

Factors Influencing The Persistence And Non-Persistence Of African American Students In
Scientific Majors At A Predominantly White University

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Dissertation submitted to the Faculty
of the Virginia Polytechnic Institute and State University
in partial fulfillment of the requirements for the degree of

Doctor of Philosophy
In
Curriculum and Instruction

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April 26, 2006
Blacksburg, Virginia

Key words: attrition, retention, African Americans in science, diversity, networks, and relationships

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Abstract

Factors that influenced African Americans to persist or not persist within their scientific major while matriculating at a predominantly White university guided the focus of this study. The study explored the perceptions of African Americans that were both persistent and non-persistent within with their scientific major in order to gain a better understanding of what steps could be taken for the retention and encouragement of more African Americans in these fields at a predominantly White university. The study explored other factors besides intelligence that inhibited or promoted the success of African Americans in scientific fields.

The study was qualitative in nature and participant interviews provided the data for the study. Actor network theory was used as a theoretical framework for exploring the factors that caused students to persist or not persist within a scientific major with the major implications of the study being: (1) The persistence of students had more to do with the open and closed networks they participated in rather than their intellect; (2) The student development of networks aligned with their ability to overcome the negative images associated with them in science; (3) Students' development of closed networks were a means of protection.

Acknowledgements

As I look back over my life and think things over, I can truly say that I have been blessed. I am truly a living testimony. Over the years, I have had the pleasure of meeting people who have been very instrumental in my development as a student. Without their support and interest, my journey towards this accomplishment would have been much more difficult.

I would first like to acknowledge my advisor, George E. Glasson, in his support of me. His leadership and guidance of my process allowed me the opportunity to take risks I normally would not have taken. He encouraged, motivated, and inspired me to step outside of my comfort zone and to have faith in my ability. He pushed me when I need to be pushed and laid off of me when that was necessary as well. He was truly an advocate for me as a student and I will forever be indebted to him.

I would also like to especially thank Dr. Brenda R. Brand in her continuous and steadfast support of me. Without her guidance, understanding, and care I would have truly been lost as I struggled to find confidence in my abilities and myself. Words alone cannot and do not adequately describe the debt of gratitude I owe her. Regardless of the headaches that I may have caused her over the years, she has been in my corner from day one and has not wavered from that position. She has truly been a blessing and an inspiration in my life.

I would also like to acknowledge the contributions of Dr. Jan Nespor. His unique perspective and explanation of the interactions and processes that occur in the world has truly had an effect on the way that I view society. The conversations we have had privately and those that have taken place within his courses assisted me in learning how to view various phenomena from a different perspective than my own. In short, he assisted me in my ability to think outside the box and look beyond the obvious. Also his support during my tenure as a graduate student has helped to guide me through this entire doctoral process.

The next member on my dissertation committee has been equally as helpful in my tenure as a graduate student. Dr. David Hicks has been a source of comfort for me since I came into the science education program. Dr. Hicks personally made me feel at ease when I was in environments in which I was the only minority. He was, in a sense, my access card into networks that I would have found difficult to enter and navigate myself, which is fitting since this dissertation dealt with networks and exclusion from them. He has been both a committee member and a friend during my time at Virginia Tech, and for that I am and will eternally be grateful to him.

Finally, the last member of my committee was Dr. Michael Herndon. Dr. Herndon has always provided me with a kind word when one was needed. As a Black man in higher education, he has served as a role model and a source of inspiration for me and other Black men on the campus of Virginia Tech. His success thus far in higher education signaled to me that I could accomplish my goal if I persevered. Dr. Herndon always told me to just keep working and things would eventually come together. He often used himself as an example of the things that were possible if one were just to persist and not give up.

I must acknowledge my family because without them none of this would be possible. My mother's, Doris S. Green, and father's, James E. Green Jr., love for me and mine for them, cannot be measured. They have supported me through every stage of my life without question. They taught me to treat everyone with respect and kindness as well as provide me with a desire to want to better myself. My parents were always there to remind me of who I was and from which I came when life was seemingly beating me down. Without their encouragement, support, love, understanding, good thoughts, and prayers, I would have been truly lost. My God and my parents has been my anchor in the midst of the storm.

I also would like to acknowledge my siblings Linda G. Green, James D. Green, and Dr.

Terry B. Green for the love and support they have shown me over the years as well. I would like to give special recognition to Terry for not letting me get too down on myself when things did not go as planned. He has truly been a source of strength for me in some of my greatest times of weakness.

I would also like to thank my aunts, uncles, cousins, and niece. I thank each of them for their support and love. Just their mere presence in my life has motivated me to be persistent in my goals. Each of them has been a true blessing in my life. I would also like to give special recognition to my grandmother, Pearlia M. Green, who is currently 96 years old, and my grand father, the late James E. Green Jr. Both expressed to me in 1991 to go and “bring that college home”, well grandmother and granddaddy, I have gone, I am bringing it back, and I am not going back any more. I would also like to thank my other grandparents, the late Issac and Deena Strange, for their love and support during their tenure on this side of Jordan River. I know that they are looking down on me from heaven and are just tickled pink that I have achieved such an accomplishment.

In addition, I would like to give special thanks to my aunt and uncle, Dr's. Ernest and Ernestine McNealy for their part in encouraging me to work towards an advanced degree. They helped and provided me with opportunities early in my academic career that have shaped my life. Both are magnificent individuals that are doing great things for African American students and that truly inspires me to want to pattern my life after theirs. I have finally earned that sheep skin my uncle has always encouraged me to pursue and I plan to put it to good use by achieving in every field of human endeavor.

I would also like to acknowledge First Baptist Church and Voices of Expression in their support of my efforts. Rev. Dr. P. L. Barrett has been a stable figure in my life for the past eight years and I thank him for that. The combination of being a member of the choir and his

messages brought me peace when I sometimes struggled with life. I have lived in Blacksburg for almost a decade and the members of Voices of Expression have changed from year to year, but the spirit has always remained constant. I thank each of them for their love, support, and kindness.

I would also like to thank Alabama State University and Hampton University for providing me with the foundation to be successful at Virginia Tech. I am proud to say that I am a graduate of both institutions and knowing what I now know, I would attend both universities again without hesitation. I would also like to thank all the friends that I have gained over the years for their support as well. To try to name them all would more than likely result in me forgetting someone, so I will refrain from that action. Each of them has played an important part in my life and I thank them all for their encouragement through the years.

Finally, I would like to thank my significant other, Bevley D. White. She has endured my ups and downs, my good and bad days, and my good and bad attitudes. She has encouraged me, taken care of me, and believed in me even when I did not. Honestly, she probably has more faith in me than I do in myself. She has been my best friend through all of this and I sincerely love her for all the support she has given me over the years. To try and described the love that I have for her would do her a disservice, so I will simply say: “Thank you ” and “I love you.”

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Chapter One: Introduction

How am I situated in the Research?

I have two degrees in chemistry as well as a minor in mathematics. I am a National Science Foundation scholarship recipient in the field of science. I have presented at various conferences around the country in the field of chemistry but I apparently was not smart enough to handle graduate chemistry on a doctorate level at a predominantly White university. Was I smart enough? I would like to think so, but the fact remains that I left a chemistry PhD program because I felt as if I was not smart or better yet was made to feel as if I was not intelligent enough to handle chemistry on the doctoral level.

While in a chemistry PhD program at a predominantly White university I formed very few relationships with the professors. I went basically unnoticed and I felt as if no one really cared whether or not I succeeded. No one ever told me that I would not make it, but subtle things were done to other African Americans that led me to doubt my ability. I chose to leave the program after all my course work was completed, I did not fail the program. I chose to leave because I felt I would not be supported in a way that I needed in order to be successful. Other African Americans had racial suits pending in the program, the NAACP was involved on behalf of other African Americans within the program, and academic deans had to get involved just to make sure that the department knew that someone was watching. This truly was not the place for me.

I left that department and started to pursue two degrees in science education at the same predominantly White university. Within this department, over the course of 6 years, I have formed numerous relationships with seemingly every professor in the building. I have been made to feel as if I was a valued member of the community, that what I thought mattered, and above all else, made to believe that I would succeed in the program. Truthfully, when I started

the program my distrust for White professors had to be noticeable, but over time the wall I built around myself for protection was and is being chipped away thanks to professors that seemingly care about my development as a graduate student.

The biggest help in this process was the assistance of an African American female professor within the department who had gone through the program herself a few years earlier. The interactions with her catalyzed my relationships with other professors within the department. After getting to know this professor, her mere presence gave me confidence; finally, I felt that someone was on my side. She constructively criticized me, as did the other professors within the department, but for the first time since my tenure as a student at a Historically Black University, I felt as if I was judged and supported as just a student, meaning that the color of my skin had little bearing on how I was treated within the department.

I am confident in saying that even if this African American professor were not present, I would have still experienced a level of success because I had already obtained an Educational Specialist degree from the department before she was hired. Although I had this accomplishment, my confidence and trust towards the faculty still varied because I kept waiting for something bad to happen, as it always seemed to do. I entered the program with baggage that I had accumulated all my life and her arrival sped up the process that would have taken much longer if she were not present. There is research that shows that African American students are helped by the presence of African American faculty within their academic major, and there is research that shows that it has very little influence whatsoever. As for me, it made a significant difference because as stated earlier, it was the interactions with her that catalyzed my willingness to trust the other faculty.

