineering related goal intentions. This survey is designed to assess factors you as students perceive may influence or prohibit your decision to enter an engineering related field. Chandra Austin a doctoral student and Dr. Theodore Lewis of the Department of Work and Human Resource education at the University of Minnesota are conducting this study You assistance would be greatly appreciated. Chandra Austin will be using the information as the basis for her dissertation.

You do not have to participate in this study if you so choose. If you decide you would like to participate in this study you will be asked to fill out a survey. The survey is four pages divided into eight different sections. Participation in this study is voluntary therefore you may choose not to participate. You will not put your name on the survey. For compensation purposes you will be asked to sign a separate sheet of paper once you turn your survey into the teacher. The survey should take 30-45 minutes to complete. You may choose not to answer any question that you feel uncomfortable with. The results of the survey will be reported as a group, therefore it will be impossible to identity you as a participant. Return of the complete survey indicates that you are also agreeing that the responses can be used in statistical calculation for the research being conducted. Upon completion you will also receive a gift card of thanks.

This study has been approved by the University of Minnesota Institutional Review Board (IRB) and ensures that you will not be placed under any undue risk and that you may choose to participate or not participate under your own free will without penalty. If you have any questions regarding this survey, please contact either Dr. Theodore Lewis at (612) 624-4707 or Chandra Austin at (803) 528-8021. You may also contact the University of Minnesota Institutional Review Board if you have any questions or concerns regarding this study and would like to talk to someone other than the researcher, you are encouraged to contact the Research Subjects' Advocate Line, D528 Mayo, 420 Delaware St. Southeast, Minneapolis, Minnesota 55455; (612) 625-1650.Thank you for your assistance with this survey.

Sincerely,

Chandra Y. Austin

Appendix G

Parent Consent

Dear Parent,

My name is Chandra Austin and I am a doctoral student at the University of Minnesota. I am also a native of Columbia, South Carolina where I attended school in Richland One School District. I am working with Dr. Theodore Lewis, a professor at the University of Minnesota, on my dissertation project dealing with career decision self-efficacy and engineering related goal intentions among high school students. With the underrepresentation of minority students in rigorous fields such as engineering, math, and science there is a need to explore the causal factors more in depth. This study will examine possible causal variables as to why students are not entering these fields as well as suggest interventions to improve the enrollment.

Your child's school has been selected to participate in this study. A survey will be given during your child's homeroom class. There is no risk involved. The survey is divided into eight sections. Section I is a student demographic section, section II is designed to measure how students feel different school factors affect their decisions, section III is designed to measure the student's sense of ethnic identity, section IV - VI is designed to measure math/ science interest and goal intentions, math/science beliefs of capability, section VII is designed to measure the students ability to make decisions about potential careers, and section VIII is designed to measure the perceived effect family relations has on students. Participation in this study is voluntary. Therefore, your child may choose not to participate. Your child will not put his or her name on the survey. The survey should take 25-35 minutes to complete. The results of the survey will be reported in aggregate form, thereby ensuring complete anonymity of the survey respondent.

If you decide not to have your child participate in this study, simply inform him or her not to fill out the survey the day it is handed out. Those students who do not participate will be allowed to use their time in a way that is agreeable to the teacher. Again there is no penalty for non-participation. I deeply appreciate your cooperation and support. If you have any questions regarding this survey, please contact either Dr. Theodore Lewis at lewis007@umn.edu;or Chandra Austin at (803) 528-8021 or austi142@umn.edu. You may also contact the University of Minnesota Institutional Review Board if you have any questions or concerns regarding this study and would like to talk to someone other than the researcher, you are encouraged to contact the Research Subjects' Advocate Line at (612) 625-1650.Thank you.

Chandra Y. Austin

Appendix H

High School Consent

Dear High School Student:

Your are invited to participate in a research study entitled Factors influencing African American Students Career decision self-efficacy and engineering related goal intentions. This survey is designed to assess factors you as students perceive may influence or prohibit your decision to enter an engineering related field. Chandra Austin a doctoral student and Dr. Theodore Lewis of the Department of Work and Human Resource education at the University of Minnesota are conducting this study Your assistance would be greatly appreciated. Chandra Austin will be using the information as the basis for her dissertation.

