

# CHAPTER I

## INTRODUCTION

The demographic landscape of America's high paying engineering and scientific occupations consists primarily of white males (Hines, 1997). African-Americans occupy less than three percent of these engineering and science-related occupations (Hrabowski & Pearson, 1993). In fact, African-Americans tend to be more represented in non-technical occupations such as education and human services (Powell, 1990). These occupation patterns have been predicted to remain relatively the same well in the 21st century (Hines, 1997). Such projections pose many threats to the United States' technological workforce and global edge. This is especially true, since white males numerically are unable to fill forecasted engineering jobs and ethnic minorities are under-represented in engineering majors. As a result, there is a necessity to produce more engineers from such populations as African Americans, Hispanic Americans, Native Americans, and women (Hermond, 1995; Hines, 1997; Sondgeroth & Stough, 1992).

In order to meet the demands of today's technical workforce, initiatives need to be developed to attract more women and minorities to engineering and scientific occupations. As a result, many universities are now beginning to spend large sums of money on recruitment, retention, and the graduation of minorities in engineering. According to the Hudson Institute's Workforce 2000, immigrants, women, and ethnic minorities will occupy nearly 85 percent of the new jobs in America (Sonderoth & Stough, 1992). The change in the workforce demographic is attributed to a number of factors such as the (1) numerical decline in white males, who traditionally filled such jobs; and (2) numerical increase and shift in the number of ethnic minorities and women

in the United States. However, at the present time, it has been projected that African-Americans and Hispanics will have the most problems finding jobs in this technical industry because of lack of educational attainment (Sonderoth & Stough, 1992).

Recognizing these trends, many foundations and governmental agencies are also beginning to take proactive stances by helping universities with their efforts to produce more engineers. They provide funds to help universities develop programs and initiatives that address the low minority representation in engineering and other scientific majors (Hermond, 1995; Hines, 1997). Many other organizations (e.g., National Action Council for Minorities in Engineering [NACME], Summer Educational Experience for the Disadvantage [SEED], and Minority Access to Research Careers [MARC]) were also established to address these same concerns. These organizations provide a variety of services from scholarships, mentoring, research and job internships, to various outreach programs. As a result, the enrollment of under-represented students in engineering and other scientific fields is beginning to increase but not in significant numbers. The relatively low increases are difficult to single out but are rather indicative of a range of factors.

Over the years, many authors (Cote & Levine, 1997; Hood, 1992; Levin & Wyckoff, 1995; Powell, 1990; Townsend, 1994) have attributed the consistently low numbers to poor retention programs, pre-college preparation, and university environments. Based on Hines' (1997) speculations, the low increases can be attributed to the stereotypic perception of minorities in relation to engineering and other scientific disciplines. This stereotype over and over again is seen as an obstacle for them to overcome. People often believe that math and science courses are extremely difficult

(Hrabowski & Pearson, 1993; Taylor, 1994) and that African-Americans are incapable of excelling in such fields (Howard & Hammond, 1985; Steele, 1997, 1999)

According to the American Council on Education (1988), Kim and Sedlacek (1996), and Trippi and Cheatham (1991), African-American males tend to drop out of college more often than their female counterparts. As a result, African-American males have become a growing concern for faculty, administrators, and staff members at predominately White institutions (PWIs). An overwhelming body of research indicates that large segments of the African-American male population are “withdrawing” from college before ever obtaining a degree (Check, 1992; Cuyjet, 1997; Dyson, 1989; Fleming, 1984; MacGuire & Halpin, 1995; Ross, 1995).

Across America, African-American males are considered an “endangered species” (Gibbs, 1988; Warfield & Marion, 1985). These males’ conditions are represented negatively in every national statistical category: education, health, employment, and death rates (Franklin, 1997). The data foreshadow the negative and unpleasant quality of life experienced by many African-American males. However, even with these discouraging odds, many African-American males still succeed in higher education and life.

The researcher of this study proposed doing a qualitative study of the persistence of African-American males in the College of Engineering at Virginia Tech. Persistence, as in Hines’ (1997) study, refers to students’ drive to remain in their respective major until they graduate. The study that Hines (1997) conducted is qualitative, consisting of structured interviews that look for factors that influence African-Americans’ persistence in natural science and other science-related disciplines. Along with Hines’ definition,

this qualitative investigation combined Graham's (1997) definition of *persistence* and *non-persistence*, which served as the guiding premise of her dissertation, Profiles of Persistence: A Qualitative Study of Undergraduate Women in Engineering. She defined *persistence* as "having completed a minimum of two years of study in engineering" (p. 13). *Non-persistence* was defined as deciding to leave engineering due to grades, finances, or lack of interest after initially enrolling in Virginia Tech.

The findings of the study were used to gain insight why some African-American males persevere in engineering disciplines and others do not. In other words, how do some African-American males persist in harsh conditions and still achieve while others do not? In this study, African-American males had the opportunity to highlight conditions, which contributed to their persistence in engineering and College in general. The study's findings rendered data that could be used to improve retention and graduation rates of African-American males in the College of Engineering. In addition, recommendations were made to improve the persistence in African-American males in the College of Engineering.

In the literature, there is a dearth of research on these combinations: persistence, engineering, and African-American males. However, it is replete with articles on persistence (Cote & Levine, 1997; Graham, 1997; Hines, 1997; Levin & Wychoff, 1995; MacGuire & Halpin, 1995), minorities (DeSousa & Kuh, 1996; Kim & Sedlacek, 1996; Scott, 1995; Sondgeroth & Stough, 1992; Tidwell & Berry, 1993; Watson & Kuh, 1996), academic success (Padilla, Trevino, Gonzalez, & Trevino, 1997; Wambach, 1983; Weber, 1992) and African-American males (Hrabowski, 1991; Hrabowski & Pearson, 1993; Hughes, 1987; Johnson, 1993; Trippi & Cheatham, 1991;). This study contributes

to the scant body of research on these combinations: persistence, engineering, and African-American males.

### **PURPOSE OF THE STUDY**

The purpose of this study was to explore, identify, and examine how African-American males were able to persist in the College of Engineering at Virginia Tech. It was intended that this study would provide the groundwork for the development of a conceptual model that had implications for recruiting, retaining, and graduating African-American males. Such a conceptual model would complement existing literature related to academic success and achievement in higher education. The crisis of African-American male students was well chronicled in the literature. It suggested that the future of African-American males looked bleak in contrast to that of their white male counterparts. They are disproportionately sent to prison, unemployed, and unsuccessful in school (Fletcher, 1999). These problems not only are symbolic of the crisis of African-American males but also are direct threats to their overall quality of life. Hrabowski and Pearson (1993) lament that African-Americans males often “strive for academic excellence, their efforts are not reinforced, and are actually discouraged by their peer groups, both in and out of school” (pp. 234 – 235). To increase the graduation rates of African-American males in higher education, it is imperative that administrators identify the conditions for their success and failure.

## **RESEARCH QUESTIONS**

This study explored the following questions:

1. What individuals have been most influential in African-American males' academic interest in engineering? How have these individuals influenced their academic interest in engineering?
2. What experiences, both positively and negatively, have had the greatest impact on African-American males' academic persistence in the College of Engineering?
3. How has the engineering, institutional, and social culture, both positively and negatively, affected the experiences of African-American males in the College of Engineering?
4. Why do some African-American males persist in the College of Engineering and others don't?
5. Are there any differences in the persistence of African-American males in the College of Engineering with a 2.5 QCA or higher, between a 2.0 – 2.5 QCA, and less than a 2.0 QCA?
6. To what degree are African-American males willing to persist in engineering?
7. What support do African-American males seek to help them persist through engineering? Why?
8. Are there any differences in the types of help sought by African-American males in the College of Engineering with a 2.5 QCA or higher, between a 2.0 – 2.5 QCA, and less than a 2.0 QCA?

## **ASSUMPTIONS**

Below are the assumptions made in this study:

### **Related to Participants**

- African-American males are capable of completing a degree in engineering due to their pre-college entrance characteristics (e.g. SAT scores, high school GPA, class rank, etc.).
- Each African-American male has his own unique collection of responses to the people (both faculty and students), engineering culture, and university at large, which all impact one's choice to persist or not persist in engineering.

### **Related to Engineering Culture**

- The engineering culture has inherent obstacles that are difficult for all engineering students.
- The engineering environment is highly connected with academic performance and persistence.

### **Related to Persistence**

- All African-American males have strengths and weakness that are inherently related to their persistence and non-persistence.
- The university's social climate can both positively and negatively impact the persistence of African-American males.

### **LIMITATIONS**

- Qualitative research often includes some form of quantitative component, but this study does not include such a component. As a result, this can be seen as a limitation.
- Because qualitative research requires awareness and perception, the students may not be able to identify factors that contribute to their persistence or lack of persistence in engineering.

### **DEFINITIONS**

The following definitions will be used in this study:

***Academic Profiles:*** A terminology used to describe the background (e.g., family, SATs, high school GPA and class rank, etc.) of the student.

***African-American:*** This group refers to African descent people, who are born, raised and/or resides in the United States. African-American and Black are often used interchangeably.

***Caucasian:*** This term refers to Americans of European ancestry. Caucasian, White, European-American are used interchangeably.

***Focus Group Interviews:*** It is a qualitative research methodology that is used to gather information and data about the researched phenomenon.

***Individual Interviews:*** It is another qualitative research methodology that is used to gather information and data about the researched phenomenon.

***Non-persistence:*** It is defined as choosing not to remain in engineering, due to grades, finances, or lack of interest after initially enrolling in Virginia Tech.

***Persistence:*** This term refers to students' motivation to remain in engineering and who have completed a minimum of two years of study in the curriculum (Hines, 1997; Graham, 1997). It is often used interchangeably with self-efficacy and motivation.

***Resiliency:*** It refers to students' ability to overcome obstacles and still achieve in spite of the challenges.

***Self-efficacy:*** An internal locus of control or belief propels students to excel academically. Motivation and persistence are often used interchangeably.

***Quality Credit Average (QCA):*** A terminology used to rate the academic achievement of a student at Virginia Tech (Beasley, 1998). At other universities, it is referred to as Grade Point Average (GPA).



## Chapter II

### LITERATURE REVIEW

After reviewing the literature on word combinations such as “persistence,” “engineering,” and “African-American males,” it was discovered that there was a dearth of information on the combined subject areas. However, the researcher did discover that the literature was replete with articles and books on different variables that influenced the academic success and persistence of African-American students at PWIs. To capture this information, this literature review was divided into nine sections: (1) psychosocial-developmental characteristics of African-American males; (2) under-representation of African-American males in higher education; (3) pre-enrollment characteristics; (4) campus environment and climate; (5) motivation and persistence; (6) math and science achievement; (7) retention and academic support programs; (8) parental and familial support; and (9) qualitative methodology and research.

Since the body of literature was scant as it related to persistence of African-American males in engineering disciplines, it was decided to use the mentioned nine sections to establish and develop the study. These points were consistently identified in the literature as contributing to persistence and academic success of African-American students at PWIs. The study was formulated entirely on the identified variables and information.