This research was about exploring the climates in scientific majors in which African Americans participate. I wanted to study why these climates existed and the origins of these

climates. This document was a self examination as well as documentation of other African American experiences so that those in higher education will recognize and change certain behaviors that make African Americans, majoring in scientific fields, feel as if they are not wanted and valued. Most importantly, I wanted to expose those behaviors that make African Americans doubt their intellectual abilities.

Writing this piece has relieved me of certain stressors that I have carried around since I came to study at a predominantly White university. I now have the knowledge base needed to explain, explore, and discuss certain phenomena that have taken place in my life as well as in the lives of many African Americans. I have explored the literature and through this exploration I have been able to hypothesize why certain trends exist within the scientific community. For example the trend of few African Americans taking advanced math and science related courses on the high school level, or the trend such as low numbers of African American students in science majors at predominantly White universities.

Liberation may occur when exploring demons of the past. Doing the required literature review and research has given me some peace where there was once conflict because I see that what I experienced has been happening since and before Africans were brought to this country, although I still at times wonder what my life would have been like as a practicing chemist with a doctorate degree. Knowing that there were societal structures in place that discouraged my involvement in chemistry provides little comfort because regardless of the peace of mind I now have, I am still haunted by the fact that I was not strong enough to handle the pressure. The failure I experienced was internal because I chose to leave my science program, but I often wonder if I had persisted with my graduate work in chemistry and finished the requirements for the degree, what price would I have paid emotionally. This research allowed me to explore the

aspects of emotional damage as well as feelings of not being wanted, through interviews and interactions with African Americans within scientific majors.

The fact remains that no matter how I choose to look at the situation, I essentially changed majors in the middle of a doctorate program in chemistry. I started to believe the stereotypes that existed about people of my color. Part of me believed that I was not intellectual enough to earn a doctorate degree in chemistry. Thinking back on that experience reminded me of how afraid and alone I felt because I felt I did not have anyone that I could turn to for help or support.

The classes were difficult but I had taken difficult classes before at other institutions. The difference was that I was not afraid of going to my professors at the predominately Black Universities that I attended. I was not afraid of what they thought of me. I was part of study groups and felt as if I was a valued part of the community. I thrived and was successful at these institutions. Truthfully, failure was not even a consideration because I knew that the support needed would be given in order to be successful. That is not to say that a chemistry course at a Black institution is easier than a chemistry course taught at a White institution because that is not the case. Chemistry is chemistry no matter what school one attends. However for me the process itself was easier because I felt as if my professors genuinely cared about my development as a chemist, wanted me to succeed, and provided me with the assistance needed in order to be successful, whether I wanted it or not.

At the predominantly White university, I was not part of any study groups. I felt isolated and needed help or a way out. Help seemingly was not an option so leaving was something that I felt I had to do for my survival. I did not want to leave, I wanted to finish my degree; I had dreamed of it since I took chemistry in high school. The truth was to stay in the program meant risking failure and going home with shame. The other option was to change my major to

something else I enjoyed and hope that the attitudes and demeanors within that major were different.

Two factors in particular were the determining reasons why I left my chemistry program. The first was the idea of failing, which in my mind, meant confirming the notion that African Americans were not intellectual enough to get a doctorate in a hard science. Maybe I did that anyway, but by leaving they could only speculate, they could not say definitively that I would have failed. I left the department with completed course work in good standing with the university. Before I would have failed and confirmed Before accepting failure and confirming any notion of African Americans not being intellectual enough to handle scientific majors, I would have committed suicide or left the program. Suicide was never a thought and not that appealing, so I left the program, but the feelings I felt were just that strong. The feelings were so intense because my life to that point had been planned around getting a doctorate degree in chemistry and when that did not materialize, I was in flux. I did not have an alternative plan because I never figured that I was not good enough to make my dreams reality.

The second reason is that I did not want to disappoint my family by failing out. To me that would have brought an embarrassment to them that they did not deserve. In my community, and many African American communities, the family of those in school live vicariously through their children because in many cases they were not afforded the educational opportunities that their children received. To not succeed meant disappointing those that have supported me financially and mentally over the years, so failure was a risk that I was not willing to take. Chances are that my family would have not been disappointed in me if I did not succeed for their goal was for me to be happy in life. The problem is when going through a storm, or in the midst of a storm, people tend to see things from a pessimistic point of view and I was no different.

I could have gotten a good job in the chemistry field and probably made a descent living financially. After all I had two degrees in chemistry with completed doctorate course work for the third, but taking a job meant failure in a sense because I went to school to earn a doctorate, not to give up and get a job. The degree that I chose to pursue would not be in chemistry but it would provide just as many opportunities as chemistry. Switching my major to a more supportive program in another area that I enjoyed was my saving grace and still allowed me to realize a long time dream of being called Dr. Green.

I am usually a person that likes to take calculated risks. I like to see if I can beat the odds when the deck is stacked against me. I beat the odds of graduating in the top five percent of my class in high school. I beat the odds of being a Black man and going to college instead of jail. I beat the odds of going and graduating from college with honors and doing it in a science. I beat the odds of going on to graduate school and obtaining a Master's degree in analytical chemistry. All my life I have been beating the odds and dispelling stereotypes that seem to characterize African Americans, but this time the risk was too great for me to persist. Support is an intangible resource that cannot be measured, and to knowingly continue in a situation where one feels that none would be given is courageous to say the least.

To tell this story and not take responsibility for my role in my decision to leave my doctorate program in chemistry would not be fair to the predominately White institution that I attended. I probably could have studied more, but when one feels failure is inevitable, it is hard to concentrate and persist. I probably should have been more aggressive with my advisor and explained how I was feeling and that I needed help, but I truly felt like he really did not want me there and could have cared less if I had left. I could have gone to the department head, or head of graduate studies within the department and tried to get assistance, but in my mind it would have been a useless endeavor. I felt like I was stupid, dumb, inadequate, and an embarrassment

to myself, to my family, to the Black universities that I attended, and to all the African Americans from previous generations that sacrificed all for me to have that opportunity. What would have been the point of taking the risk, failing, and confirming what I felt they already thought of me?

This is my story. It may be similar or possess some of the same characteristics of other African Americans who switched their major from science while studying at predominantly White universities or it may be totally different. The science education literature shows us that the marginality of African Americans happens on every level within the sciences, from elementary school, to the highest level of educational attainment. I qualitatively explored the effects of this marginality by studying the stories of those African Americans at predominantly White universities that chose to persist in and leave the field of science. By studying why African Americans chose to change and those who chose to remain in scientific majors, the current literature should be extended about the actions that can be taken for the retention and recruitment of more African Americans into scientific fields. At the very least, it will provide some insight into some of the feelings many Black students have while studying science at a predominantly White institution.

Purpose

The purpose of this research was to examine factors influencing African American students' participation in scientific fields in lieu of the historical and political misuse of science and its modern conceptions. The study was designed to give voice to their perceptions of studying science in predominantly White environments.

This research attempts to provide information useful for effectively confronting the negative stereotypes within the halls of higher education that distribute assertions of inadequacy and also declarations of entitlement. The ultimate goal of this research was to shed light on this

climate, the infrastructure that currently exists, and to ultimately show that this infrastructure is a major contributor to the lack of participation by African Americans in scientific fields.

This study examined the experiences of African Americans who could no longer persist in a scientific major as compared to those African American students who were currently persisting. Studies of a quantitative and qualitative nature exist in the literature reporting the failure and successes of African Americans in scientific fields (Smyth & McArdle, 2002; Greene, 2000; Simpson, 2001; Grandy, 1998; Scott, 1995) but none actually tell the story of those African Americans that met all the criteria required by the predominantly White university, but still chose to leave their scientific major. Present studies concentrate more on those students that persisted within their major, so this research was designed to go beyond the quantitative findings and give voice to those African American students that the data does not represent.

Research Questions

The research will be guided by the following questions:

- 1) What factors influenced the decision of the African American student to major in a scientific field upon completion of high school?
- 2) What were the experiences and feelings of the African American student while majoring in a scientific field at a predominantly White university?
- 3) What factors led African American students to the decision to change academic majors from a scientific field?
- 4) What factors influenced the decision of those African Americans who chose to persevere within their chosen scientific major?
- 5) How did the personal network of the African American student contribute to (his/her) failure/success within their chosen scientific major?

Background of the Problem

In this society most would agree that a good way to financially secure a decent living is to obtain a good education in a field that is essential to mankind. This society is scientifically and technology driven, so in order not to be left behind it behooves a person to develop the skills necessary to compete in a market that our country's economic future is tied to (Maton et al., 2000). The demand for citizens with scientific backgrounds increases with each generation and that demand will continue to grow due to the fact that these skills are seen as vital to all areas of the American way of life (Smyth & McArdle, 2002).

The problem is that in the past, as well as presently, several minority groups are seemingly locked out of the success that could come with having a scientific education. Quite a while ago the American government made a vow to assist African Americans in obtaining educational equivalence with Whites (Maton et al., 2000) in hopes that this would secure equal opportunity in this country. Close to forty years later that objective is not close to being achieved in those things that truly hold value in this country, but the commitment is said to remain intact (National Task Force on Minority High Achievement, 1999).