You do not have to participate in this study if you so choose. If you decide you would like to participate in this study you will be asked to fill out a survey. The survey is four pages divided into eight different sections. Participation in this study is voluntary therefore you may choose not to participate. You will not put your name on the survey. For compensation purposes you will be asked to sign a separate sheet of paper once you turn your survey into the teacher. The survey should take 30-45 minutes to complete. You may choose not to answer any question that you feel uncomfortable with. The results of the survey will be reported as a group, therefore it will be impossible to identity you as a participant. Return of the complete survey indicates that you are also agreeing that the responses can be used in statistical calculation for the research being conducted. Upon completion you will also receive a gift card of thanks.

This study has been approved by the University of Minnesota Institutional Review Board (IRB) and ensures that you will not be placed under any undue risk and that you may choose to participate or not participate under your own free will without penalty. If you have any questions regarding this survey, please contact either Dr. Theodore Lewis at (612) 624-4707 or Chandra Austin at (803) 528-8021. You may also contact the University of Minnesota Institutional Review Board if you have any questions or concerns regarding this study and would like to talk to someone other than the researcher, you are encouraged to contact the Research Subjects' Advocate Line, D528 Mayo, 420 Delaware St. Southeast, Minneapolis, Minnesota 55455; (612) 625-1650.Thank you for your assistance with this survey.

Sincerely,

Chandra Y. Austin

Appendix I

Letters to Teachers

Dear High School Teacher:

Your high school students are invited to participate in a research study that is designed to assess factors your students perceive may influence or prohibit their decision to enter an engineering related field. Students who complete this survey may benefit by identifying factors that could increase self-realization on how they perceive things and equip others such as parents or teachers with tools to help in areas they see as struggles. Chandra Austin a Columbia native and student at the University of Minnesota, and Dr. Theodore Lewis a professor in the Department of Work and Human Resource Education at the University of Minnesota are conducting this study. Your assistance in this study would be greatly appreciated. The information obtained will be used by Chandra Austin as the basis of her dissertation study on Factors influencing African American Students Career decision self-efficacy and engineering related goal intentions.

The survey that will be administered is four pages divided into eight different sections. Section I is a student demographic section, section II is designed to measure how students feel different school factors affect their decisions, section III is designed to measure the student's sense of ethnic identity, section IV - VI is designed to measure math/ science interest and goal intentions, math/science beliefs of capability, and the students ability to make decisions about potential careers, section VII is designed to measure the students ability to make decisions about potential careers, and section VIII is designed to measure the perceived effect family relations has on students. The student will not put their name on the survey. For compensation purposes the student will be asked to sign a separate sheet of paper once they turn the survey into you .The survey should take 30-45 minutes to complete. The student may choose not to answer any question that they feel uncomfortable with. The results of the survey will be reported as a group, therefore it will be impossible to identity them individually as a participant.

Please administer in a way that ensures students complete only one survey in its entirety. Attached to this letter is a script to be followed when administering this survey. Thank you for your assistance with this survey. If you have any questions about this survey please feel free to contact me at 803-528-8021, or email me at austi142@umn.edu.

Sincerely,

Chandra Y Austin

Appendix J

Script for Administration of Survey

Please distribute surveys to all students who have parental consent in your class. Once all of the surveys have been handed out, please read the following script aloud. This will serve as the student assent form.

Dear High School Student:

You are invited to participate in a research study that is designed to assess factors you may perceive influence or prohibit your decision to enter an engineering related field. The survey is for African American Students. A separate activity containing questions relating to careers is to be completed by those who are not African American. Students who complete this survey may benefit by identifying factors that could increase self-realization on how they perceive things and equip others such as parents or teachers with tools to help in areas they see as challenging. Chandra Austin a Columbia native and PhD student along with Dr. Theodore Lewis a professor at the University of Minnesota are conducting this study. Your assistance in this study would be greatly appreciated. The information obtained will be used by Chandra Austin as the basis of her dissertation study on Factors Influencing African American Students Career decision self-efficacy and engineering related goal intentions. You do not have to participate in this study if you so choose.

If you decide you would like to participate in this study you will be asked to fill out a survey. The survey is divided into eight different sections. Section I is a student demographic section, section II is designed to measure how students feel different school factors affect their decisions, section III is designed to measure the student's sense of ethnic identity, section IV - VI is designed to measure math/ science interest and goal intentions, math/science beliefs of capability, and the students ability to make decisions about potential careers, section VII is designed to measure the students ability to make decisions about potential careers, and section VIII is designed to measure the perceived effect family relations has on students.

You will not put your name on the survey at all so that it will remain completely anonymous. The survey should take 25-35 minutes to complete. You may choose not to answer any question that you feel uncomfortable with. The results of the survey will be reported as a group, therefore it will be impossible to identity you as a participant. Return of the complete survey indicates that you are also agreeing that the responses can be used in statistical calculation for the research being conducted.