#### PSYCHOSOCIAL-DEVELOPMENTAL CHARACTERISTICS OF AFRICAN-AMERICAN MALES

First and foremost, African-American males *collectively* are very diverse (Barnes, 1994; Lee, 1991; Priest, 1991). The group comprises various subcultures, backgrounds, and experiences but shares common grounds that can be linked to various facets of life in

America (Elligan & Utsey, 1999; Pearson, 1994; Priest, 1991). Those experiences that are common to African-American males are what distinguish them from their white male counterparts and even from their African-American female counterparts (Moore, 2000).

Many African-American males are often first seen as being a part of a group rather than individuals (Hilliard, 1985). This perception is a reoccurring image and theme of African-American males, going back as far as the beginnings of slavery. Hilliard (1985) further articulates that this perception is widespread and highly ingrained in the psyche of American culture. Both sociopolitical and historical-oppressive forces are influential in characterizing them as “objects of fear” (Hilliard, 1985; Lee & Bailey, 1998). These oppressive forces, in turn, have shared in preventing African-American males from assuming traditional masculine roles that have been customarily afforded to their white male counterparts (Lee & Bailey, 1998). These forces have traditionally operated in such a way that they have impacted the psychosocial development and sex-role socialization of African-American males (Lee & Bailey, 1998).

What is most obvious about African-American males is that they are *black* and *male*. To fully understand their psychosocial development, many social scientists and behavioral theorists recommend that scholars understand how *blackness* and *maleness* intertwine with each other in America, how the two are interpreted by society and internalized by African-American males, and how African-American males respond to such interpretations (Allen-Meares, 1999; Duncan, 1999; Franklin, 1992; Hilliard, 1985; Locke, 1999). Generally speaking, when people are born, “they are socialized by members of their community to fit into social order” (Vontress, 1992, p. 459). This

notion of conceptualization suggests that the development of African-American males is socially constructed. Aligned with this notion, Vontress (1992) writes:

Socialization is holistic. At birth, it is primarily physical. Parents and others who attend children feed, change, bathe, and burp them. Gradually, attendants introduce social controls. They spank, scold, and instruct newcomers in the ways of the group. By responding to the special qualities of children, adults help them to develop an understanding of their individual uniqueness. Consequently children come to perceive their emotional, intellectual, psychological, and social dispositions. From contact with authority figures, they also acquire an intangible self that allows them to transcend the immediate environment and to connect spiritually with departed ancestors, powerful deities, and other inexplicable forces in their lives (p. 459).

The above-mentioned quote also implies that those authority figures in social institutions as the family and community are instrumental in showing a child the way of the group and society. For African-American males, this process of socialization is critical for successfully overcoming societal obstacles (Lee & Bailey, 1998). The psychosocial development for males (Havighurst, 1972; Piaget, 1970; Pollack, 1998) and African-American males in particular unravels (Harris, 1995; Lee, 1995) into a series of life stages (e.g., childhood, adolescence, and adulthood). Nevertheless, for many African-American males, it has been an up-hill struggle as they progress through these life stages (White & Cones, 1999). From infancy to adulthood, images of inferiority are communicated. These messages have made it difficult to assume a masculine posture (Grier & Cones, 1968; White & Cones, 1999).

During the early part their development, African-American males are taught to be resourceful in increasing their life opportunities to counter societal structural obstacles (White & Cones, 1999). They are taught that they must be better than their white male counterparts. Grier and Cobbs (1968), in their classic book Black Rage, state that

African-American males are taught, at an early age, to “hold back, to constrict, to subvert, and camouflage [their] normal masculinity” (p. 59). In more detail, the authors explain:

In the black household the man faces greater than usual odds in making his way. The care and rearing of children falls even more heavily on the wife; she is the culture bearer. She interprets the society to the children and takes as her task the shaping of their character to meet the world as she knows it. This is every mother’s task. But the black mother has a more ominous message for her child and feels more urgently the need to get the message across. The child must know that the white world is dangerous and that if he does not understand its rules it may kill him (p. 61).

The literature (Howard-Hamilton, 1997; Lee & Bailey, 1998; Vontress, 1992), suggests that many oppressive forces are stacked against African-American males and that it takes a resilient personality to overcome them. Those who are able to achieve are often scarred emotionally, psychologically, and socially, due to fighting institutional racism and seeing many of their African-American male peers falling victims of society’s oppressive forces (Franklin, 1992; Howard-Hamilton, 1997; Lee & Bailey, 1998; Moore, 2000). Howard-Hamilton (1997) recommends to educators and administrators to learn to infuse student developmental theories that are applicable to the African-American culture and that are able to empower and motivate African-American males to succeed on college campuses. Other authors (Harris, 1995; McEwen, Roper, Bryant, & Langa, 1990) have pointed out that many of the present student development theories are not applicable for African-American male students, due to cultural differences. When attempting to infuse developmental issues of African-American males in existing theories, McEwen, Roper, Bryant, and Langa (1990, p. 430) suggested the following:

1. *Developing ethic and racial identity:* inculcating ethnic identity and information and facts on African self-consciousness development.

2. *Interacting with the dominant culture:* discussing acculturation, assimilation, and association with white students on campus.
3. *Developing cultural aesthetics and awareness:* understanding and appreciating other cultures as well as one's own.
4. *Developing identity:* enhancing one's own unique and diverse characteristics, societal interaction, and group identification.
5. *Developing interdependence:* establishing personal relationships amid some separation from immediate family but with development of extended campus family.
6. *Fulfilling affiliation needs:* satisfying African American students' social needs outside the campus community.
7. *Surviving intellectually:* challenging African American students to compete with those who had educational privileges preparing them for the academic rigors of college.
8. *Developing spirituality:* understanding the role and importance of religion and spirituality in the growth and development of African Americans
9. *Developing social responsibility:* coming face-to-face with real and perceived social inequities, thus becoming social advocates on campus.

### **UNDER-REPRESENTATION OF AFRICAN-AMERICAN MALES IN HIGHER EDUCATION**

Over the years, many groups of the population have made considerable strides and gains in achieving a piece of the American dream, but this has not been the case for African-American males (Locke, 1999). Some have found themselves at a disadvantage, due to being "black" and "male" (Majors & Billson, 1992). These disadvantages are easily detected by examining various national statistical databases. Statistics indicate, when compared with their white male counterparts, African-American males have higher rates of imprisonment and criminality; drug and alcohol abuse; homicide and suicide;

unemployment; and mental disorders (Austin, 1996; Majors & Billson, 1992; Roberts, 1994).

Majors and Billson (1992) stated, “dropout rates are high, failure is common, performance below grade level is pervasive, and alienation is epidemic” (p. 13). In comparison to white males, African-American males are more often recommended for remedial instruction and special education (Blake & Darling, 1994; Majors & Billson, 1992; Patton, 1981; Serwatka, Deering, & Stoddard, 1989) rather than college preparatory courses and programs (Duncan, 1999; Oakes, 1992). Serwatka et al. (1989) hypothesized that African-American males are disproportionately placed in classes for the mentally and emotionally disturbed because they are perceived as threatening, disruptive, and incapable of learning (Majors & Billson, 1992).

Negative perceptions of African-American males communicate that they are lazy, unmotivated, unemployable, and intellectually inferior (Rowan, Pernell, & Akers, 1996). These perceptions have exacerbating effects in various areas of their lives. Such areas include, but are not limited to, prospective employment and eligibility for postsecondary education (Dyson, 1989). In regards to employment, they typically have higher rates of unemployment in comparison to other groups (e.g., Asian-Americans, Hispanic-Americans, etc.). For example, between 1990 and 1994, African-American males were disproportionately unemployed more than their African-American female counterparts, and they were unemployed two times as often as their white male and female counterparts (Austin, 1996).

Many scholars (Austin, 1996; George, 1993; Gibbs, 1984; Locke, 1999; Staples, 1986) attribute high unemployment to poor educational attainment and skill development.

Due to their low reading and writing skills, African-American males are easily considered as “functional illiterates (Staples, 1987). Staples (1987) found that nearly 44% of African-American males were considered functional illiterates. Such statistics imply that African-American males are a group at risk.

In 1983, the National Commission on Excellence in Education (NCEE) forecasted in A Nation At Risk that there were direct consequences for not possessing basic skills of literacy. The NCEE reported that people who did not possess these basic skills were at risk of suffering from marginalization, both economically and socially. Austin (1996) reported in his book, Repairing the Breach, based on findings of the National Task Force on African-American Men and Boys, that many of the problems that African-American males face are correlated with the nation’s changing social and economic conditions. These conditions have evolved around a global economy that shifted from manufacturing to an information and service-oriented economy. The changing economy negatively impacted those individuals who lacked the education and technical skills to compete or add value to their respective vocations (Austin, 1996). It is imperative that African-American males equip themselves with the necessary skills and competencies to compete in this global economy. On the contrary, recent trends suggest that African-American males, even when well educated and trained, are often the last hired and the first to be laid off during corporate downsizing, reengineering, and merging. In more detail, Rowan et al. (1996) asserted:

African American males with the same educational achievements, occupational positions, employment history, and spanning well over the past 30 years – from around 1954 to the present – have received earned income approximately 57 percent lower than that of their European American male counterparts (p. 10).

Over the years, the enrollment of African-American males in college has declined (Davis, 1995; Hrabowski & Pearson, 1993; Jackson, 1992; McJamerson & Person, 1989; Patterson-Stewart & Murry, 1993; Washington & Newman, 1991; Wingert, 1990). Though more African-Americans are graduating from high school (Hrabowski & Pearson, 1993) and performing better on college entrance exams (Wingert, 1990), fewer African-American males are enrolling in college to pursue postsecondary education. Within a ten-year span of time (e.g., 1976 to 1986), the enrollment for African-American males dropped from 4.3% to 3.5% (American Council on Education, 1997; Washington & Newman, 1991), and, within a four-year span of time (1980 to 1984), enrollment dropped nearly 6.3% (Gibbs, 1988).

Although high school dropouts among African-American males have declined steadily, educational data still suggest that they lag behind their African-American female counterparts in matriculating in college and obtaining degrees (Simms, Knight, & Dawes, 1993). Data, as recent as 1994, indicated that the male-to-female ratio for African-Americans was the lowest of all ethnic minorities (Cuyjet, 1997). Enrollment for African-American females was 24% higher than African-American males (Franklin, 1997). If this trend were to continue, Slater (1994) estimated that nearly 67% of the college degrees awarded to African-Americans would be given to African-American women.

Franklin (1997) attributes the disparity to better retention for African-American females and poorer retention for African-American males. In contrast, Cuyjet (1997) states that the disparity is difficult to pinpoint but should be viewed from a range of factors. The author divided the factors into two broad categories: “those preventing black



men from ever getting to college in the first place, and those leaving them somewhat underprepared when they arrive on the campus and thus contributing to the higher rate of attrition often experienced by African American men” (Cuyjet, 1997, p. 6). Negative circumstances, such as high school dropout, incarceration, problem drinking, and drug abuse, are common inhibitors that prevent African-American males from matriculating and/or considering college (Majors & Billson, 1992). Students who make it to college but are unsuccessful in staying because of academic reasons are often characterized as “unprepared” (Cuyjet, 1997). Brown (1997) asserted that lack of academic preparation was an important reason why African-Americans were not attaining their share of bachelor degrees.