The assimilation of African Americans in science remains a concern for the Black community and has to be a major concern for this society in general. Racism and prejudices are major contributors that perpetuate the marginality of African Americans (Franklin and Franklin, 2000). Tatum (1997) defines this marginalization in her book "Why are all the Black Kids Sitting Together in the Cafeteria" as "the cultural images and messages that affirm the assumed superiority of Whites and the assumed inferiority of people of color" (pg. 6). These messages, embedded within the subconscious of society, play a major role in determining African American participation and experiences in scientific fields. This research focuses on the factors that contribute to African Americans matriculating at a predominantly White university,

changing their academic major from a scientific focus.

Several bridge programs exist at both Black and White institutions whose primary purpose is to help minorities' transition from high school to college. The programs on the campuses of White institutions are designed to try to help these students adapt to an environment in which they are a small minority. The hope is that by allowing these students to take classes during the summer before the rest of the incoming class arrives, the institution will have a better chance of retaining the student until graduation.

The fact that these programs exist on primarily every predominantly White university is a clear indication that the university knows that minority students, especially those of African descent, are not competing on a level playing field with the majority of the students that attend the university. The programs help some students but in majors that are scientific in nature, majors that are traditionally dominated by White males, the attrition rate of African Americans is still very high. This suggests that trying to integrate and introduce a student into an environment that maybe hostile prior to his or her arrival is not the only factor when dealing with retention.

Educational Importance

Society as a whole pays a penalty for its quietness. Uncontested private, ethnic, and institutional racial discrimination damages human promise, and causes a sense of anxiety, apprehension, and hostility in this society. It dirties our perception and alters our images of one another (Tatum, 1997). "The Toxin of racism that runs through the veins of society has yet to find an antidote and it can traumatize, hurt, humiliate, enrage, confuse, and ultimately prevent optimal growth and functioning of individuals and communities" (Harrell, 2000; Adams, 1990; Pierce, 1995). Racism isolates people and does not promote the recognition or appreciation of similarities and differences.

According to Miller (1988), when people have significant occurrences in their lives, whether good or bad, they look to other persons to share them with. When doing so they expect to be listened to and validated. If validation does not occur, a disconnection could take place (Tatum, 1997). Through this discussion, intangible resources can be extracted having the potential to illustrate both the inter-personal and intra-personal relations necessary for the productive integration of African Americans, and possibly other minorities, into scientific fields.

Those professors that teach in scientific fields who are interested in the retention of African Americans in science related fields might benefit from the findings of this research. It is hoped that teachers of science may recognize through this research valuable ways to better support their African American students. The results of this study will better equip faculty and administrators to develop new types of support programs for African American college students in fields that are scientific in nature.

Additionally, African American students may use this study to familiarize themselves with some of the experiences other African American students encountered. Hopefully, the results will provide them alternative ways to cope and exist within predominantly White environments. Also intangible resources can be extracted having the potential to promote the associations necessary for the recruitment of African Americans in scientific majors.

Finally, this study will fill a major void in the literature concerning African Americans majoring in science at predominantly White institutions. There are quantitative and qualitative studies that investigate the experiences of African Americans on these campuses (Smyth & McArdle, 2002; Greene, 2000; Simpson, 2001; Grandy, 1998; Scott, 1995) but few that detail the factors that cause many African Americans to switch from scientific majors. There are studies dealing with the persistence of African Americans but few that discuss the perspectives of those

Africans Americans that could persist no more. This study will prove valuable in its discussion of the first hands accounts of those Africans Americans who did chose to leave their major.

Limitations

The attractiveness of using the interview method in qualitative research has become increasingly popular and is becoming the “gold standard of qualitative research” (Silverman, 2000, pg 291-292; Mason, 2002) but according to Silverman, using it does not come without risk because using this form of methodology relies primarily on the data that is given by the participants. The information that will be requested will require the participants to draw upon their short and long term memories of accounts that have taken place in their lives. This according to Blaisdell (1995) and Mason (2002) can present problems of reliability because some participants may not be conscious of certain entities that may be responsible for their decision to leave scientific majors, while others may not be able to accurately detail the particular stimulus that led to their decision.

Delimitation

This study will only deal with the experiences of African Americans at one predominantly White research institution. This research cannot be generalized to all African American students studying science at this predominantly White university or to other predominantly White universities. The research also may or may not be generalized to other minority groups studying science at predominantly White universities and this research may or may not be generalized to all predominantly White universities. However, the assumption can be made that some of the experiences discussed by the participants may mirror experiences of other African Americans or other minorities in scientific majors at predominantly White institutions.

Definition of Terms

African American refers to persons of African descent who were born, raised, and live in the United States of America.

Scientific Majors refer to all majors as described by the National Science Foundation that are mathematically, chemically, engineering, or biologically based. The social sciences were excluded from this list by the researcher.

Predominantly White University refers to an institution where the ethnicity of the majority of the students is Caucasian or White.

Overview of the Chapters

Chapter 1 contains the introduction to the study, which includes how I am situated in the research and my motivation for doing such a study. The chapter continues with the purpose, research questions, background, importance, limitations and delimitations of the study.

Chapter 2 contains the literature review for this study. The literature review for this research contains two components. The first component discusses the foundation of how inferiority and the perception of African Americans became intertwined with one another and how that perception has progressed through the 18th, 19th, 20th, and 21st centuries. The next component begins with a discussion on why African Americans would want to participate within scientific fields and connects with the first component of the literature review by showing through the current literature how the perception of inferiority that plagues African Americans has a direct correlation to the low number of them participating within scientific fields.

Chapter 3 contains the methodology that will be used in this study. This chapter discusses validity and other components that make up a qualitative study. The chapter discusses the participants as well as the environment in which the research will be conducted, and provides a brief overview of actor network theory.

Chapter 4 begins the reporting of the data chapters and reports the academic background of the students as it relates to their secondary experience. The chapter includes experiences with their teachers, peers, family, and classes.

Chapter 5 reports the experiences of those students that did not continue within their scientific majors. The chapter reports on their reasons for choosing their particular major as well as reports on their interactions with their professors, peers, and their overall environment.

Chapter 6 reports the experiences of those students that are currently persisting within their scientific majors. This chapter also reports on reasons for choosing a particular major as well as reports on the students interactions with their professors, peers, and the overall environment of their major.

Chapter 7 contains information about the theory that will be used to analyze and interpret the data collected (The Actor Network Theory). The secondary and college experiences of the students will be interpreted from this framework.

Chapter 8 is the conclusion of the study. It provides implications for the study and provides recommendations for faculty and university administrators for better retention and recruitment of African American students within scientific majors at Virginia Tech.

Chapter Two: Literature Review

Part One: Social Darwinism and a General Overview

Long before Social Darwinism was established, the relationship between race and intelligence had been a subject of conversation amongst numerous European intellectuals (Dennis, 1995). Social Darwinism provided a foundation that allowed ideas of European supremacy to manifest because it provided a framework that allowed these ideas to rationally function (Dennis, 1995). According to Dennis (1995), individuals such as Buffon (1797) and Gobineau (1853/1915) used this framework to establish a trend in racist ideology by connecting the pigmentation of a person's skin to their conduct and human capabilities.

Darwin himself used his theories of evolution to explain occurrences within the animal species. He never applied his theories to human beings. It was others like Herbert Spencer that applied Darwin's evolutionary theories to those of the human race. In fact, it was Spencer (1874) who coined the phrase "survival of the fittest," not Darwin. It was also Spencer that believed that the rules of natural selection applied to the human species as well as to those biological species (Dennis, 1995). Spencer believed that humans are guided by rules of opposition and power, and that they progress from an uncouth and antiquated condition to one of separation and advancement. According to Spencer, those not able to adjust should by nature's law perish or be beneath those who have adjusted (Dennis, 1995).

This doctrine of Social Darwinism promoted racial conflict because the key to social advancement required "a continuous over-running of the less powerful or less adapted by the more powerful, a driving of inferior varieties into undesirable habitats, and occasionally, an extermination of inferior varieties" (Greene, 1963 as cited in Dennis, 1995, pg 244). Darwinism, explained in simpler terms, can be construed as the battle for survival in which a competition between the races take place and in this competition, the fittest or superior, will replace the

weakest or inferior (Montagu, 1965). Put into these terms the conflict amongst the races is justifiable because it supplies a biologically impartial resolution that is neat but most of all natural (Montagu, 1965).

The idea of Social Darwinism most notably presented itself in the United States during the antebellum period by the nations leading Social Darwinist, William Graham Sumner (Dennis, 1995). Sumner situated the ideal of slavery into Social Darwinism and reasoned within this framework that because “slavery permitted superior groups the leisure to construct and develop more refined cultures, it actually advanced the cause of humanity” (Bierstedt, 1981; Dennis, 1995, pg 244). Sumner also believed that the current status of certain groups of people at the time (1960’s) was also a result of the natural selection of nature.

Scholars such as Spencer and Sumner helped to create the atmosphere and disposition towards race relations in American society. In their assessment of society, aptitude and merit were characteristics only identifiable within the European community. Their view, which was housed in the framework of Social Darwinism, also supported the reality of institutional structures that already existed in society.