Each section has separate directions so please read all of the directions carefully. Please complete the survey on your own, and provide thoughtful responses to each question. When you are finished, kindly, wait quietly until all the surveys are collected and sealed in an envelope. If you finish early or decide not to participate please work on your school assignments. Neither I nor any other school official will have access to your completed surveys. Thank you very much for your assistance with this survey.

Appendix K

Survey Instrument

Factors Influencing African American High School Students on Career Decision-Making Self-Efficacy and Engineering Related Goal Intentions

Please respond to the following questions to the best of your ability. Your response may advance knowledge about the perceptions that African American students have about engineering careers. Please do not put you name anywhere on the form. Your answers will be confidential. You could decide not to take the survey if that is your preference.

The survey is divided into 8 sections:

I. Background
II. School Factors
III. Ethnic Identity
IV. Math/Science Expectations
V. Math/Science Confidence
VI. Math/Science Interest
VII. Career Decision Making
VIII. Family Relations

Please complete all 8 sections of the survey to the best of your ability.

I. Background

1. **What is your gender?**
   ○ Male ○ Female

2. **What is your year in high school?**
   ○ 9 ○ 10 ○ 11 ○ 12

3. **Have you ever completed an engineering course (PLTW)?**
   ○ Yes ○ No

4. **With whom do you live? (Mark only one)**
   ○ Both your mother and father
   ○ Your mother and a male guardian
   ○ Your father and a female guardian
   ○ Your mother only
   ○ Your father only
   ○ Your mother and sometimes your father
   ○ Other relatives
   ○ Other adults

5. **What is your Father s or male guardian s highest education level? (Mark only one)**
   ○ Did not complete high school
   ○ High school or GED Graduate
   ○ Two-year college degree
   ○ Four year college degree
   ○ Graduate degree (Master's)
   ○ Graduate degree (PhD, JD, MD)

6. **What is your Mother s or female guardian s highest education level? (Mark only one)**
   ○ Did not complete high school
   ○ High school or GED Graduate
   ○ Two-year college degree
   ○ Four year college degree
   ○ Graduate degree (Master's)
   ○ Graduate degree (PhD, JD, MD)

7. **What is your Father s or male guardian s occupation?**

   _____

8. **What is your Mother's or female guardian's occupation?**

   _____

9. **What is your current G.P.A.?**

   _____

10. **Have you taken Physics?**
    ○ Yes ○ No

11. **Do you intend to take physics by the time you graduate? (skip if you answered "yes" to the previous question)**
    ○ Yes ○ No

12. **Have you taken Calculus?**
    ○ Yes ○ No

13. **Do you intend to take calculus by the time you graduate? (skip if you answered "yes" to the previous question)**
    ○ Yes ○ No

14. **Indicate the grade you received in Mathematics in the 8th grade.**
    ○ A ○ B ○ C ○ D ○ F

15. **Indicate the grade you received in Science in the 8th grade.**
    ○ A ○ B ○ C ○ D ○ F

II. School Factors

This section is on your opinions on schooling. Indicate your level of agreement with each statement on the scale provided.

	Strongly disagree	Disagree	Somewhat agree	Agree	Strongly agree
a. School is important to me	①	②	③	④	⑤
b. People who drop out of school can still get a job	①	②	③	④	⑤
c. My teachers help me learn	①	②	③	④	⑤
d. In most lessons I feel I learn a lot	①	②	③	④	⑤
e. I want to go to college when I graduate	①	②	③	④	⑤
f. Most children in my school will go to college	①	②	③	④	⑤
g. I get along well with my teachers	①	②	③	④	⑤
h. Teachers hold the key to my success	①	②	③	④	⑤
i. The classes in my school are challenging	①	②	③	④	⑤
j. I am responsible for my own academic success	①	②	③	④	⑤
k. I worry a lot about kids teasing me for getting good grades	①	②	③	④	⑤
l. African American people who do well in school may still not get good jobs	①	②	③	④	⑤
m. I would be interested in learning about African American engineers and inventors	①	②	③	④	⑤
n. If you are an African American, going to school is a waste of time	①	②	③	④	⑤
o. Teachers in my school are highly qualified	①	②	③	④	⑤
p. Teachers in my school expect African American students to go to college	①	②	③	④	⑤
q. I do better in school when I feel my teacher understands me	①	②	③	④	⑤
r. My school emphasizes math and science	①	②	③	④	⑤
s. Teachers or Counselors encourage me to take challenging classes	①	②	③	④	⑤

III. Ethnic Identity

This section is on Ethnic Identity. Indicate your level of agreement with each statement indicated.