### **PRE-ENROLLMENT CHARACTERISTICS**

Making the transition from high school to college is a challenging process for any student, but for African-American males the adjustment is exceptionally challenging. In many cases, a significant portion of the group lacked the academic preparation necessary to succeed in higher education (Cuyjet, 1997; Tidwell & Berry, 1993), especially in academic majors such as engineering, math, and science (Fullilove & Treisman, 1990; Hrabowski, 1991; Hrabowski & Pearson, 1993; Hrabowski, Maton, & Greif, 1998; Marrett, 1987). When comparing African-American males with their white male counterparts, they were less likely to take college preparatory courses (Carzile & Woods, 1998). “This stems from a number of conditions: attending academically poorer elementary and secondary schools, lowered expectations of peers and significant adults toward academic achievement, peer pressure to disdain educational accomplishments and

education as an outcome, financial hardships limiting educational access, lack of appropriate role models, and other barriers owing to racism” (Cuyjet, 1997, p. 7).

As a way of combating poor retention and graduation rates, many academic institutions increased their admission standards to guarantee that students were prepared for the rigorous academic demands of their institution (Haralson, 1993; Hughes, 1987). Most universities and colleges wanted prospective students to show evidence of academic success in the following areas: (1) standardized tests such as Scholastic Aptitude Test (SAT) and American College Test (ACT); (2) cumulative grade point average (GPA); and (3) class rank (Brown, 1997; Scott, 1995). Students who do not show evidence of promise in these three areas are often identified as academically “unprepared” or “at risk.” Disproportionately, African-American males are identified under these categories.

Although African-Americans were increasingly improving their SAT scores, they still lagged considerably behind white Americans. Angela King (1999) presented in her article, “Closing the Education Gap: A Race Against Time,” the most recent statistics on SATs. She stated that, in 1995, only 465 (.44%) out of 103,872 African-American seniors scored 650 or higher on the verbal portion of the test, and only 1,437 (1.38%) out of 103,872 scored higher than 650 on the math portion. In contrast to African-Americans, 36,700 (5.4%) out of 674,343 Caucasian students scored 650 or higher on the verbal portion and 51,306 (7.6%) scored 650 or higher on the math portion. Carson, Huelskamp, and Woodall (1991) attributed the low SAT scores to school setting rather than race/ethnicity. King (1999) suggested that the disparity could be attributed to a range of factors from “poverty to a lack of computers and other technology...to low expectations of black children” (p. 79). Regardless of race/ethnicity, evidence suggested

that urban residents' SAT scores were significantly lower than suburban and rural residents' (Carson et. al., 1991). The same disparity in achievement was generally noticeable within groups (e.g., poor whites vs. affluent whites) when economics were considered. Because African-Americans more often reside in urban settings and go to inadequate schools, Taylor (1994) posited that African-American students could easily be considered doubly disadvantaged by race and locale.

Evidence of research suggested that a significant portion of the African-American student population that attended PWIs left by their sophomore year in college (Jackson, 1992). Aligned with these sentiments, Lunnenborg and Lunnenborg (1986) found that high school GPA alone was not a strong enough indicator for predicating college success for African-American students. Morgan (1990) and Astin (1982) found that combining the high school GPA and combined SAT scores (e.g., verbal and math parts) resulted in a stronger prediction of college GPAs for African-American students. On the contrary, Morgan's (1990) findings suggested that high school GPAs and SAT scores were not as reliable for Caucasian students. Regardless of the group, the intensity and rigor of the high school curriculum were stronger predictors of academic success than high school GPAs and SAT scores (Astin, 1982; D'Augelli & Hershberger, 1993; Morgan, 1990; Scott, 1995). Aligned with these findings, Adelman (1998) found that early exposure to trigonometry and higher-level mathematics were even better predictors of college success than high school GPA or SAT or ACT scores. He also reported that the academic curriculum intensity scale narrowly reduced the college completion margin between African-Americans and Caucasians. For example, African-Americans who were among the top 40% of academic curriculum intensity scale and who took trigonometry (or

higher) had a 70% college graduation rate, compared with 84% of Caucasians with comparable backgrounds (Adelman, 1998). The graduation gap between the two groups was significantly reduced when using the academic curriculum intensity scale as opposed to using the high school GPA and SAT or ACT scores.

Unlike other researchers, Giles (1992) found that high school GPA, high school class rank, and SAT scores were inadequate in predicting academic performance for African-American students at Virginia Tech. Even with the best regression models, she stated that a significant part of the variance for the first year performance was unexplained by the information available (Giles, 1992). When looking at the top 15% of high school students, it was difficult to predict the level of academic success for students. For example, Pervin, Reik, and Dalrymple (1966), in their classic study, found similar results in the 1960s. The authors discovered that 45% of the students at the University of California dropped out before ever completing their degrees, though only the top 15% of high school graduates were eligible for admission.

MacGrath and Braunstein (1997) conducted a more recent study that examined the relationship between attrition and certain demographic, academic, financial, and social factors for freshmen. The sample was comprised of 353 students: Caucasian-Americans (64.3%), Hispanic-Americans (13.6%), African-Americans (7.7%), Asian-Americans (1.1%), and Others/Unknown (12.5%). The two authors' analysis indicated that certain factors such as socioeconomic status, high school GPA, SAT scores, impressions of the institution, and participation in the financial aid program were significant predictors of retention. Students who stayed had higher high school GPAs, SAT scores, and first semester GPAs than those who left.

On a case-by-case basis, students are sometimes admitted to college provisionally. “Provisional status” means that the student’s acceptance is restricted as a result of not successfully taking and/or completing college preparatory courses or scoring high enough on the SAT or ACT while in high school. Most provisional students are required to participate in special summer programs prior to entering the university to bring their academic skills up to college level (Brown, 1997) and are required to complete their first semester or quarter in good standing. These special summer programs, referred to as “summer bridge programs,” consist of special advising, mentoring, tutoring, academic success workshops and various other components to enhance the academic success rate of under-prepared students (Hrabowski & Pearson, 1993).

These special programs are often “knee jerk” responses to dismal graduation rates of African-Americans in higher education. Many universities such as Virginia Tech, University of Maryland-Baltimore County and various others offer special programs to minority students regardless of their admission status (e.g., regular or provisional admissions). This was especially true for minority students in non-traditional disciplines such as science, math, and engineering majors (Cheek, 1992; Hrabowski & Maton, 1995; Jibrell, 1990; Pearson & Bechtel, 1989).

In 1975, the National Academy of Sciences conducted a national study on the attrition of minorities in engineering colleges. This report indicated that “[minority] students had insufficient preparation in mathematics and the physical sciences, inadequate motivation toward engineering as a career choice, lack of adequate financial resources and no self-confidence” (National Academy of Sciences, 1975). The National Academy of Science also found that engineering programs needed to do the following to

increase retention of minorities: (1) develop and expand pre-college academic programs, (2) identify successful minority undergraduate and graduate students to tutor other students, (3) increase the presence of minority faculty, and (4) improve the personal interactions between students, faculty, and staff. Other studies and reports have also indicated similar findings. For example, Hrabowski (1991) found that even those African-American students with high-standardized scores and high school grades do not always succeed in engineering. He discovered that many of these students earned well below a “C” in courses, such as chemistry, engineering, and calculus. In one particular science department at the University of Maryland Baltimore County, failure rates dropped from 60% to 40% when the science faculty began giving students more feedback on homework assignments, quizzes, and tests (Hrabowski, 1991).

Due to mentioned circumstances, it was not surprising that African-American males were not pursuing and graduating with engineering degrees (Allen, 1988). Perhaps this was why African-American students were majoring in the social sciences and humanities at higher rates than disciplines such as math, science, and engineering (Hines, 1997; Powell, 1990; Murry & Mosidi, 1993; Smith, 1990; Young, 1983). In order to change such trends, Murry and Mosidi (1993) recommended that educators develop programs and interventions that encouraged and prepared African-American students to pursue careers (e.g., engineering) that offered greater advancement and financial stability. The authors further suggested that such interventions needed to be innovative and creative to counter negative trends.

## CAMPUS ENVIRONMENT AND CLIMATE

Since the 1960s, the enrollment patterns of African-American students shifted from Historical Black Institutions (HBIs) to Predominately White Institutions (PWIs) (Harvey & Williams, 1993; Tidwell & Berry, 1993; Townsend, 1994). The shift can easily be attributed to *Brown vs. Board of Education of Topeka, Kansas*, which was based on the monumental Supreme Court decision that declared “separate but equal” unconstitutional (Tidwell & Berry, 1993). It was this case that dramatically changed the demographic landscape of higher education (Allen, 1992).

The *Brown* case mandated that all public educational institutions (e.g., elementary, secondary, and higher education) abolish their segregation policies (Scott, 1995) and enroll minority students in their respective institutions. After the mandate, PWIs developed recruiting initiatives and educational opportunities to attract talented African-American students to their respective universities (Davis, 1998; Tidwell & Berry, 1993; Townsend, 1994). Unfortunately, many of the African-American students found it difficult to adjust to the environment (Fleming, 1984; Fordham & Ogbu, 1986; Tidwell & Berry, 1993; Weber, 1992; Willie & McCord, 1972). Some of their adjustment tribulations were common to all college students (Tinto, 1996), while others were specific to African-American students (Allen, 1992). Tidwell and Berry (1993) asserted, “It could be that years of functioning in a social system that mandated second class citizenship for minorities that ideas about the inferiority and superiority of various groups are too deeply entrenched for society to manage to change” (p. 466). Clearly, this suggested that institutions of higher education were microcosms of society, which reflected the beliefs and values of the majority culture.

Then and even today, African-American students often feel isolated and alienated at PWIs (Delphin & Rollock, 1995; Hughes, 1987; Schwitzer, Griffin, Ancis, & Thomas, 1999; Sedlacek, 1987). Consistent with these sentiments, Cuyjet (1998) found apparent differences between African-American students' and non-African-American students' (e.g., Hispanics, Whites, Native-Americans, and Asian-Americans) perceptions of PWIs' environments. His study was conducted at six different universities around the country. These universities differ from each other in size, mission, location, and racial composition. The author used a quantitative instrument, *Perceptions on Community/Environment (PCE)*, to "assess students' perception on matters pertaining to their relative acceptance in a college or university environment, with a particular emphasis on issues related to the racial/ethnic identity" (Cuyjet, 1998, p. 66). "The atmosphere in my classes makes me feel like I belong," "My fellow students are condescending to me," and "Campus rules and regulations seem to have been more for ethnic majority (white) students than for African-Americans" are examples of items on his quantitative instrument. Participations were able to respond to the questions using a Likert-type scale – *strongly agree, agree, disagree, and strongly disagree*. More specifically, the author found that African-American students responded overall more negatively to the questions than did non-African-American students. It can be assumed that these African-American students felt marginalized by their negative perceptions. In an earlier study, Davis (1994) examined the relationship between perceived social support and academic achievement of African-American males that attended HBIs and PWIs. The author found that the African-American males who attended HBIs had higher GPAs than those who attended PWIs. One possible explanation for these findings might



be that African-American students have more contact with professors at HBIs than PWIs (Cokley, 1999).