This literature review traces historically the idea of perceived racial inferiority in regard to African Americans and other minority groups and how that label has inhibited the full participation or inclusion of African Americans in science and other human endeavors. Implicit throughout this document is the theme of Social Darwinism because Darwinism was the casing that gave shelter to racist ideologies. Social Darwinism provided the validity, the credence, and the power to convince a nation that the idea of natural selection should be applied to man and that the way things were structured in this society was the way that nature intended. This was the foundation that was laid and one wonders how people that were marginalized by this science view the nature of it.

The Nature of Science in Science Education

Throughout history, human kind has found and developed many interesting theories about the order of the world and about the people who live in it. Some theories have been proven legitimate based on the evidence provided, while other theories have not fared so well. The interesting occurrence, however, is that these theories, legitimate or not, have provided road maps of processes to future generations that followed. The procedure in which these processes are formulated is the foundation that gives science the credence that renders it unique from other disciplines. The processes of examining, reasoning, testing, and authenticating are all pivotal components in the constructing of that foundation, and those components are at the core of the nature of science (Science for all Americans, 1989).

According to Lederman et al (2002, pg. 498) “typically, the nature of science refers to the epistemology and sociology of science, science as a way of knowing, or the values and beliefs inherent to scientific knowledge and its development.” Accordingly Glasson and Bentley (1999, p. 470), “the most influential current curriculum documents in science education consider the nature of science as basic content for the K-12 curriculum for all students.” Project 2061’s Science for All Americans (1989) and Benchmarks for Science Literacy (1993) are both major contributors to the establishment of the current National Science Education Standards (NRC, 1996). These documents establish the nature of science to include three categories: the scientific worldview, scientific inquiry, and the scientific enterprise.

The scientific worldview relays that those who practice science have specified fundamental standards that guides their way of thinking about how they practice and regard science. This line of thought is concerning the nature of the world and what knowledge can be obtained from it. This scientific world view is supported by four tenets: the world is understandable, scientific ideas are subject to change, scientific knowledge is durable, and

science can not provide complete answers to all questions (Science for all Americans, 1989).

Scientific inquiry implies that every discipline of science, from chemistry to physics to biology, etc., requires evidence to substantiate claims. Although scientists may differ in the process in which their research is conducted, the basic premise of how they conducted that research should be similar. It is that premise that makes research scientifically legitimate. This characteristic is what makes science inquiry based, and everyone, regardless of whether they practice science, could employ these skills on a daily basis on issues of importance to them if they so choose. Scientific inquiry is supported by five tenets: science demands evidence, science is a blend of logic and imagination, science explains and predicts, scientists try to identify and avoid bias, and science is not authoritarian (Science for all Americans, 1989).

The Scientific Enterprise recognizes that science has individual, societal, and foundational facets. The activity or practice of science, presently, is what separates it from the practices of other disciplines. The scientific enterprise consists of four tenets: science is a complex social activity, science is organized into content disciplines, science is conducted in various institutions, and there are generally ethical principles in the conduct of science (Science for all Americans, 1989).

Even with those three principles established and with those principles being the foundation and framework of sciences' curriculum within the K-12 system, theorists, philosophers, academics, sociologists, and educators of science are prompt to dispute on particular matters concerning the nature of science (Lederman et al, 2002). Perhaps the reason for this is that it is impossible or at least very difficult to specifically define an ideal such as the nature of science, because that nature can take on so many meanings. The nature of science has many sides to it, it is very complicated, and has many layers. Also the views about the nature of science, like scientific knowledge, are provisional and tentative. Throughout the history of the

nature of science, views about it have changed (Lederman 2002 & see Abd-El-Khalick & Lederman, 2000a, for a broad survey of these changes).

It may be argued, for example, that science has been used throughout history as a means to separate, classify, and rank things according to some type of order. Science in the past as well as in the present separates everything, the good from the bad, trees from other trees, trees from insects, people from animals, good methods from bad methods, and so on. The very methods provided by Science for all Americans are given to separate good science from bad science, to legitimize the scientific process. The question that this raises is: Is the nature of science inherently good or bad given what it has been used for? It could be reasonably debated that science really has no nature at all, because how can something that is inanimate have a nature?

Many talk of science as if it is an entity that lives, breathes and operates separately from the rest of the world. In that aspect and that aspect alone, science can be pure and objective, but science does not operate in this manner. The science that society has come to know cannot exist independently from the world because science is a tool that takes on the very nature of whoever controls it. Science in essence is a set of principles, established by man, which help to guide man to 'pure and objective' science, an ideal that he will never come to know. Science with the involvement of man cannot have one true nature. Given this parameter, the nature of science can be good or bad depending on whose hands control it.

Working on the assumption, for example, that guns were created to kill, it may be asked if the nature of a gun is inherently good or evil? In some hands, a gun kills, and in other hands a gun may serve to protect from evil. The point is that the gun takes on the characteristics or the intent of the person using it. Science can act in much the same way; it can be used for good or evil. Both guns and science have no say in how they are used because both are only tools.

The nature of science, like scientific knowledge, is a concept that is comprised of

educated conjectures made by those who practice and study science. Since science is an entity that cannot exist separately from society, a scientist's opinions, prior experiences, preparation, and viewpoints may have some bearing on their practice (Lederman et al, 2002) and "all these background factors form a mindset that affects the problems scientist investigate and how they conduct their investigations, what they observe (and do not observe), and how they interpret their observations." (p.501) This is important because many people believe that scientists and their observations are always impartial (Lederman et al, 2002; Popper, 1992) but in reality it may not constantly play out in this manner. This is because science and the practice of it is a societal construct, and practitioners of science are members of this society and can be as given to presuppositions as anyone else (Grant, 1992). "Observations and investigations are always motivated and guided by, and acquire meaning in reference to questions or problems, which are derived from certain theoretical perspectives." (Lederman et al., 2002, p. 501)

The question now becomes: can one separate the nature of an individual from the nature of science? Stanfield (1995, p. 223) argues that science cannot be separated from its creators. He contends that:

Social realists argue that for far too long there has been reluctance to view scientists as human beings with biases derived from their historical and cultural contexts, politics, and idiosyncrasies. They claim that the traditions, institutions, communities, and networks scientists, as cultural baggage carriers, create, stabilize, and transform are sociological and anthropological phenomena (Arnold, 1988; Bernal, 1987; Gould, 1981; Harding, 1993; Jones, 1981; Niebuhr, 1932; Stanfield, 1985a, 1994a, 1996).

Stanfield also states that:

One cannot divorce the history of the human sciences from the sociology, politics, and economics of capital formation (Cox, 1948; Niebuhr, 1932; Schwendinger &

Schwendinger, 1974; Stanfield, 1985b). It is this sense that the human sciences, by their very nature are social, cultural, and political and therefore intrinsically biased (p.223). The nature of science has been throughout the course of history both good and bad. It could be reasonably debated that in the case of African Americans, science or the misuse of science has been used to hinder the full inclusion of them into society.

The technical definition of science is “a branch of knowledge or study dealing with a body of facts or truths systematically arranged and showing the operation of general laws” (Random House College Dictionary, 1988). The very nature of science, in the hands of certain persons, excludes and separates, systematically using information to project certain images or beliefs. As a result general laws are implied within society, not laws that are written down or spoken, but invisible laws of social practices. Those unwritten, unspoken and invisible laws imply that African Americans have no worth in this society, are mentally inferior, are second-class citizens, and deserve their lot in life. The nature of science when misused has made those of African descent appear less than they really are.

The History of African Americans and the Misuse of Science

It may be argued that science has been represented as something that is free of personal beliefs and values, something that is uncorrupted, without fault, something that is above all else, objective. Since the 18th century, science has on many occasions been used as a rationalization to recommend, develop, and endorse bigoted social practices in this society (Dennis, 1995). Science does and has always had great authority in society. It is because of the authority given to science that it has had great effect on the attitudes toward the idea of race in society as known in present time. Science, since its inception, has had a reputation of being exclusionary. Science was, and remains, an institution in which not everyone can participate because it was designed to be such. Norman (1998) describes the institution of science in this way:

The institution of science by way of the Royal Society in England and other academies in Europe rendered science a powerful force in the hegemonic projects of Europe. It was the scientific establishment that reinforced the widely held notions that the bodies of women, the lower class, and the colonized were mere “signs” that were to be interpreted and incorporated into narratives aimed at consolidating as natural and legitimate the position of privilege occupied by European males at the top of the gender, class, and race hierarchy. The almost unassailable position of prestige and influence attained by science through its institution was used to legitimize the tendencies of exclusion and dominance manifested in the wider society. (p. 366)

In order to preserve this institution of privilege, much pure and objective science was conducted in an effort to keep the European male in control of society.

Since the 17th century, science has been so esteemed and powerful that it prevailed over all other thoughts that opposed tactics of supremacy and separation. Scientists, because of the esteem and power that science encompassed, were held in high regard in society. During the 17th and most of the 18th centuries, the works of scientists were deemed indisputable, so without dispute, the scientists’ findings about racial inequality were basically unchallenged by those of importance, and since science was viewed by humanity as a discipline that was incontestable, their assertions about race were accepted by the mainstream (Norman, 1999; Schiebinger, 1989; Stepan & Gilman, 1993).