	Strongly Disagree	Disagree	Somewhat Agree	Agree	Strongly Agree
a. It is important to me to think of myself as African American	①	②	③	④	⑤
b. I feel that I am part of the African American community	①	②	③	④	⑤
c. I have a lot of pride in what members of the African American community have done and achieved	①	②	③	④	⑤
d. I feel close to others in the African American community	①	②	③	④	⑤
e. If I am successful it will help the African American community	①	②	③	④	⑤
f. It is important for my family and the African American community that I succeed in school	①	②	③	④	⑤
g. Some people will treat me differently because I am African American	①	②	③	④	⑤
h. As an African American, the way I look and speak influences what others expect of me	①	②	③	④	⑤
i. Things in the African American community are not as good as they could be because of lack of opportunity	①	②	③	④	⑤
j. It helps me when others in the African American community are successful	①	②	③	④	⑤
k. People might have negative ideas about my abilities because I am an African American	①	②	③	④	⑤
h. If I work hard and get good grades, other African Americans will respect me	①	②	③	④	⑤

IV. Math/Science Expectations

This section is on your expectations about math and science for the future. Indicate your level of agreement with each statement on the scale provided.

	Strongly Disagree	Disagree	Somewhat Agree	Agree	Strongly Agree
a. If I take a lot of math courses, then I will be better able to achieve my future goals	①	②	③	④	⑤
b. If I learn math well, then I will be able to do lots of different types of careers	①	②	③	④	⑤
c. If I take a math course, then I will increase my grade point average	①	②	③	④	⑤
d. If I get good grades in math, then my parents will be pleased	①	②	③	④	⑤
e. If I get good grades in math and science, my friends will approve of me	①	②	③	④	⑤
f. If I do well in science, then I will be better prepared to go to college	①	②	③	④	⑤
g. I plan to take a lot math classes in high school	①	②	③	④	⑤
h. I intend to take a lot of science classes in high school	①	②	③	④	⑤
i. I am committed to study hard in my science classes	①	②	③	④	⑤
j. I intend to enter a career that will use math	①	②	③	④	⑤
k. I am determined to use my science knowledge in my future career	①	②	③	④	⑤
l. I intend to enter a career that will use science	①	②	③	④	⑤

V. Math/Science Confidence

This section explores the amount of confidence you have in your ability to do math and science. For each item below indicate your level of ability on the scale provided.

	Very low ability	Low ability	Moderate ability	High ability	Very high ability
a. Get an A in math in high school	①	②	③	④	⑤
b. Get an A in science in high school	①	②	③	④	⑤
c. Determine the amount of sales tax on clothes I want to buy	①	②	③	④	⑤
d. Collect dues and determine how much to spend for a school club	①	②	③	④	⑤
e. Figure out how long it will take to travel from Columbia to Charlotte driving at 55 mph	①	②	③	④	⑤
f. Design and describe a science experiment that I want to do	①	②	③	④	⑤
g. Classify animals that I observe	①	②	③	④	⑤
h. Predict the weather from weather maps	①	②	③	④	⑤
i. Construct and interpret a graph of rainfall amounts by state	①	②	③	④	⑤
j. Develop a hypothesis about why kids watch a particular TV show	①	②	③	④	⑤

VI. Math/Science Interest

This section explores your interest in math and science activities. Indicate the extent to which you like each activity on the scale provided.

	Strongly dislike	Dislike	Somewhat like	Like	Strongly like
a. Visit a Science Museum	①	②	③	④	⑤
b. Listening to a famous scientist talk	①	②	③	④	⑤
c. Solving computer problems	①	②	③	④	⑤
d. Solving math puzzles	①	②	③	④	⑤
e. Touring a science lab	①	②	③	④	⑤
f. Joining a science club	①	②	③	④	⑤
g. Creating new technology	①	②	③	④	⑤
h. Using a calculator	①	②	③	④	⑤
i. Working with plants and animals	①	②	③	④	⑤
j. Taking classes in science	①	②	③	④	⑤
k. Working in a medical lab	①	②	③	④	⑤
l. Reading about science discoveries	①	②	③	④	⑤
m. Participating in a science fair	①	②	③	④	⑤
n. Working in a science laboratory	①	②	③	④	⑤
o. Learning about energy and electricity	①	②	③	④	⑤
p. Working as a astronomer	①	②	③	④	⑤
q. Taking classes in math	①	②	③	④	⑤
r. Working with a chemistry set	①	②	③	④	⑤
s. Inventing	①	②	③	④	⑤
t. Watching a science program on TV	①	②	③	④	⑤

VII. Career Decision Making

This section is about your confidence in your ability to make career decisions. Indicate your level of confidence on the scale provided.