Trujillo (1986) discovered in his research that Caucasian instructors paid less attention to African-American students and often ignored them in class, whether consciously or unconsciously. This was especially true when the representation of African-Americans was low (Loo and Rolison, 1986). Gloria, Kurpius, Hamilton, and Wilson (1999) found, from a sample of 98, that social support, university comfort, and positive self-beliefs were highly associated with the persistence of African-American students at their PWI. These findings substantiate past studies (Fleming, 1990; Gossett, Cuyjet, & Cockriel, 1998; Kimbrough, Molock, & Walton, 1996) that emphasized the importance of personal, social, and academic support of African-American students at PWIs. Although the three constructs predicted persistence, social support and university comfort appeared to be the strongest predictors (Gloria et al., 1999).

In a qualitative study, Schwitzer et al. (1999) found that African-American students felt less supported and nurtured in their PWI than in their communities and high schools. In addition, the authors found that these students were less likely to approach their instructors for help, unless the instructor had the same gender, race, or both. Students' reservations were directly related to their fears of being perceived as needing help as a result of being African-American. This passive behavior was "rooted in the fears and self-doubt engendered by a major legacy of American racism: the strong negative stereotypes about black intellectual capabilities" (Howard & Hammond, 1985, p. 18).

Claude Steele (1997), a renowned social psychologist at Stanford University, referred to this notion of behavior as the “stereotype threat.” He first coined the term to explain the structural barriers and achievement gaps of capable African-American students. He suggested that African-Americans’ academic achievement had less to do with their academic ability than with the threat of negative stereotypes about their capacity to achieve. The premise of the author’s theory began with the assumption that negative societal perceptions about particular groups can detrimentally impacted the intellectual and identity development of individual group members. The stereotype threat occurred most often when one was pursuing a career or education that was not perceived as common. “This predicament threatens one with being negatively stereotyped, with being judged or treated stereotypically, or with the prospect of conforming to the stereotype” (Steele, 1997, p. 14). More importantly, it intensified the fears and uncertainties of the person being negatively stereotyped (Howard & Hammonds, 1985). The stereotypes have negative effects that can cause anyone fatigue (Steele, 1992).

Nettles (1987) suggested that the needs of African-Americans and Caucasians were quite different. The author further explained that PWIs have fallen short in meeting the needs and expectations of African-American students, particularly in providing social support and nurturance that foster academic success. “Because social adjustment and interpersonal climate seem to be central factors in many African-Americans’ satisfaction and success on predominantly white campuses, counselors must understand how these issues operate to develop effective interventions for these individuals” (Schwitzer et al., p. 190).

As compared to whites, D'Augelli and Hershberger (1993) found that African-American students perceive their PWIs more negatively. Other studies (Allen, 1981; Hughes, 1987; Thompson & Fretz, 1991; Wright, 1981) even suggested that they perceive "greater racial tension and hostility in their environment, express lower levels of satisfaction and greater levels of isolation, and feel less identified with the institution than do white students" (Thompson & Fretz, 1991, p. 437). As compared to African-American students at HBIs, they reported greater levels of dissatisfaction and consequently did not fare as well academically (DeSousa & Kuh, 1996; Fleming, 1984; Gurin & Epps, 1975; Kemp, 1990). Fleming (1984) found that the environment was very important in fostering success for African-Americans both on HBIs and PWIs. In her longitudinal study, she found that students who attended HBIs made greater intellectual gains than their peers who attended PWIs. In addition, the author's findings suggested that the development of African-American males more negatively suffered at PWIs than HBIs. On contrary, African-American females were more assertive and self-reliant at PWIs than HBIs.

When there was incongruence between the student and environment, dissatisfaction and alienation were common symptoms of a poor fit. If the environment was in conflict with the student, there was a high probability that the student would have problems adjusting and would likely to withdraw from college. Tinto (1987) found that person-environment incongruence was highly correlated with students withdrawing or transferring from college. For African-American students, withdrawal was often the response to maladjustment and dissatisfaction with PWIs. Therefore, it can be assumed

that the campus environment was central to the success of African-American students in PWIs (Schwitzer, et al., 1999).

The theory of person-environment congruence proposed that a good fit between the person and environment has a positive impact on student achievement and personal satisfaction (Thompson & Fretz, 1991). On the contrary, a poor fit has the opposite effect. For African-American students at PWIs, environmental characteristics of the institution were critical for retention, persistence, and academic success. Therefore, it was imperative that PWIs developed support programs and interventions to foster a more comfortable environment (Scott, 1995; Watson & Kuh, 1996).

According to Fordham and Ogbu (1986), African-American students have a limited amount of established resources to affirm their identity and to connect with their cultural heritage on PWIs. As a result, African-Americans often find it “necessary to create their own cultural networks to remedy their exclusion from the wider, White-oriented university community” (Allen, 1992, p. 29). Willie and McCord (1972) found that African-American students expected more social acceptance than they were actually receiving from PWIs. The authors also found that this contributed to African-American students segregating themselves from other groups. It was clear that the campus environment has devastating effects on the overall experience of African-American students. Perhaps just as important as the campus environment, informal contacts with faculty and administrators play vital roles in academic success of African-American students (Watson & Kuh, 1996).

### **MOTIVATION AND PERSISTENCE**

Over the last two decades, numerous studies have been published on motivation and persistence of students in higher education (Somers, 1995). Evidence from research

(Graham, 1997; Scott, 1995; Somers, 1995; Wambach, 1993; Weiner, 1985; Wilson-Sadberry, Winfield, & Royster, 1991) indicated that persistence and motivation have a profound effect on academic performance. “Certain variables consistently associated with persistence are included in an integrationist theory of persistence” (Donovan, 1984, p. 244). The variables were typically associated with learning environments, academic problems, relationships with instructors, and interactions with other students (Wilson-Sadberry, et al., 1991).

As a way of better understanding persistence, Tinto (1975) developed a conceptual model, which was derived from Durkheim’s (1951) theory of suicide, based on the assumption that suicide was likely to occur when individuals were inadequately integrated into and connected with society. Tinto (1975) focused his model on the interactions between individual students and the college environment. The author hypothesized that the two interactions influenced the educational outcomes of college students. He further suggested that lack of integration in the two main dimensions (e.g., academics and social life) of college life can or will lead to withdrawal. It was the individual’s integration into the academic and social environment that most determined whether or not the individual would persist in college (Wambach, 1993). For example, Tinto (1975) stated:

When one views the college as a social system with its own value and social structures, one can treat dropout from that social system in a manner analogous to that of suicide in the wider society... social conditions affecting dropout from the social system of the college would resemble those resulting in suicide in the wider society; namely insufficient interactions with others in the college and insufficient congruency with the prevailing value patterns of the college collectivity... lack of integration into the social system of the college will lead to low commitment to that social system and will increase the probability that individuals will decide to leave college and pursue alternative activities (pp. 91 – 92).

Another popular conceptual model for explaining persistence was Weiner's (1985) attribution theory. This model was conceptualized that students attribute their academic performance, whether positively or negatively, to ability, effort, and task difficulty (Wambach, 1993). The explanations, which students attributed to their educational performance, were important determinants of motivation, self-esteem, and future plans (Scott, 1995; Wambach, 1993). Signer, Beasley, and Bauer (1997) found that, when poor performance was attributed to low ability, students often "gave up" and developed a nonchalant orientation toward academic-related topics.

Howard and Hammond (1985) asserted that everyone encounters failure, but unexpected failure affect students differently from expected failure. For example, a student who is confident in his or her ability but happens to fail at a task was likely to attribute his or her failure to not working hard enough. On contrary, a student who was expecting to fail was likely to attribute his or her failure to lack of ability and was likely to hesitate approaching the task again. It was clear that expectancy and cognition have a tremendous impact on educational performance. In more details, Howard and Hammond (1985) lamented:

The negative expectancy first tends to generate failure through its impact on behavior, and then induces the individual to blame the failure on lack of ability, rather than the actual attribution in turn becomes the basis for a new negative expectancy. By this process the individual, in effect, internalizes the low estimation originally held by others. This internalized negative expectancy powerfully affects future competitive behavior and future results (p. 20).

Howard and Hammond's (1995) aforementioned quote was not limited to any specific group. However, it did provide a basis for explaining why some groups were achieving academically and why others were not. For African-American students, a

notable difference between their attitudes and white students' attitudes in regards to academic success was that white students tended to expect to make good grades and black students just wanted to keep from failing (Erwin, 1976). Other research (Clark & Klotkin, 1964; Nettles, 1988) reported that academic performance was highly dependent on students' motivation, regardless of their pre-college academic performance and/or entrance examination scores. Consistent with these findings, Dorsey and Jackson (1995) found that African-American students who persisted at PWIs did so primarily because of their own personal motivation, high aspirations, and somewhat high degree of satisfaction with the academic life. The two authors' sample was comprised of African-American juniors and seniors (N=86). The study's overall purpose was to examine these students' perceptions and experiences at a large, Midwestern PWI. As a way of gathering the data, the authors used a quantitative instrument, based on a Likert measurement scale -- *strongly disagreed, disagreed, had no opinion, agreed, or strongly disagreed*. "It is important for me to graduate from college," "I foresee that I can be a success at this university," and "I feel that the services, information, and/or facilities that the university provides are conducive to the success of Blacks students" were examples of items on the instrument. More specifically, these items were used to measure internal (e.g., self-concept, personal motivation, and aspiration) and external factors (e.g., academic quality, faculty relations, and sociocultural environment).

African-American students in Scott's (1995) study agreed that motivation and effort were key factors to their academic performance at Virginia Tech. These students also suggested "these things combined with the absence or presence of clear goals and good study habits made a major contribution to their grades since enrolling at the

university” (p. 98). When making between-group-comparisons (e.g., below 2.0 group, 2.0 – 3.0 group, and 3.0 and above group), the author noticed that each group clearly recognized the importance of these factors, but approached the factors differently. For example, Scott (1995) revealed:

The successful students [3.0 and above] talked about investing extra study time, using campus resources, studying with peers, and talking to professors. The satisfactory students [2.0 – 3.0] also engaged in similar activities but not to the extent as the successful group. The less successful students [2.0 or less] admitted that academics were not a priority and that they had not spent adequate time on their studies (p. 98).

For students in engineering and other scientific majors, Lent, Brown, and Larkin (1984) found that students “who reported high self-efficacy for educational requirements achieved higher grades and persisted longer in technical and scientific majors over the following year than those with low self-efficacy” (cited by Graham, 1997, p. 65). The authors (Lent, Brown, and Larkin, 1987) also found in another study that self-efficacy was a more reliable factor in predicting students’ academic performance in scientific fields than interest congruence and consequence thinking. Self-efficacy referred to one’s confidence about his or her ability to accomplish a certain task or assignment. The outcome of performance was what usually predetermined the level of persistence (Wambach, 1993). Bandura (1986) identified four stimuli that were known for changing one’s persistence: (1) performance accomplishments; (2) vicarious learning experiences; (3) encouragement and support; and (4) emotional arousal. According to Maddux and Stanley’s (1986) research, performance accomplishment had the most influence on one’s self-efficacy. Vicarious learning, encouragement, and arousal were the three main influential factors.