Three reasons can account for the acceptance of these narrow-minded social theories of the time. The first is that science has done a spectacular job in its persuasive declaration to absolute impartiality; 2) Institutional science has been successful in positioning itself outside the grasp of ethical, political, and spiritual examination (Norman, 1998) and; 3) science provided

clear and precise evidence that showed the natural inferiority of African Americans, as well as women and those from different socioeconomic classes.

It was not until the late 18th and early 19th centuries that opposition started to emerge, but by this time the damage had been done. The doctrine of racial inferiority had already been allowed to infiltrate the fabric of society. Perhaps through the use of two scientific methodologies in particular, Craniometry and IQ testing, scientists managed to use science to really embed the notion of racial superiority of European Americans and the racial inferiority of African Americans in American society.

Craniometry

In the 1800's, scientists such as Carleton S. Coon, Samuel G. Morton, and Paul Broca measured and weighed the human brain to document unequal intelligence between races, and all came to the conclusion that African Americans were inferior to whites and that women were inferior to men. Social Darwinism would give theoretical sophistication to the methodology these scientists used that claimed that people of African descent, because of the size of their skull in relation to those of European descent, were not on the same level intellectually as whites and for this reason their less significant status among society was merited (Stanfield, 1995). This message was allowed to penetrate society even though these scientists found substantial amounts of evidence that contradicted their original hypothesis.

For example, the average white persons' brain that was measured during this time had a volume of about 1400 cubic centimeters, while those of African descent had some 50 cubic centimeters less, but what the scientists using this methodology failed to communicate was that the Neanderthal man, Mongols, and Eskimos all have brain volumes that exceed those of European descent by at least 150 cubic centimeters (Montagu, 1965). Also added to the list of

those with greater brain size would be the American Indian as well as some entire African nations (Montagu, 1965).

The fact that none of these findings were discussed in regard to African Americans when such claims were made about them being inferior because of their brain size is not shocking. This is further evidence that indicates that science or scientists are influenced by the social constructs in which they live. This is evident in that scientists neglected to discuss their entire findings because it went against their worldviews about race in this society. The truth is that no one in the past or present has been able to make a correlation between brain size and intellectual ability (Grant, 1992). This is because brain size, skull size, weight, volume, cell number, etc. has no relation at all to intelligence (Montagu, 1965).

Intelligence Testing

In the latter part of the 19th century and well into the 20th century, this ideology of inferiority continued with intelligence testing (better known as IQ testing). This methodology again was used to show that African Americans and other minorities were not as intelligent as Caucasian and that their position as stated earlier in society was therefore deserved. The tests were used as an extension from Craniometry in that the scientists wanted to relate smaller skull size, as well as the volume of the brain, to low performance on intelligence tests that were designed. Again Social Darwinism gave theoretical and scientific validity to these methodologies. The IQ tests were used to exclude African Americans from certain fields of work requiring a higher level of thought.

For example, the US Army developed tests to place soldiers in particular lines of duty in World War I. These tests showed that on average, Caucasian outscored African Americans, but ironically those African Americans from the north in many cases outscored their White counterparts from the south. One possible explanation for this outcome could be attributed to the

conditions in which African Americans of the north lived. The environment African Americans from the north lived in was not as harsh as those African Americans who lived in the south. In the north, segregation was less prominent and this allowed African Americans to attend school along side those of European descent. The results of these tests indicated that environment and opportunity to learn had more to do with the results on the intelligence tests than did genetics (Hines, 2002).

Racialists did not agree with the finding concerning environment related to African Americans. Scientists such as Professor Richard Lynn of the University of Ulster believed that those with European blood would continually out score those of African descent. He believed, along with others like Arthur Jensen, that the difference in scores were too large to be explained by the environmental conditions in which African Americans lived; therefore, the reason must be genetic make up (Grant, 1992). Lynn goes on to say that those African Americans with higher scores had more white ancestry than those that scored lower, and those whites that scored lower had significantly more African ancestry. The important point to note here is that even though he did his work in 1972, he was runner-up for the Thatcher award (a prestigious scientific award for excellence in research) in 1991 for the work he did on the races (Grant, 1992). Also regardless of their scores African Americans were still placed in subservient roles.

Social Darwinism

To give an idea of how much Social Darwinism was and to some extent still is entrenched in this society, Henry E. Garrett, a visiting professor at the University of Virginia, in 1961 published an article called “The Equalitarian Dogma” in *Perspectives in Biology and Medicine* in which he asserted that holding African Americans to the mental equals of Whites was the scientific hoax of the century (Synder, 1962). The article received national attention because of Garret’s reputation within the scientific community. Garrett believed that the idea that

all men were born of equal endowments was ludicrous as well as deceptive because he believed those of African descent have never accomplished anything of significance. He, like Jensen and Lynn, contended that the environment in which African Americans lived had little to do with their intelligence. They contended that their score's on intelligence tests were mostly a sign of their genetic composition (Synder, 1962). According to Synder (1962), Garrett was under the belief that some in society suppressed evidence of African American mental and social immaturity in an effort to help them. Garret believed that their efforts were sincere but unfortunately erroneous and referred to these actions as the equalitarian dogma.

Although the findings by these scientists in Craniometry and intelligence testing may have been filled with racial prejudices, for many white Americans, these scientific methods only confirmed what they already believed about African Americans: “that there was White ethnic hierarchy, and that this hierarchy, despite differences, stood atop all other races, especially the African American race (Dennis, 1995, p. 247).” Even without the backing of science there was a real need for white America to believe that African Americans were inferior to them, and due to the validation that science provided, even those with low economic status could take solace in knowing that those of African descent were beneath them.

Science provided the objective confirmation needed for those of lower economic status to believe, without a shadow of doubt, that at the very minimum they were made better than the Negroes. Perkinson (1991, p. 42) wrote: A professor from the University of Virginia was quoted saying in 1900 that “the Negro race is essentially a race of peasant farmers and laborers. As a source of cheap labor for a warm climate he is beyond competition; everywhere else he is a foreordained failure.” The misuse of science led persons to think in this manner and these thoughts led scholars such as W. E. B. DuBois’s and Fredrick Douglass to believe that there was

a “natural bias toward analysis that glorifies one’s own status groups and deprecates those of others” (Jorgensen, 1995, p. 236).

Slavery

According to Dennis (1995) the science methodologies of that day accomplished two things: “they confirmed White Superiority and they strengthened the idea that Blacks should be excluded from the core culture of American society” (p. 247). These thoughts are still prevalent today because science laid the foundation for these thoughts to manifest through the years, regardless of the fact that science has been recognized to be imperfect and not beyond letting personal biases or agendas into its absolute objectivity.

For example, the South in the 1840’s and the 1850’s received tremendous pressure from the North to abolish slavery. In order to ease some of this pressure or tension about slavery, the South badly needed a way to justify its position on slavery to the North because at this time, other countries in the world had completely eradicated slavery. Science served as the South’s justification. It was around this time that much of the literature that was discussed earlier in regard to African inferiority and White superiority started to emerge (Dennis, 1995; Oakes 1982).

In order to justify slavery, those of the south used the Declaration of Independence for its foundation. In his book, *The Idea of Race*, Ashley Montagu articulates how the signatories of the Declaration of Independence did not mean in the biological sense that “all men are created equal” and that “they are endowed by their creator with certain unalienable rights; that among these are life, liberty, and the pursuit of happiness.” It was believed the signatories were speaking from a political sense only, in part because the author of the American Declaration of Independence, Thomas Jefferson himself declared that, “Blacks are inferior to Whites in the endowments of both body and mind” (Modern Library, 1944, pg 262). The declaration for

equality was by no means intended to represent equal aptitude; its intent was to establish the position that a person within set parameters is entitled to live without restrictions and to realize himself to his fullest potential and that a person has the unequivocal right to develop himself without repercussion.

This view caused those who had the most interest in slavery to prove that African Americans were not biologically, or in any other way equal to them. Because of this they could not enjoy the rights and privileges granted by the Declaration of Independence to the level of whites. This doctrine of racism gained strength through the various scientific experiments like Craniometry and IQ testing that were previously mentioned and the various interpretations of those experiments. Science convinced society that it was justified in enslaving African Americans because African Americans were by nature beneath those with white ancestry, were in a sense not human, and were “scarcely capable of mental endowment (Jorgensen, 1995, p. 234).” According to Montagu (1965) three things were to be accomplished by this doctrine:

- 1) To prevent homogenization or magnetization and thus deterioration of the superior race;
- 2) to keep the races segregated so that each has the opportunity to pursue life, liberty, and happiness within the prescribed limits; and
- 3) to provide educational and social opportunities for the members of each race according to the limits of their assigned capacities, the superior race, of course, enjoying superior opportunities to those of which the inferior race is held to be capable of taking advantage (p 45).