	No confidence at all	Very little Confidence	Moderate confidence	Much confidence	Complete confidence
a. Use the internet to find information about occupations that interest you	①	②	③	④	⑤
b. Select one major from a list of potential majors you are considering	①	②	③	④	⑤
c. Make a plan of your goals for the next five years	①	②	③	④	⑤
d. Determine the steps to take if you are having academic trouble with an aspect of your chosen major	①	②	③	④	⑤
e. Accurately assess your abilities	①	②	③	④	⑤
f. Select one occupation from a list of potential occupations you are considering	①	②	③	④	⑤
g. Determine the steps you need to take to successfully complete your chosen major	①	②	③	④	⑤
h. Persistently work at your major or career goal even when you get frustrated	①	②	③	④	⑤
i. Determine what your ideal job would be	①	②	③	④	⑤
j. Choose a career that will fit your preferred lifestyle	①	②	③	④	⑤
k. Find out the employment trends for an occupation over the next ten years	①	②	③	④	⑤
l. Prepare a good resume	①	②	③	④	⑤
m. Change majors if you did not like your first choice	①	②	③	④	⑤
n. Decide what you value most in an occupation	①	②	③	④	⑤
o. Find out about the average yearly earnings of people in an occupation	①	②	③	④	⑤
p. Make a career decision and then not worry whether it was right or wrong	①	②	③	④	⑤
q. Change occupations if you are not satisfied with the one you enter	①	②	③	④	⑤
r. Figure out what you are and are not ready to sacrifice to achieve your career goals	①	②	③	④	⑤
s. Talk with a person already employed in a field you are interested in	①	②	③	④	⑤
t. Choose a major or career that will fit your interests	①	②	③	④	⑤
u. Identify employers, firms, and institutions relevant to your career possibilities	①	②	③	④	⑤
v. Define the type of lifestyle you would like to live	①	②	③	④	⑤
w. Find information about graduate or professional schools	①	②	③	④	⑤
x. Successfully manage the job interview process	①	②	③	④	⑤
y. Identify some reasonable major or career alternatives if you are unable to get your first choice	①	②	③	④	⑤

VIII. Family Relations

This section is on relations in your family. Indicate your level of agreement with each item on the scale provided.

	Strongly Disagree	Disagree	Somewhat Agree	Agree	Strongly Agree
a. My parents think being in a gifted program is important.	①	②	③	④	⑤
b. My parent(s) tell me that if I want to be successful, I must work hard in school.	①	②	③	④	⑤
c. My parent(s) and teachers get along well.	①	②	③	④	⑤
d. My parent(s) believe(s) that going to school is important.	①	②	③	④	⑤
e. Family members talk to me about what I learn in science/math class.	①	②	③	④	⑤
f. Family members attend school sponsored events such as science fairs, academic bowls, field trips.	①	②	③	④	⑤
g. My parents take me to the public library to obtain math/science related materials.	①	②	③	④	⑤
h. A family member checks my homework to make sure it is done properly.	①	②	③	④	⑤
i. My parent(s) volunteer at my school.	①	②	③	④	⑤
j. My family encourages me to participate in extra-curricular activities in school such as science fairs and academic bowls.	①	②	③	④	⑤
k. My family is proud of me when I do well in school.	①	②	③	④	⑤
l. My parents encourage me to do well in mathematics.	①	②	③	④	⑤
m. My parents help me in any way I can to progress in science and math.	①	②	③	④	⑤
n. My family encourages me to take advanced math or science courses.	①	②	③	④	⑤
o. My parent(s) think that math is one of the most important subjects to study.	①	②	③	④	⑤
p. My parents hold the key to my success.	①	②	③	④	⑤
q. In my family we believe science and math are not worthwhile subjects.	①	②	③	④	⑤
r. My family encourages me to pursue a career in math or science.	①	②	③	④	⑤
s. My parent(s) show great interest in my math and science grades.	①	②	③	④	⑤
t. People in my family have been treated mean or unfairly by other people.	①	②	③	④	⑤
u. People in my family complain about not having good jobs.	①	②	③	④	⑤
v. My parent(s) is(are) happy with their job.	①	②	③	④	⑤

Thank you very much for completing this survey!