In a qualitative study of undergraduate women in engineering, Graham (1997) found that personality and social support were the most important factors that attributed to women persisting in engineering. In contrast, the differences between non-persistent and persistent women were on the items related to expectations of engineering, difficulty level of engineering, and involvement in extracurricular activities. The author also found that non-persistent women had unrealistic expectations about engineering, perceived engineering courses as a “weed out” discipline, and commonly isolated themselves from others. When comparing males, Campbell and McCabe (1982) and Sax (1992), discovered that women were more persistent than females in scientific majors.

### **MATH AND SCIENCE ACHIEVEMENT**

Many explanations have been given for the under-representation of African-American males in math, science, and engineering careers. The explanations range from a variety of factors, such as (1) inadequate secondary educational facilities and resources; (2) poor performance in mathematics and science; (3) low expectations from teachers and counselors in their academic abilities; (4) the lack of mentors in their lives to promote their interest in science and mathematics; and (5) inadequate parental support (Fullilove & Treisman, 1990; Hrabowski & Pearson, 1993; Hrabowski & Maton, 1995; Hrabowski et al., 1998; Peterson, 1993; Signer, Beasley, & Bauer, 1997). Regardless of the explanation, many researchers believe that more emphasis should be placed on improving the overall education for African-American males.

The futures of African-American males, in large measures, were highly predetermined by their academic performance at the different school levels – elementary, middle, secondary, and college. Each school level served as a feeder to the next. It was

clear that the early years of education were crucial for students who anticipated majoring in engineering and other scientific fields. Mathematics and science courses were typically the classes that indicated whether or not students were in college preparatory tracks. More often than not, African-American males avoided college preparatory courses that prepared them for engineering and science disciplines (Hrabowski, 1991). They were disproportionately placed in special education tracks (Serwatka, 1993) and lower-leveled vocational tracks (Jibrell, 1999). Hrabowski and Pearson (1993) stated that these males “avoid advanced mathematics and science in high school, possibly because their teachers think they are unable to compete in these courses” (p. 234). Other authors (Fordham & Ogbu, 1986; Fries-Britt, 1997) argued that African-American males often shied away from college preparatory courses to avoid undue criticism from their peers. Within many African-American male circles, the perception of being smart was often viewed as “acting” or “being” white (Fries-Britt, 1997). Jones, Burton, and Davenport (1982) found that the following constructs influenced students’ mathematics learning: “achievement motivation, career expectations, influence and parents, parental education and occupation, enjoyment of mathematics, self-esteem as a mathematics student, mathematics utility and relevance, teacher expectations, and locus of control” (Signer et al., 1997, pp. 378 – 379).

Howard and Hammonds (1985) posited that a negative stigma of inferiority followed African-Americans everywhere they went, especially in various academic arenas; subsequently, many avoided academic fields (e.g., engineering, math, and science) where the stigma might be deemed true. This clearly constituted an unwanted burden for African-American males who aspired to pursue engineering and scientific

fields in college. Howard and Hammond (1985) further posited that “black inferiority” is communicated in different venues of society. It is communicated in the classroom, media, and even on the job. These effects are debilitating and detrimental to African-American males’ self-concept, and self-confidence. In turn, it negatively tarnishes their academic performances. Other authors (Hrabowski, 1991; Hrabowski & Pearson, 1993; Trippi & Cheatham, 1991) echoed these same sentiments.

Other research suggested that white males were out numbering black males in taking college preparatory courses (Chung, Baskin, & Case, 1999; Carzile & Woods, 1988; Hrabowski & Pearson, 1993), and inevitably this trend has put a damper on the number of engineering degrees awarded to African-American males each year (Hall & Post-Kammer, 1987; Powell, 1990). In order for African-American males to be successful in engineering, many researchers have recommended that they be introduced to different careers available to them as a result of math and science. The best way to improve the present numbers was to start at an early age (Taylor, 1994). Early exposure was an important predictor of mathematical achievement (Ethington & Wolfe, 1984). It played a tremendous role in positively influencing students’ impression of science, both physical and natural. Along these lines, Peterson (1993) encouraged counselors to do the following:

As counselors, we need to be present in the planning of mathematics and science activities so we can support positions that represent all students. We must support gifts and talents of all kinds. We must make sure, too, that well-meaning mathematicians, scientists, and engineers do not force-feed higher order mathematics and science courses to students who could better served by different type of curricular approach. We must make clear that our role is not to steer students into specific occupational fields... (p. 246).

## **RETENTION AND ACADEMIC SUPPORT PROGRAMS**

Over the years, retention and graduation rates of African-American males have become a growing concern for faculty, administrators, and staff members at PWIs. This was evident by a recent body of research (D'Augelli & Hershberger, 1993; Davis, 1994; Hrabowski, et al., 1998; Sherman, Giles, & Green, 1994; Townsend, 1994) on African-American males. Such studies (Hines, 1997; Hrabowski & Maton, 1995; MacGuire & Halpin, 1995; Taylor, 1994) suggested that African-American male students needed to be cultivated and nurtured in order for them to persist in higher education, particularly in scientific fields such as engineering. Outreach programs for both middle and secondary school students, pre-college programs for entering freshmen, and academic support for undergraduate students were common interventions used to assist African-American males in succeeding in college, both at PWIs and HBIs (Fortenberry, 1994; Hrabowski & Maton, 1995; Scott, 1995).

When designing retention programs for African-American males, educators have identified different factors that contributed to academic success and persistence. Hrabowski and Maton (1995) identified four critical points that influenced African-American male students' academic success. The information was based on the authors' extensive literature review, applied research, and experience working with African-American males in science. Furthermore, the four points were the basis of the authors' Meyerhoff Program at the University of Maryland Baltimore County. This program was founded to recruit, retain, and graduate African-American males in science and engineering fields.

Knowledge and skills, motivation and support, monitoring and advising, and academic and social integration were the four key factors that positively or negatively influenced the academic performance of African-American males in science and engineering. The first point was related to basic intellectual ability and analytic and problem-solving skills. In order to be successful in science or engineering, it is essential that students have basic computational skills. Although students have different learning styles, backgrounds, strengths, and weaknesses, it was important that educators consider such diversity in their retention interventions. The availability of various resources for students with different backgrounds and needs made this an achievable goal.

The second point was related to students' motivation, interest, and support. Because science and engineering curricula were strenuous and challenging, it was considered necessary the students were genuinely interested in their chosen discipline of study and that they received the necessary support for success. Support was the main component that generated resiliency and persistence in African-American males, especially in trying times. The authors further suggested that support came from a range of sources, including family, faculty, administrators, and peers.

The third point was associated with advising and monitoring students' academic progress. The authors asserted that good advising and follow-up were instrumental in helping African-American male students stay on track. Good advising and monitoring were key ingredients to counter academic mishaps and unwise decisions. Perhaps more significant than any of the mentioned points was the fourth point, academic and social integration. The literature was filled with accounts and research that support the importance of African-Americans being fully integrated into the campus community.

The authors recommended that every effort should be made to create a welcoming environment that help facilitate relationships across genders, race, class, and social status. Once students were comfortable with the environment, they were more able or willing to integrate both academically and socially into campus life. Landis (1991) argued that this could be achieved through interventions that included faculty involvement, study groups, course clustering, and learning centers for students.

At many universities, similar interventions have been established (Hermond, 1995), regardless of whether the university is a PWI or HBI, such as Morgan State University (Cheek, 1992), Florida A&M University (Fortenberry, 1994), University of Virginia (Townsend, 1994), and University of Akron (Lam, Doverspike, & Mawasha, 1997). Retention efforts comprised of tutoring, mentoring, counseling, and special workshops. In fact, Morgan State University's retention interventions, illustrated by Cheek (1992), targeted freshmen and any students considered "at risk" in the College of Engineering. The retention program was divided into three phases: (1) pre-semester phase, (2) early-semester phase, and (3) mid-semester phase. The program was comprehensive, involving every faculty, staff, and administrator in engineering. The people involved serve as personal contacts (Campus Parents) for at least two freshmen students. During the pre-semester phase, administrators, such as the deans and department heads, sent out correspondences to these students to "inform them of the University's expectations, their assigned advisors and campus parent, and time commitment during enrollment" (p. 177). The second phase, early-semester intervention, required that campus parents set up meetings with their assigned student(s). They determined students' academic progress and provided assistance. This phase helped

students increase their motivation and adjustment to Morgan State University. The last phase, mid-semester intervention, entailed providing feedback and advising to students as well as going over the student's mid-term reports and providing encouraging support in helping the student improve his or her academic performance. In addition to the three phases, a summer bridge program, parent program, and other means of academic support were used to help improve the retention and graduation rates. Although the author neglected to provide empirical findings, he reported encouraging anecdotal outcomes and benefits of this comprehensive retention program.

At \*Florida A&M University (FAMU), Fortenberry (1994) highlighted the strengths of its recruitment and retention of African-American students. Though it was a HBI, it still had a national reputation for landing National Achievement Scholars. A disproportionate number of these scholars opted to major in engineering and other scientific disciplines. As a way of attracting top African-American students, FAMU offered very competitive academic scholarships, referred to as the Life-Gets-Better Scholarship. These scholarships covered tuition, room, board, and fees. In addition, the recipients were guaranteed summer internships. As a way of retaining the students, students were enrolled in engineering-only sections of science and engineering courses. They were encouraged to study in groups with peers, and tutors were provided to help them in difficult courses. The author also reported that retention and graduation rates improved drastically but failed to provide any supporting data.

Retention interventions at the University of Virginia have received a lot of attention over the years (Townsend, 1994). In fact, this university was considered a

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\* Please note that FAMU shares the same engineering program with Florida State University (FSU), a PWI. The difference between the two is that some students officially attend FAMU and others attend FSU.

national leader for its high graduation rate of African-Americans. Its efforts were not specific to engineering but targeted at underrepresented students all around its campus, regardless of their majors. Institutional commitment, faculty involvement, mentoring, financial support, and maintaining a critical mass were identified as critical to the University of Virginia's success. Along these lines, other research suggested that such factors were instrumental in recruiting, retaining, and graduating African-Americans.

Lam et al. (1997) described a retention program that was developed by the University of Akron's College of Engineering. The program was entitled Increasing Diversity in Engineering Academics (IDEAs). Its purpose was to increase the representation, retention, and graduate rates of African-American students in the College of Engineering. In order to meet its purpose, the program placed a major emphasis on (1) improving the representation of African-American students, (2) enhancing their academic performance, and (3) helping them develop collaborative learning communities, which focused on academic success rather than remediation. Lam et al. (1997) reported that the program provided peer support networks, collaborative learning environments, academic success workshops, and financial incentives. Historically, such skills developed from the program have been difficult for African-American students to acquire on their own. The authors stated, "Any conclusions are speculative in that it would be impossible to tease out any true cause and effect linkages or to make any definitive conclusion on the utility of the program...the results do suggest that whatever the reason the program works; more African-American students are being retained, graduating and finding employment" (Lam et al., 1997, p. 65).