Today's Messages Regarding Racial Inferiority

Science as a whole still enjoys that cloak of irrefutable exactness that it enjoyed when it was making the claims of the past. The scientists of the past have always claimed objectivity when questioned, and to an extent the scientific community of today invokes that same claim to objectivity, with essentially the same effect when questioned. In 1923 Carl Brigham published *A*

Study of American Intelligence and in 1994 Richard Herrnstein and Charles Murray published *The Bell Curve*. Both publications claimed to be scientifically reliable and completely objective when reporting the findings that Whites were superior to African Americans and other races of people (Vera & Feagin, 1995).

These two books would probably be of little importance if they went unnoticed, but the fact remains that both sets of authors had an audience. *A Study of American Intelligence* was offensive but understandable due to the time in which it was written and published; however, *The Bell Curve* was totally shocking due to the fact that it was published in 1994, a time when supposedly the use of science was used to unite instead of separate. The message about the inferiority of different ethnic groups was again allowed to permeate through society. That message was the same message that has been with this country for generations and that message is “groups of people should learn to appreciate what they do well and not aspire to other things outside their natural capabilities” (Zappardino, 1995, p. 6). This view is the offspring of the misuse of science and this perspective has had great effect on African Americans.

The Effects of the Misuse of Science in the African American Community

African Americans such as Douglass and DuBois could predict the status of future generations of African Americans because of the results of the oppression they were experiencing in their day. Four tenets given by Jorgensen (1995) depict a realistic synopsis of African Americans, and those realities can and have created a climate of racism in the field of science and in the society as a whole.

1st and 2nd Tenet Discussion

The first and second tenets state: 1) “racial oppression creates negative social facts such as the low economic, political, and social status of the oppressed and its harmful effects on the character of a portion of the oppressed population” and 2) “The negative social facts that are the

consequences of the oppression are used as justification of oppression” (Jorgensen, 1995, p. 235). These tenets are communicated daily about African Americans. In today’s society the suppressors try to hide their continuous study of the suppressed by masking their experiments in social problem approaches. Through these approaches the misuse of science has validated and reconfirmed the notion that African Americans are mentally inferior by creating an undertone that leads people to draw these conclusions (Stanfield, 1995).

Take for instance the “sociological studies of dysfunctional African American families and gender categories, the educational psychological studies of poor African American performance on standardized tests, and the identity pathologies of children of mixed descent to the neurological explanation of inner city African American violence” (Stanfield, 1995, p. 226). In addition according to Power, Murphy, and Coover (1996), in a content analysis of prime-time fictional programming from 1955-1986, Lichter, Lichter, Rothman, and Amundson (1987) found a strong association between crimes, drug trafficking, and African American characters.

Similarly, in a series of studies on reality based news reports, Entman (1994) suggests that the television news “paints a picture of Blacks as violent and threatening towards Whites” (p. 29). Entman (1994b) also noted a “dearth of positive portrayals of African Americans as contributors to American Society.” The negative images place African Americans at a disadvantage. They are not only faced with the challenge of overcoming the expected hurdles for achievement, but their hurdles are further compounded by struggles to prove their self worth.

These studies and perceptions of African Americans cannot help but validate the notions of white superiority, white normality, and above all else African American inferiority (Stanfield, 1995). “The historical origins, institutionalization, and transformation of science as sources of racially and ethnically bounded knowledge reaffirms its’ legitimacy” (Stanfield, 1995, p. 224). Society in general is fine with these results because it legitimizes the dominant group position in

this society (Stanfield, 1995). It gives privileges and advantages in which everyone cannot participate.

The system is a very complicated entity that has maintained its advantage and privilege by destroying the self- efficacy of an ethnicity's hopes and dreams, causing African Americans to question their value in this society. Those questions guide the journey that African Americans travel in their quest to define themselves. They must wade through images perpetuated in today's society that are in most cases not positive. In these circumstances, African Americans are forced to maintain vigilance, and thus must devote major energy to discerning, preventing, and ameliorating such negative presumptions.

Many African Americans live life, confronting stereotypes that affect their existence. "In effect, stereotyped assumptions greatly determine the salience of African Americans physical and psychological presence in many contexts" (Franklin & Franklin, 2000, p. 45). Their experience, the history of African Americans, those representations of their race in which they see in the media, all have an effect on the psyche of African Americans.

Due to this stigma that science has established and validated about race, many African Americans live their entire lives trying to "refute the degrading, humiliating and offensive racial images and stereotypes" (Yeakey and Bennett, 1990, p. 12) that have plague their race. The images that are perpetuated has caused frustration as well as aggression in African Americans, and to take an entire race on their shoulders truly has an effect on the consciousness of African Americans, especially when "the drive towards achievement and accomplishment that the African American professional inspires is overwhelmed and distorted by the social reality it conceals" (Yeakey and Johnson, 1979, p. 12).

Almost every problem that plagues African Americans can be traced back to the roots of perceived racial inferiority, and how the misuse of science helped establish those roots. The

roots that were validated by science have developed into what is formally known as racism. The residue of this misuse of science has manifested in the lives of many African Americans.

Racism can be seen, according to Harrell (2000, p. 43) as:

“A system of dominance, power, and privilege based on racial group designations; rooted in the historical oppression of a group defined or perceived by dominant group members as inferior, deviant, or undesirable; and occurring in circumstances where members of the dominant group create or accept their societal privilege by maintaining structures, ideology, values, and behavior that have the intent or effect of leaving non-dominant group members relatively excluded from power, esteem status, and/or equal access to societal resources.”

Another author, Tatum (1997, p. 7), believed that racism was “not only a personal ideology based on racial prejudice, but a system involving cultural messages and institutional policies and practices as well as the beliefs and actions of individuals.” She further notes “in the context of the United States, this system clearly operates to the advantage of Whites and to the disadvantage of people of color” (p. 7). The system of privilege that whites enjoy, oppresses and denies African Americans and other minorities of those unalienable rights that are dictated in the constitution.

Studies report the connections between the impact of racism on African Americans and their social and physical conditions (Franklin & Franklin, 2000; Gordon, Gordon, & Nembhard, 1994; Leary, 1996). These studies analyze the degree to which the complicated and frequently pathological state of affairs unconstructively affect the development, self-identity, and self-esteem of African Americans (Gordon, Gordon, & Nembhard, 1994). African Americans are psychologically injured by their demoralized standings and treatment (Kardiner & Ovessey 1951).

In the system of advantage, those in power set the parameters in which those without power operate, meaning that the individuals in power have a large amount of control in shaping the structure of society. The structure of society places African Americans at a disadvantage because their predetermined positions have devalued significance due to implications such as African Americans being considered throughout history as less intelligent than Whites, or incapable of performing in high cultural capital professions such as science. This line of thought is embedded so deeply in this society that African Americans may internalize the representations or images that the dominant group holds about them, making it challenging for them to have faith in their own ability (Tatum, 1997).

Each generation of African Americans throughout history has experienced obstacles that they had to overcome. Those generations that follow have the history of those that came before them and the present circumstances in which they now live. The effects of having experiences that include overcoming racial obstacles and operating in a system that was designed to keep them in place leaves a people feeling invisible or not of worth because the cycle of injustice repeats itself.

In this society many messages are conveyed about African Americans. Images and information that have been made popular by the media can easily be interpreted to mean that African Americans are lazy and unintelligent. From these depictions many believe that African Americans deserve the secondary status that they hold in this society. Society, for the most part, has absolved itself of the responsibility for the negative state that many African Americans may find themselves.

3rd and 4th Tenet and Discussion

The third and fourth tenet relays that 3) “oppression justifies itself by ignoring positive social facts about the oppressed” and 4) “that oppressors must always find a way to scientifically

and morally justify their oppression” (Jorgensen, 1995, p. 235). Fredrick Douglass, W. E. B. DuBois, Benjamin Banneker, and Phyllis Wheatley believed that no matter how much advancement is made by people of color, the oppressors would always find ways to hinder their progress. The misuse of science has validated and laid underpinnings for the justification of racial oppression.

Science and African Americans have been at opposite sides of the spectrum. While the misuse of science has been used throughout history to attempt to show the mental inferiority of African Americans, its’ constant survival through over 400 years of oppression, counter ideas of mental inferiority with very little success at changing beliefs. If any of the assertions made by science were true, African Americans would not have made any advancement since slavery. Thus the use of science has essentially violated and misrepresented the identity of African Americans in an effort to maintain and sustain a system of privilege for European Americans. Montagu (1965) believe that African Americans are in a no win situation because even when they operate by the rules that white America establishes, their accomplishments essentially are belittled and twisted into other evidence of their insufficiency.

What if the social structure of society actually dictated that African Americans could not participate fully within this society? If society was arranged in a way that primarily benefited those that possessed certain characteristics, could society blame African Americans for their current situation? Turner (1984, pg 7) believed that oppression is the result of the following conditions:

- 1) When a social system reveals populations that are biologically, culturally, and/or socially distinguishable
- 2) When one population perceives another as a threat to its well-being, particularly when
 - a) There is competition over scarce resources, and

- b) Political leaders need to unify a population by focusing on a common enemy
- 3) When populations possess vastly unequal degrees of power; and
- 4) When discriminatory actions can become institutionalized in specific social structures and in cultural beliefs that legitimate these structures

If these conditions are met, which they are in this country, then according to Turner (1984), oppression will take place.