## PARENTAL AND FAMILIAL SUPPORT

Transitioning to college from high school is a stressful period for many students (Lafreniere, Ledgerwood, & Docherty, 1997). Whether it is meeting new friends, finding classes, or just being away from family, many students still need support in college. More often than not, support comes from parents and other family members. These individuals often are called upon to provide encouragement and reassurance about college. According to several authors (Baker, McNeil, & Siryk, 1985; Baker & Siryk, 1984), the adjustments of college life can be categorized into four areas: “(1) *academic adjustment* to college-level educational requirements; (2) *institutional adjustment* or commitment to college pursuits, academic goals, and eventual career direction; (3) *personal-emotional adjustments* or the need to independently manage one’s own emotional and physical well-being; and (4) *social adjustment* to roommate, peer, faculty, and other interpersonal relationships” (Schwitzer et al., 1999, p. 189). These areas usually cause students to question their ability, lose their motivation, or just fail out. Hrabowski and Maton (1995) found that parents and other family members were instrumental in fostering enthusiasm and increasing efforts of students. This was especially true of minority students such as African-Americans (Hrabowski, 1991; Hrabowski & Maton, 1995; Hrabowski, et al., 1998; Scott, 1995; Smith & Hausfaus, 1998; Taylor et al., 1995).

A growing body of literature indicated that parental and familial support has had advantageous effects on students’ academic performance (Hrabowski, 1991; Hrabowski et al., 1998; Lafreniere, et al., 1997; Sanders, 1998; Scott, 1995; Taylor, Hinton, & Wilson, 1995) and career development (Blustein, Walbridge, Friedlander, & Palladino,

1991; Fisher & Griggs, 1995; Fisher & Padmawidjaja, 1999; Middleton & Loughead, 1993; Young & Friesen, 1992) of students. Parental support was manifested in different ways – emotionally, socially, and financially. In an integrated framework, Middleton and Loughead (1993) identified the different ways as *positive involvement*, *non-involvement*, and *negative involvement*. An example of positive involvement was parents who were actively involved in their child’s educational development. Non-involvement illustrated parents who took a “hands-off” approach to their child’s educational development. Such students often reported that their parents were not concerned about their futures. Negative involvement was an illustration of parents who made all the educational decisions and choices for their child. These parents were accused of trying to live their dreams through their child’s.

When examining the academic achievement of minority students in math and science, Smith and Hausfaus (1998) found that parents played a significant role in their children’s academic achievement. The authors further discovered that students did better in math and science when their parents were involved and supportive of their education. Parental support was closely linked with academic success of minorities in math and science. Likewise, Solorzano (1992) found that a college education was held in high regard for African-American families. When researchers controlled for socioeconomic status, they found that African-American families expected their children to attend college to a higher degree than Caucasian parents. Hrabowski (1991) found that parental involvement was a strong element in student success in his Meyerhoff Scholars Program at the University of Maryland Baltimore County, a million-dollar initiative designed to

increase the number of African-American males who were successful in scientific disciplines.

Hrabowski and Maton (1995) presented interesting results from the Meyerhoff Program. The overall grade point average (GPA) of three different cohorts (N=69) of Meyerhoff Scholars was a 3.5, which was significantly higher than comparable-historical cohorts (mean=2.8). These Meyerhoff Scholars even out-performed prior cohort groups in specific science and math courses (means of 3.4 and 2.4, respectively). Although many of the components of the program (e.g., recruitment, bridge program, scholarship support, faculty involvement, etc.) were highlighted, family involvement was the component that distinguished this program from other retention initiatives around the country, especially in scientific fields. For this program, “parents are kept informed of student progress, invited to special counseling sessions as problems emerge, included in various special events, and have formed a mutual support resources, the Meyerhoff Family Association” (Hrabowski & Maton, 1995, p. 22).

Additional data from a comprehensive qualitative study of the Meyerhoff Program (Hrabowski et al., 1998), involving the students (N=60) and their parents (e.g., mother and/or father), revealed a number of factors contributing to the success of the African-American males in the Meyerhoff Program. These factors were “(1) the importance of reading, beginning with parents (especially mothers) who read to their sons at a young age, (2) the parents’ view that education is both necessary and valuable, (3) active encouragement on the part of parents toward academic success, (4) close interaction between the parents and their son’s teachers, (5) strong parental interest in homework, and (6) considerable verbal praise” (Hrabowski et al., 1998, p. 194). The

authors also found that the students and their parents were virtually on the same page about critical parenting components, such as love, encouragement, discipline, and reassurance. Furthermore, the authors indicated that these parents did a great job of encouraging and instilling the importance of academic achievement.

## **QUALITATIVE METHODOLOGY AND RESEARCH**

The purpose of this study was to explore, identify, and examine how African-American males were able to persist and, more importantly, excel in the College of Engineering at Virginia Tech. It was believed that this research would become an example of how persistence can be investigated from the perspective of African-American male students themselves. In regards to qualitative research, many authors (e.g., Krueger, 1994; Mason, 1996) recommend that qualitative researchers carefully develop their research questions, so they would be able to generate meaningful and useful data. In other words, the research questions should be an integral part of qualitative research. Good research questions combined with a strong interview protocol should enable the researcher to highlight the points that African-American males identify as contributing to their success and persistence in engineering. Therefore, every attempt should be made (1) to better understand the institutional barriers that were perceived as having to overcome in order to persist as an engineering student and (2) to pinpoint the factors that most influenced their decision to pursue engineering.

Given the nature and complexity of this study, a qualitative research methodology seemed more aligned with the type of data that would render in-depth information (Mason, 1996; Miles & Huberman, 1984; Patton, 1980) reflective of African-American males' experiences in the College of Engineering. Since African-American males'

experiences often go unheard, qualitative research was “best-suited to discover or investigate the inner person” (Ross, 1995, p.45). In other words, this particular methodology allowed the opinions, perspectives, and emotions of African-American males to be observed in the research, qualities which often do not emerge through quantitative research methodologies (Greenbaum, 1998; Kruegar, 1994; Mason, 1996; Patton, 1980; Rubin & Rubin, 1995). Qualitative data were generated in participants’ own words, expressions, and phrases (Scott, 1995). According to Kuh and Andreas (1991; cited by Graham, 1998, p. 78), a qualitative research methodology shared the following three assumptions:

- (1) a holistic view which seeks to understand phenomena in their entirety in order to develop a complete understanding of a person, program, or situation;
- (2) an inductive approach in which the researcher does not impose much of an organizing structure or make assumptions about the interrelationships among the data prior to making the observations; and
- (3) naturalistic inquiry, a discovery-oriented approach in the natural environment (Rudestam & Newton, 1992).

For this study, the qualitative research methodology employed focus groups and individual interviews. The objective of the interviews was to allow the participants to respond to the research questions “in their own words without preconceived notions imposed by the researcher” (Scott, 1995, p. 70). Using these two research methodologies strengthened the research design because they provided a different context for inquiry and discovery (Graham, 1998; Merton, Fiske, & Kendall, 1990) and the two combined allowed the researcher to triangulate the data, which helped validate the study’s findings (Jorgensen, 1989; Mason, 1996; Miller & Fredericks, 1994; Patton, 1980, 1991;

Silverman, 1985). In addition, the multiple research methodologies (e.g., focus group and individual interviews) helped the researcher reduce bias, in turn allowing the researcher to present a more complete picture of the researched phenomenon (Silverman, 1985). Although each of the qualitative research methodologies had its own particular approach to collecting and analyzing data, what they share was a common conceptualization of human behavior (Patton, 1991) and a strong history in student affairs research (Graham, 1997; Kuh & Andreas, 1991; Patton, 1990, 1991; Scott, 1995). Therefore, the two approaches are most advantageous for the study.

Historically, focus group interviews have been used to capitalize on the strengths of group discussions for the purpose of producing data on a particular phenomenon (Krueger, 1994). Academic research, product marketing, evaluation research, and quality improvements were common reasons for using focus groups (Morgan, 1998). This research approach was frequently employed to learn more about the “unknown” or “subjectivity” of particular topics and/or people. For example, the researcher brought together group participants who had similar backgrounds to discuss a particular topic held dear to the researcher (Rubin & Rubin, 1995). The focus group interviewer’s role was to facilitate discussion and dialogue related to the topic (Krueger, 1994, 1998). This kind of communication was achieved by asking questions and listening to responses of the entire group (Rabin & Rabin, 1995). Since open discussion and interaction have shown to be critical in focus groups, it was imperative that communication was not limited only to two-way conversation, interviewer to an interviewee, instead encouraged communication among all group participants (Krueger, 1998).

The essence of the focus groups was to let group participants spark off each other (Rubin & Rubin, 1995). It was not uncommon for group participants to mention something that was not previously mentioned. In many instances, this helped the researcher see how an individual's opinions and perceptions were shaped or changed by other group participants' dichotomous responses (Krueger, 1994). These dichotomous responses enabled group participants to examine their own views that otherwise might not have been examined.

Many qualitative researchers have found "homogeneous" focus groups most beneficial because they helped reduce repetitive, dichotomous responses. According to Greenbaum (1998), the more homogeneous the focus groups, the better the group participants will relate to one another and, of course, to the topic. The extent of homogeneity was typically predetermined by the study's purpose and recruitment criteria (Krueger, 1994). Focus groups entailed 4 to 12 participants and usually required about one to two hours to complete (Rubin & Rubin, 1995). "Factors determining the group size included: manageability of the group, time, space, resources, the number of groups to be conducted, the type of data the researcher wishes to collect, the desired depth and breadth of the data needed, and the availability of potential participants" (Scott, 1995, pp. 70 – 71).

Other factors to be considered include the different obstacles that often prevent prospective group participants from participating in focus groups. These obstacles are often, indirectly or directly, related to starting/ending times, distance, and location of focus groups (Krueger, 1994). Many authors have recommended that researchers provide enticing incentives (e.g., money, meals, refreshments, certificates, etc.) to prospective

participants for their investment of time (Krueger, 1994; Scott, 1995). Also, the researcher should do a thorough job of identifying potential obstacles that may impede the study. Once, or if, any potential obstacles are identified, the researcher should build the incentives should be built around the potential obstacles to counter or reduce the occurrence of any misfortunes (Krueger, 1994). Such a practice implies that participation in the study was needed and appreciated. Therefore, it can be assumed that participants were more apt to participate in the study if the focus groups were perceived beneficial to themselves or others similar to them.

For this study, focus group interviews provided opportunities for African-American males to share their stories and experiences through group interactions. Therefore, these focus group interviews were considered an excellent method for gathering information related to “persistence” and “engineering.” They seemed to work best when group participants were given opportunities to express their thoughts, feelings, and emotions in a non-disruptive way (Krueger, 1994, Mason, 1996).

Data from focus group interviews provided insights that may not have been possible through other research methodologies like questionnaires and surveys (Krueger, 1994; Kuh & Andreas, 1991). Through this particular qualitative methodology, a natural atmosphere for sharing and disclosing was provided. More often than not, focus group interviews inherently encouraged dialogue and conversational exchange that often prompted participants to investigate their own attitudes, perceptions, and experiences on the given topic or subject area (Krueger, 1994; Morgan, 1998). The interviewer was able to probe deeper into the subject matter, which was not always possible through other structured methodologies, such as mail-out questionnaires and surveys (Krueger, 1994).



The primary purpose of the individual interviews was to obtain data that validated the person's experience (Brenner, 1985). In many ways, the individual interviews were complementary to focus group interviews (Graham, 1998). These particular interviews allowed the researcher to generate in-depth analysis of each person's own story (Graham, 1998). The objective was to get the person to disclose useful information from his own perspective, without collaboration from others. For this to happen, the researcher developed rapport with the interviewee to obtain information related to the phenomenon (Graham, 1998). "For it is only when the researcher and the respondent have the possibility of communicating directly with each other that the subtleties of the mutual understanding between the two parties can be harnessed" (Brenner, Brown, & Canter, 1985, p. 3). Keeping this in mind, it is just as important that the researcher not "bias" or "taint" the interviewing process by guiding the interviewee to answer the questions in a particular manner. Instead, a framework of neutrality was created that does not impose one's views or belief system on the person being interviewed (Brenner, 1985). This is easily achieved by allowing the interviewed person to tell his or her story in his or her own way, completely without the intrusion of the researcher/interviewer (McCracken, 1988).

Validity, reliability, and generalizability of findings have been identified as just as important to qualitative studies as to quantitative research. The three measures are primarily achieved through the objectivity and impartiality of the researcher (Scott, 1995). Therefore, the researcher should be sensitive to one's own bias and prejudice (Jorgensen, 1989). As a way of countering personal bias, selective colleagues should be used to bounce ideas off of for the improvement and credibility of data analysis (Lincoln

& Guba, 1985; Ross, 1995; Scott, 1995). Also, the following three points should be performed: (1) spend sufficient time with each participant to check for discrepancies, (2) explore each participant's experience meticulously, and (3) utilize multiple forms of data (e.g., field notes, literature reviews, etc.) to explain the researched phenomena (Graham, 1997). Lincoln and Guba (1985) referred to the three points as (1) prolonged engagement, (2) persistent observation, and (3) triangulation. Aligned with this, Graham (1997, p. 83) wrote, "A program of cooperative research that utilizes more than one technique within the same research project compensates for the inherent weaknesses in both techniques and provides a means of triangulation."

These two methods of data generation (e.g., individual and focus group interviews) should be strategically conducted, yet sensitive to the researched phenomenon (Mason, 1996). In other words, the primary objective of qualitative research is to plug gaps in knowledge by exploring, identifying, and examining the researched phenomenon.

## **CHAPTER III**

### **METHODOLOGY**

This chapter begins with a brief illustration of the campus setting and concludes with a detailed synopsis of the research design (e.g., sample selection, data collection, data analysis, and trustworthiness of study).

#### **Campus Setting**

The setting for this study was a large, predominately white institution (PWI) located in the southeastern part of the United States and southwestern part of Virginia. The university was founded 127 years ago as the state's first publicly supported, comprehensive, land-grant institution (Beasley, 1998). In this rural setting, the Blue Ridge Mountains surround the university, which gives it a small town ambiance. The university initially placed a strong emphasis on agricultural, mechanical, and technological disciplines. Courses in engineering and agriculture were among the first offered at the university (Virginia Tech College of Engineering, 1997). Expanding its original emphasis, the university began to offer programs in the humanities, arts, and social sciences.

Historically, the university's student composition was comprised of white males, residing in the Commonwealth of Virginia. Women and people of color did not attend the university. Those men who did attend came from various places around the state to pursue their education in agriculture and engineering. While attending school, everyone actively participated in the Corps of Cadets (today, it is one of two remaining state universities with a Corp of Cadets that operates within a non-military student body).

The university is recognized as one of the nation's top fifty research institutions and the state's leading research institution (Virginia Tech College of Engineering, 1997). Today, the university's demographic composition is not consistent with the state's demographic composition. Since its very beginnings, the demographic composition has undergone considerable changes. Although the student body is still predominately white, it now includes both women and people of color. However, in certain academic disciplines, such as engineering, the presence of African-Americans is relatively small. Table 1 shows data on African-American and White students for the last five enrolled cohorts in the College of Engineering.

Total enrollment is about 26,000, including both part-time and full-time students, undergraduates and graduate students. The campus is divided into eight different Colleges: (1) College of Engineering; (2) College of Architecture; (3) College of Agriculture and Life Sciences; (4) College of Human Resources and Education; (5) College of Forestry and Wildlife Resources; (6) College of Veterinary Medicine, (7) College of Business; and (8) College of Arts and Sciences. The College of Engineering, the second largest, tends to overshadow the other Colleges with its cutting edge technological advancements and huge research grants. As a result, programs in the College of Engineering have received a lot of interest, both from prospective students and employers. However, this College has not always been able to recruit, retain, and graduate African-Americans in large numbers.

During the 1980s, the College of Engineering began committing resources to recruit underrepresented students (e.g., African-Americans, Hispanic-Americans, and women) in engineering.

Table 1

Data for Engineering Cohorts:

<b>1995 Cohort</b>	<b>African-American</b>		<b>White</b>	
	Males	Females	Males	Females
High School GPA	32 3.30	13 3.35	728 3.48	146 3.60
Math SAT	42 573	16 516	853 644	197 622
Verbal SAT	42 458	16 428	853 527	197 523
Total SAT	42 1031	16 944	853 1170	197 1145
High School Class Rank	32 20%	13 14%	707 17%	165 12%

<b>1996 Cohort</b>	<b>African-American</b>		<b>White</b>	
	Males	Females	Males	Females
High School GPA	47 3.23	22 3.35	970 3.49	176 3.71
Math SAT	48 545	23 549	997 647	182 636
Verbal SAT	48 529	23 540	997 590	182 606
Total SAT	48 1174	23 1088	997 1237	182 1242
High School Class Rank	39 19%	21 21%	809 17%	144 11%

<b>1997 Cohort</b>	<b>African-American</b>		<b>White</b>	
	Males	Females	Males	Females
High School GPA	45 3.38	20 3.57	897 3.55	170 3.71
Math SAT	45 575	20 549	931 646	175 636
Verbal SAT	45 528	20 538	931 597	175 608
Total SAT	45 1102	20 1087	931 1244	175 1245
High School Class Rank	39 16%	18 10%	740 16%	151 10%

<b>1998 Cohort</b>	<b>African-American</b>		<b>White</b>	
	Males	Females	Males	Females
High School GPA	51 3.29	16 3.55	871 3.53	170 3.67
Math SAT	52 564	16 556	905 647	174 630
Verbal SAT	52 528	16 543	905 596	174 597
Total SAT	52 1091	16 1098	905 1242	174 1227
High School Class Rank	42 17%	14 10%	712 17%	150 12%

<b>1999 Cohort</b>	<b>African-American</b>		<b>White</b>	
	Males	Females	Males	Females
High School GPA	36 3.29	10 3.52	847 3.57	164 3.72
Math SAT	42 578	11 554	905 646	171 644
Verbal SAT	42 535	11 528	905 597	171 600
Total SAT	42 1113	11 1082	905 1244	171 1244
High School Class Rank	32 22%	9 12%	679 17%	132 11%

After successfully recruiting underrepresented students (e.g., African-Americans), the College still fell short in graduating the students. As a way of improving the graduation rates for African-American students, in the 1990s, the College created an Office of Minority Engineering Programs (OMEP) to recruit, retain, and graduate these students. OMEP developed programs (e.g., academic advising, pre-college initiatives, mentoring, and tutoring) to improve recruitment, retention, and graduation rates for underrepresented students (Office of Minority Engineering Programs, 1996). As a result, the representation and graduation rate of underrepresented students in the College improved dramatically but still has room for improvement.

From 1987 to 1996, the College graduated on the average: 20 ( $n=202$ ) African-Americans, 11 ( $n=109$ ) Hispanic-Americans, and 209 ( $n=2,092$ ) women, out of an average of 4460 ( $N=49,065$ ) engineering students each year (Office of Minority Engineering Programs, 1996). In general, the men outnumber women in engineering. As a result, they receive more engineering degrees.

### **Sample Selection**

This study proposed to explore, identify, and examine how African-American males were able to persist in the College of Engineering at Virginia Tech. The findings were used to gain insight into how some African-American males persevered in engineering disciplines and others do not. Through qualitative research methods, African-American males had the opportunity to highlight factors, which contributed to their persistence in engineering and college in general. It was expected the study would render data that could be used to improve recruiting, retention, and graduation rates of African-American males in the College of Engineering.

For this study, the researcher was interested in five groups of African-American male engineering students. The first group (Ultimate-Persistent Group) was African-American male students who had already graduated with an engineering degree from Virginia Tech. The second group (Exemplary-Persistent Group) was African-American male engineering students who were categorized as juniors and/or seniors with a 2.5 QCA or higher. The third group (Satisfactory-Persistent Group) was African-American male engineering students who were categorized as juniors and/or seniors with a 2.0 – 2.5 QCA. The fourth group (Unsatisfactory-Persistent Group) was African-American male engineering students who were categorized as juniors and/or seniors with less than a 2.0 QCA. The fifth group (Non-Persistent Group) comprised of African-American male students who had left engineering but were classified as juniors and/or seniors based on the number of years enrolled in university. The sample breakdown is noted in Table 2.

Following approval of the research proposal by the Institutional Review Board to Conduct Research Involving Human Subjects (Appendix 1), Virginia Tech's OMEP was contacted for assistance in identifying and locating African-American males in the College of Engineering who met the study's minimum criteria. As a result, the researcher obtained names, addresses, telephone numbers, and email addresses of potential participants. These individuals were contacted by personal emails in the form of a letter (Appendix 2 & 3). The email messages provided information about the purpose of the study, requirements of participation, scheduled dates/locations, and contact information about the researcher.

Table 2

Required Characteristics of Sample:

Profile Descriptor	QCA Requirement	Academic Status	Academic Major	Race	Gender
*Ultimate-Persistent Group	Not Required	Completed degree	Engineering	Black	Male
Exemplary-Persistent Group	2.5 QCA or Higher	Juniors and Seniors	Engineering	Black	Male
Satisfactory-Persistent Group	2.0 – 2.5 QCA	Juniors and Seniors	Engineering	Black	Male
Unsatisfactory-Persistent Group	Less than a 2.0 QCA	Juniors and Seniors	Engineering	Black	Male
**Non-Persistent Group	Not Required	Juniors and Seniors	Non-Engineering	Black	Male

\* This group was referred to students who have already graduated with an engineering degree from Virginia Tech. The researcher was more concerned about whether or not the person had graduated with an engineering degree rather than the person’s actual QCA.

\*\* This group referred to students who changed from engineering to another major but was classified as juniors and/or seniors based on number of years enrolled in university. The researcher was more concerned about why the student changed his major rather than what his QCA actually was.