The need to suppress certain groups of people makes it clear that privilege can be obtained by the suppressors, so much so, that in order to maintain this sense of entitlement, the suppressors must condemn the aptitude of the suppressed even though the actions contradict what the suppressors believe is ethically correct (Dennis, 1995). The actions and practices of the suppressors are in complete contradiction to the “fundamental yet abstract antiracist moral principles embodied in the U.S. Constitution and Declaration of Independence and the virulent racism evident in American social practice” (Jorgensen, 1995, p. 234). Knowing these actions were and are ethically and morally wrong, the assumption can be drawn that power (political, social, and economic) can be gained by maintaining the suppressed in substandard places in society (Dennis, 1995).

The misuse of science has created a system of privilege that has over the years guaranteed, as a whole, European control and success in all aspects of American life. Science has through its systematic arrangements of truths managed to create a system that separates and oppresses those who do not possess the same skin color as White America. All minorities are affected by this system of privilege, but African Americans are the primary beneficiaries of all the hate and bigotry that exist in society. Science has established a system for African Americans that lack parity and equity for all who live in it (Johnson, 1992).

Part Two: Why Science?

The relevant question becomes: why would African Americans want to be a part of something that has continuously tried to disenfranchise them, or why would African Americans want to be a part of something that has implied and has tried to prove since its inception that they could not think on a higher order?

The answer in part lies in the prestige that science holds in this society. Science maintains a distinctively authoritative position in this country and in the world. For example it allows access to high compensation occupations, and it provides a knowledge base for more informed conversations about issues that concern society on a local, state, country, and global level (Calabrese- Barton, 2002). Science is a field in which high cultural capital is given because it is deemed a profession in which one has to problem solve and think. Cultural capital as defined in Moore (2003) by Pai & Adler (2001) states:

Cultural capital refers to the ability to understand and practice the norms, discourse patterns, language styles, and language modes of the dominant culture. That is given the cultural forms of our society are dominated by white middle-class norms, behaviors, and language, individuals who lack the knowledge and skills associated with these norms and behaviors are denied access to success. (p. 72)

The system places tremendous value on those high cultural capital fields in which African American or other minorities are not represented.

Weber (1968) reasoned that a select few create status positions within society that incorporates a unique way of living to persons like them that secure access to those things that are not privy to the general population. With regard to education, Bourdieu (1977) asserts that within learning environments, usually controlled by those of the select group, advantages are given to those students who possess those same characteristics. Those students that are members

receive more attention and are recognized as being members of the select group with better intellectual capabilities than those students who lack their characteristics (Simpson, 2001). “Specifically, schools utilize particular linguistic patterns, authority structures, interaction dynamics, and course material, all of which are familiar to children from higher social statuses” (Simpson, 2001, p. 67). The experiences, and the way a child is socialized and taught mirror the way that schools and classrooms are managed. These experiences, or ways of living of the child, are now transformed into cultural capital that gives the child access to resources everyone child is not privy to (Bourdieu, 1977).

Science is a field in which intelligence is automatically bestowed on the participant. African Americans achieving in scientific fields have forms of intelligence bestowed upon them also, because the system was designed for this to occur. In order to complete a degree in science, a process must occur. The process once completed is transformed into cultural capital to whoever goes through it, and as DiMaggio (1982) reasoned can now be used by disadvantaged students as a key to access privileges that were once denied. The credentials a person has or lacks before this process takes place does not matter as much because now that student can utilize forms of this cultural capital to improve their acceptability into territories protected by the governing few (Simpson, 2001).

Science as a profession demands and obtains respect and it is not a coincidence that it is a field dominated by white males. When white males dominate a field, its position in society has tremendous political and economic power. It is because of this domination that those who participate in the realm of science have high cultural capital, as well as economic value in this society. Remembering that the dominant group preserves positions of high cultural capital to those who embody their same characteristics, African American and other minorities do not fit because their cultural capital was not given to them at birth. They had to break into the system

of privilege by obtaining a permit, which in most cases is a degree that the select group had to recognize as legitimate. African Americans participation in scientific fields “challenge the ideologies that justify power inequalities and utilize that knowledge to break silences, disrupt power relations, articulate what is possible, construct different realities, and experiment with alternative ways of learning and knowing” (Calebrese-Barton, 1998; Moore, 2003, p 108).

The question that has to be asked is: can African Americans, who have been historically marginalized by science, now have full access to it? According to Meyer (1998):

Access means entrance, opportunity, the ticket in. The opposition is retreat, withdrawal, the closed door. One direction moves forward; the other recedes inward. At the heart of this duality are perceptions of belong or misfit, the social act of participating or not, and the communication in a particular or silence. Within the learning context are situated constructions of meaning that are dependent upon the surrounding discourse. Therefore, access hinges on taking up, becoming fluent in that discourse; retreat rests on silent nonparticipation. (p. 467)

The only way African Americans will be more represented in scientific fields is when they “challenge accepted definitions of school and science, deconstruct the ideology of white, male, middle-class privilege, and establish purposes and goals for science education for critical self awareness rather than accumulating facts” (Calebrese-Barton, 1998 p. 33).

Science within Secondary Education

The messages of inferiority of African Americans still permeate through society. The most obvious sign of this is represented in urban schools where the majority of the population is African American and other minorities. In urban schools “minority students in urban poverty in the United States often have inequitable access to the kinds of science classes, teachers,

resources, and opportunities necessary for academic success in science” (Calabrese-Barton, 2002, p. 2).

These acts of neglect are a clear indication that the welfare of certain students is devalued in this society. Instead of receiving quality instruction and a good experience in science, these students come in contact with a science that focuses on their perceived conduct, rather than science itself and it is not surprising that studies exist showing the complete absence of science in many low track urban science classes (Barton, 2002; Oakes, 1990, 2000; Page, 1990). This leads to the chastisement of learners through embarrassment and degradation, shredding them of respect and dignity (Barton, 2002; Oakes, 1990; Polakow, 2000). Access to quality science education is being denied based upon an institutional design that has been in place for centuries, white middle to upper class children receive the best education while other ethnic groups receive substandard education. The system as is has no equity.

During the 1980’s a new focus of science education began to emerge. The focus shifted to an ideal known as ‘science for all’ instead of ‘science for scientists’. The focus, because of this new concept, was to help students’ function in an advancing scientific and technical society rather than focus on the requirements of yet to come practitioners of science (Barton, 2002). This noble idea failed to fully take into account what it would require for this ideal to come to fruition. Because of the division that exists in social class, verbal communication, and ethnicity, it is impossible to have a ‘science for all’ framework when issues such as access to materials and lack of human and public funds still exist for underserved populations.

In addition, this deficiency plays into the way that science is taught in the classroom, how success is evaluated and the motivation behind this evaluation (Barton, 2002). This lack of parity influences the participants (instructors and learners) in this system as well as the treatment they receive by those in influential positions within the system (Barton, 2002).

The barriers that exist for African American children and other minorities (these are just a few) are a good indication of why the achievement gap between them and their white counterparts exist. This gap is a result of the constraints in which African Americans work. The general public never hears about how the current system contributes to these outcomes. The general public has no idea about the concept of hidden curriculum (Brand, Glasson & Green, 2006). However, the general public does hear that whites out score blacks on average by so many points on the SAT. The general public also hears that the achievement gap between African Americans and their white counterparts on standardized tests is at an all time high. These messages taken out of context reinforce the notion that intellectually, those of European descent and other ethnicities are superior to African Americans.

The messages of inferiority are very clear in the social structures that contribute to unequal distribution of resources that are currently in place. Through the lack of interest in the success of particular students, a participant in this system can easily interpret his/her participation in it as devalued. It is as if the words of Hernstein and Murphy, “groups of people should learn to appreciate what they do well and not aspire to other things outside their natural capabilities” (Zappardino, 1995, p. 6), have been transformed into policy because society does not fully invest the time and resources necessary for many African Americans and other minorities to succeed in science, other subjects, as well as in life.

In 2000, Webster & Fisher conducted a study in Australia that indicated that access to resources had a direct correlation to students’ attitudes toward science. The study indicated that the negative attitude displayed by the students towards science was the result of the lack of resources they had. This attitude could be directly linked to the students lower scores on science achievement tests (Barton, 2002).

Similar studies have been conducted in the United States with the finding being the same. The Oakes studies of 1990 and 2000 (as cited in Barton, 2002) examined student scores on national exams and course taking patterns in California. They divulged that even though both of these entities have increased for urban students, there still exists a significant gap between white and non-white students, and between high poverty and non-poverty students. The study also indicated that these gaps were a result of the lack of opportunities that still existed between different educational environments as well as within that same educational environment (Barton, 2002).

Atwater, Wiggins & Gardner (as cited in Barton, 2002), conducted investigations that examined urban middle school students' perceptions and success in science. These investigations, much like the Webster and Fisher study of 2000, revealed that the lack of resources provided to these students, especially those of African American descent, within science led to the development of negative dispositions towards science, which in turn impacted their achievement. These negatives attitudes about science persist throughout their middle school careers and maybe throughout their entire secondary education (Barton, 2002). These studies like those of Ascher (1985), and Brand, Glasson & Green (2006) reveals that minority student attitudes toward science are extensively prejudiced by how they perceived their science instructor.