### Sampling Techniques

Those African-American males who met the minimum criteria for the *Ultimate-Persistent Group* were contacted by using a “snowball sampling” technique (Bogdan & Biklen, 1992; Mertens, 1998), which was initiated through a personal email in the form of a letter. Since most of the alumni lived in other states, it was concluded that the snowball sampling technique was the most logical and efficient way to solicit participation in the *Ultimate-Persistent Group*. The snowball sampling technique is considered a widely accepted technique in qualitative research as long as a credible explanation of the researched phenomenon being studied was provided (Kaase & Harshbarger, 1993; Lincoln & Guba, 1985). The researcher contacted African-American male engineering alumni who stayed in contact with the OMEP and who were on the OMEP alumni-emailing list. Alumni members were asked (1) to participate in the study



and (2) to recommend other African-American male engineering alumni who might be interested in participating in the study. This process was continued until ten willing participants were gathered. For the *Exemplary-Persistent Group*, *Satisfactory-Persistent Group*, *Unsatisfactory-Persistent Group*, and *Non-Persistent Group*, a random sample was used. Initially, ten students, for each group, were invited to participate in the study. However, the researcher was unsuccessful in obtaining the goal of ten participants for each group.

For all five-sample groups, prospective participants were requested to let the researcher know, within one week after receiving the email message in the form of a letter, whether or not they were going to participate in the study. A small gift of \$10.00 was offered to encourage participation in the overall research study (e.g., focus groups, individual interviews, and biographical questionnaire), and participants were also promised refreshments and snacks for the focus group interviews but not for their individual interviews. The *Ultimate-Persistent Group* was the only group not promised refreshments and snacks because these individuals participated in “electronic” focus groups and individual interviews.

After hearing from prospective participants who said they were going to participate in the study, personal letters in the form of emails (Appendix 4 & 5) were sent, attached with an informed consent form (Appendix 6), biographical questionnaire (Appendix 7, 8, & 9), and information on their scheduled focus groups and individual interviews. If a prospective participant failed to respond to the email message by the deadline, the researcher called the participant to request his participation. Everyone that was initially solicited to participate agreed to participate in the following samples:

*Ultimate-Persistent Group* and *Exceptional-Persistent Group*. However, this was not the case for the *Satisfactory-Persistent Group*, *Unsatisfactory-Persistent Group* and *Non-Persistent Group*. Many of the prospective students in these three sample groups did not show-up for their scheduled focus groups and/or just opted not to participate in the study all together. In the case of the *Satisfactory-Persistent Group*, three students did not show up for their scheduled focus group; as a result, they were disqualified for the study. The three students' absence did not present any threats to this group's data because researchers, when conducting focus groups, usually invite more students than they need. In other words, they usually invite ten participates in focus groups when actually they expect seven to eight to show up or complete the study. In the case of the *Unsatisfactory-Persistent Group* and *Non-Persistent Group*, many participants in these categories gave a number of reasons for not participating, such as not having enough time to participate and having time conflicts with scheduled dates. Everyone on the two lists was invited to participate because the two groups were relatively small. As a result, the researcher got seven total participants in the \**Unsatisfactory-Persistent Group* and eight total students for the *Non-Persistent Group*. Forty-two total participants started and completed the entire study, when combining all five-sample groups.

Follow-up emails in the form of a letter were sent to all five samples to remind the participants about their scheduled focus group (Appendix 10) and individual interview (Appendix 11). A second reminder was given by telephone.

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\* One participant transferred out of engineering the day of his focus group but neglected to tell the researcher until after the focus group. The participant was still included in this sample rather than the *NPG*.

## Data Collection

An interview guide with open-ended questions was used as the interviewing protocol. There was an interviewing protocol for the focus groups (Appendix 12, 13, & 14) and individual interviews (Appendix 15, 16, & 17). Both interview protocols allowed the participants to conceptualize their perceptions and opinions in their own words. The protocols also helped minimize leading or directing participants to answer the question in a particular manner (Brenner, 1985; Schwitzer, Griffin, Ancis, & Thomas, 1999). Both interview protocols served as a reference sheet to make sure the interviewer covered all relevant topics and questions (Patton, 1987).

The focus groups ranged from 2.5 to 3.5 hours, and the individual interviews ranged from 30 minutes to 1 hour. Both interviews took place in an empty room in OMEP for all the sample groups, except the *Ultimate-Persistent Group*. The *Ultimate-Persistent Group* participated in “electronic” focus groups via *AOL Instant Messenger* (Appendix 18). This method was chosen because members of this group lived far away and because “electronic” focus groups were more convenient for both the researcher and participants. Although *AOL Instant Messenger* was relatively secure, all participants were requested to use pseudonyms for anonymity.

Before each focus group, the participants were requested to complete both the informed consent form and biographical questionnaire but only if they had not already returned these forms. Individuals who participated in the *Ultimate-Persistent Group* had to fax all paperwork to the researcher prior to their scheduled “electronic” focus group. The “traditional” focus group interviews started right after completing any needed paperwork and having refreshments. They were concluded by focus group facilitators

with highlights of the interview. When the focus group interviews were completed, the participants were contacted the same night via telephone and/or email to see if they had any other thoughts related to the focus group topics and when they wanted to schedule their individual interview (Appendix 19). The study's participants were contacted via email to remind them of their scheduled individual interview.

As in Graham's (1995) study, one of the underlying premises was to "develop a theory of persistence through the use of open-ended questions, thus allowing the participants the flexibility to frame and structure their responses" (p. 88). Along with the focus groups, individual interviews were used to collect data. They took place in an empty room in OMEP for all the samples, except for the *Ultimate-Persistent Group*. The *Ultimate-Persistent Group* participated in "electronic" individual interviews via *AOL Instant Messenger*. This method was used because members of this group lived far away and because "electronic" individual interviews were more convenient for both the researcher and participants. Participants in this group were requested to use pseudonym names to protect their identities. For the other individual interviews, the "traditional" individual interviewing method was used. This method consisted of taking notes, in addition to audio taping each interview. Closure for each interview was provided by summarizing the main points. Thereafter, participants were given their \$10.00 gifts for participating in the study, and, the next day, participants were contacted via telephone or email to see if they had any other thoughts as a result of their individual interview (Appendix 20). In addition, each participant was sent a personalized thank-you note in the form of an email (Appendix 21). This was also the case for the *Ultimate-Persistent Group*, but the researcher did not audio tape the interviews; instead, he was able to print

out the interview from *AOL Instant Messenger*. In addition, these participants were mailed their \$10.00 gifts.

To make sure the research questions generated data relevant to the study, selected colleagues were involved to provide feedback and recommendations on research questions and findings. Ross (1995) categorized such colleagues as “key informants” or “peer debriefers.”

### **Data Analysis**

All focus groups and individual interviews were audio taped, transcribed verbatim, coded, and analyzed utilizing the grounded theory approach. *Grounded theory* (Glaser & Straus, 1967; Mason, 1996; Scott, 1995) refers to collecting and analyzing data simultaneously for the purpose of developing theoretical and thematic explanation, in turn, to explain, compare, and trace the development of the researched phenomena. This process involved the following steps: “ (1) comparing the data applicable to each conceptual category; (2) integrating the categories and their properties; (3) delimiting the emergent theory; and (4) writing up the theory” (Jorgensen, 1989, p. 113). Field notes and information from the biographical questionnaire were also included in the analysis.

The researcher relied heavily on the transcripts for analyzing the data. This process was referred to as *transcript-based analysis* (Morgan, 1998). However, other sources of generated data were used for this approach including field notes, follow-up summary statements, and biographical questionnaires. The different methods of obtaining data can be found in Table 3.

Followed by each focus group interview, the researcher, along with selected colleagues, discussed the interview process and compared notes. The people involved

were the researcher and three other people trained in qualitative research (e.g., two advanced level graduate students and one hired consultant), but only two of the three colleagues (e.g., one advanced level graduate student and one hired consultant) actually participated in the data analysis. Both advanced level graduate students were involved with the focus groups by being either the facilitator and/or note-taker. After getting the audio tapes transcribed, the researcher gave his selected colleagues copies of the transcripts, so they could help code and develop themes from data. They were also asked to read the transcripts a minimum of two times before coding and developing any themes. After this process was completed, the selected colleagues met with the researcher to discuss their categories and themes. They coded the data and identified recurring themes, then copies of the conclusions were sent randomly to participants in all five samples to make sure the conclusions coincided with findings.

In conclusion, this process continued throughout the study until saturation and redundancy occurred (Scott, 1995). Saturation and redundancy suggested that generated data were not producing any new information.

### **Trustworthiness of Study**

In qualitative research, it should be assured that all responses are accurately reported and represented (Scott, 1995), and multiple sources should be used to triangulate the data to increase the study's credibility (Miles & Huberman, 1994). For this study, multiple sources were used to address triangulation and credibility issues. As a result, literature reviews, focus groups, individual interviews, biographical questionnaires, field notes, and telephone follow-up statements were used to triangulate the data for this study. The research team was also used to help analyze the data and to provide reliable feedback

and recommendations about the findings (Lincoln & Guba, 1985; Ross, 1995). In other words, the research team served in the role as “peer debriefers” to increase objectivity (Scott, 1995).

Table 3

Data Sources for Research Questions:

1. What individuals have been most influential in African-American males' academic interest in engineering? How have these individuals influenced their academic interest in engineering?

**Data Sources:** Literature Reviews, Focus Groups, Individual Interviews, Biographical Questionnaire, Field Notes, and Telephone/Email Follow-up Statements.

2. What experiences, both positively and negatively, have had the greatest impact on African-American males' academic persistence in the College of Engineering?

**Data Sources:** Literature Reviews, Focus Groups, Individual Interviews, Biographical Questionnaire, Field Notes, and Telephone/Email Follow-up Statements.

3. How has the engineering, institutional, and social culture, both positively and negatively, affected the experiences of African-American males in the College of Engineering?

**Data Sources:** Literature Reviews, Focus Groups, Individual Interviews, Biographical Questionnaire, Field Notes, and Telephone/Email Follow-up Statements.

4. Why do some African-American males persist in the College of Engineering and others don't?

**Data Sources:** Literature Reviews, Focus Groups, Individual Interviews, Field Notes, and Telephone/Email Follow-up Statements.

5. Are there any differences in the persistence of African-American males in the College of Engineering with a 2.5 QCA or higher, between a 2.0 – 2.5 QCA, and less than a 2.0 QCA?

**Data Sources:** Literature Reviews, Focus Groups, Individual Interviews, Biographical Questionnaire, Field Notes, and Telephone/Email Follow-up Statements.

6. To what degree are African-American males willing to persist in engineering?

**Data Sources:** Literature Reviews, Focus Groups, Individual Interviews, Field Notes, and Telephone/Email Follow-up Statements.

7. What support do African-American males seek to help them persist through engineering? Why?

**Data Sources:** Literature Reviews, Focus Groups, Individual Interviews, Field Notes, and Telephone/Email Follow-up Statements.

8. Are there any differences in the types of help sought by African-American males in the College of Engineering with a 2.5 QCA or higher, between a 2.0 – 2.5 QCA, and less than a 2.0 QCA?

**Data Sources:** Literature Reviews, Focus Groups, Individual Interviews, Field Notes, and Telephone/Email Follow-up Statements.