The above research studies, as well as many other studies within the science education community, establishes why certain groups of students out perform other groups of students on achievement tests and plausible explanation has been established on why achievement gaps exist and persist between minority and non-minority students (Barton, 2002; Atwater, Wiggins & Gardner, 1995; Webster & Fisher, 2000). Research in science education has exposed how teachers' perceptions of students can cause them to achieve and not to achieve (Brand, Glasson

& Green, 2006). The research in science education has even revealed how a lack of resources can hinder a child's performance and how the present system only seems to serve one particular group of students (Barton, 2002).

As discussed earlier, research indicates why trends of low achievement are occurring and persisting. The problem is that the general public does not have access to this research, or better yet this research is not disseminated in a way that the general public has access to it. The general public has access to newspapers, television, etc. and these media sources do not portray African Americans and other minorities in a positive light. Thus through the publishing of certain facts out of context in popular media sources, the messages of inferiority are still validated within this society.

The seeds of inferiority that were planted by such doctrines as Social Darwinism in the prolific soil of this country are still producing offspring and the result of this offspring is the separation and exclusion of African Americans and other minorities from full participation within scientific fields. Many people believe that everyone is given equal opportunities in every area of interest, but in those selective fields that are "said" to require intellect, those groups that were deemed inferior in the past are still denied total access. This is evident by the low numbers of African Americans participating within the science arena on a collegiate level.

The secondary school system must do a better job in preparing and keeping the interest of African Americans in subjects that are traditionally dominated by whites. A pattern exist as shown by the literature that minority students get the worst of what the secondary academic system has to offer. This reason alone accounts for why there are not more African American students interested in scientific fields. After years of being perceived as not being able to handle a scientific curriculum, not having the resources allotted to have a good scientific curriculum, and after years of performing on a level that confirmed perception, and expectation, why would

any African American want to attend college and major in an area where he/she has been conditioned to believe that they are incompetent. The literature about science on the secondary school level is a plausible explanation to why so few African Americans choose science as a major when they graduate from high school.

Science within Higher Education

African Americans constitute fewer than three percent of all science, math and engineering-related occupations (Hrabowski & Pearson, 1993). This indicates a need for or lack of African American presence within the scientific community. According to Johnson (1992), the need for access in scientific fields for African Americans and other minorities should be a major concern for the United States. The distinction in the quality of life that sets citizens of the United States apart from the rest of the world will be adversely affected by the lack of minority representation within the scientific community. By limiting the access of particular groups into the field of science, much potential is lost. If the trend is allowed to continue, society will find its ability to compete in the international market compromised (Johnson, 1992).

Whites males are becoming less interested in careers in science (Johnson, 1992). If America wants to continue to be a leader in scientific advancement, then it must diversify its workforce. Currently the numbers indicate no such change. Johnson (1992, pg 4) states:

According to their population size, African Americans are underrepresented disproportionately by a factor of 4.62 in the general U.S. science and engineering workforce, and by a factor of 7.5 among doctoral level scientist and engineers. In other words, African Americans represent only 22% of their expected numbers in the scientific and technical fields, and only 13% of their expected numbers among doctoral level scientist. Blacks are 12% of the U.S. population, 10% of the U.S. work force, 6.7% of the professional workers in the United States, but represent only 2.6% of the scientific

and engineering work force and only 1.6% of the doctoral level of scientific and engineering workforce.

In order for more representation of African Americans within the science community an increase in the number of African Americans majoring in and completing degrees in scientific fields must occur.

There are African Americans majoring in science at predominantly black universities but they make up a small percentage of the total number of institutions in America. But interestingly, between 1997 and 2001, there were 126,790 science and engineering degrees awarded to African Americans and fourteen historically black universities were in the top twenty institutions conferring these degrees with Florida A&M leading the way with 1,611 (NSF report, 2004). The highest ranked predominantly white institution was the University of Maryland at College Park ranking fifth with 1,203 (NSF report, 2004). None of the major institutions made the list.

The majority of the African American students attend predominantly white institutions and currently African American participation in science related majors at these locations are dismal at best. Some authors attribute the under-representation to poor retention programs, lack of pre-college preparation, and the university environments (Hall-Greene, 2000; Cote & Levine, 1997; Hines, 1997; Levin & Wyckoff, 1995), while others attribute it to the stereotypic perception of African Americans being mentally inferior (Hall-Greene, 2000; Moore, 2000). Other studies have indicated that isolation and negative experiences are contributors to the lack of African Americans in scientific majors (Scott, 1995).

Regardless of the factors, many talented African Americans that would have majored and persisted in science related majors are being wasted due to the institutional design that discourages their involvement at predominately white institutions. Culotta and Gibbons (1992) quoted the biology chairman at North Carolina Central University as saying:

The way we see it, the majority schools are wasting large numbers of good students.

They have black students with admissions statistics that are very high, tops. But these students wind up majoring in sociology or recreation or get wiped out altogether. (p.

1218)

A study found that many freshmen with declared majors in science that attend predominately white institutions find themselves struggling due to an institutional design that “weeds” them out (Massey, 1992; Seymour & Hewitt, 1997). The design is hierarchical in nature in that it relies on the hopes that only the best students continue on, while the others whose academic abilities are supposedly deficient, either fail or change majors altogether.

This process begins when they enter into classes that are described as being complicated, non-interesting, and unrelated to whatever created a students’ natural curiosity in science initially (Maton et al, 2000; Gainen, 1995; Treisman, 1992; Duderstadt, 1990). This design not only hurts those students that are a little deficient, but it even hurts those top students academically because they have now earned lower grades than they would have made if the structure of the classes were different. What does it say about institutions of higher learning that purposefully encourage the failure of students that are a little behind academically instead of giving them the support needed to be successful?

Between the years of 1977 and 1993 the percentage of science and engineering degrees awarded to African Americans was around 6% (Grandy, 1998). Between the years of 1994 and 2001 that figure has slightly increased (social science was excluded) to around 7.6% (NSF, 2001). If psychology is excluded then that figure is 6.6% (NSF, 2004). The dismal increase is not understandable due to the fact that numerous studies show that African Americans entering college are as likely, if not more likely than whites to initially intend a scientific major (Smyth & McArdle, 2002; Leslie, McClure & Oaxaca, 1998; NAS, 1987; Oakes, 1990; Post, Stewart &

Smith, 1991; Green, 1989; Lee, 1987; Dunteman, Wisebaker, & Taylor, 1979). One possible explanation for this is that these students know that scientifically based occupations provide a greater level of income than most other occupations.

Elliot, Strenta, Matier, and Scott (1995) conducted a study that found affirmative action admission policies inadvertently causing many talented African Americans from pursuing majors in scientific fields at selective colleges. The results indicated that only 34% of blacks that initially declared science, math, or engineering finished their degree requirements as compared to 61% of whites. Hypothetically 66% of those black students who failed out or switched majors and 39% of those white students could have had a scientific degree if they would have attended an institution that supported their efforts. In order for there to be serious representation or growth of African Americans in science, then predominantly white universities must do a better job in supporting these students upon acceptance into these majors in whatever way possible in order to ensure their success.

When a university accepts a student, that university is saying to that student and their parents that they want him/her there and that they believe that the student will be successful if he/she attends that university. The standards and criteria that each institution has and that each student is suppose to meet before acceptance tells the student they are academically prepared for that particular college. If this is the case, every student accepted should be expected and encouraged to complete the degree within his/her chosen field.

In his book *Knowledge in Motion*, Nespor (1994) details specific accounts of a professor within a physics department who admitted that certain classes were designed to weed out at least 25% of those who register. He also noted that this particular department seemingly took pride in knowing that out of the beginning freshmen that wanted to be physicists, only a few would succeed in their goal. Nespor also cites another study that was done in engineering (Hacker,

1989) that quoted a professor saying that they only expected 40% to 50% to graduate from their engineering program. Most, if not all students would not knowingly go into a situation where they know that there is a concerted effort to weed them out. They come to college fully expecting to be successful and weeding out should not be something a beginning freshman should have to be concerned about.

For African Americans majoring in science, weeding out is more damaging because so few decide to major in these fields because they have other factors besides school that affects their success. For example, two of the most common explanations given to explain why few black students persist and achieve in the weed out system prevalent within scientific majors are inadequate finances (Maton, et al., 2000; Astin, 1982, 1993), and deficient academic backgrounds (Maton et al., 2000; Willingham et al., 1990; Ramist et al., 1994; Elliot et al., 1995). The first simply relays that on average, black families with children in school typically have lower incomes than those of European descent, causing the black student to have to work to pay for their tuition and other necessities. Within competitive majors such as science, working to survive and persistence within a scientific major are negatively linked (Garrison, 1987).

The second explanation given to explain the low number of black students within scientific majors is that their academic background is not as advanced as white students who major in these areas (Malton et al., 2000). On average, black students entering college have lower SAT scores and high school grade point averages, as well as lower participation in advanced scientific courses in high school than both White and Asian counterparts (Maton et al., 2000; Willingham et al., 1990; Ramist et al., 1994; Elliot et al., 1995). These factors have a strong positive correlation to how students perform in weed out courses (Willingham et al., 1990; Elliot et al., 1995). Since on average black students are lacking in these areas from the onset, persisting in majors with a design to weed them out becomes much more difficult.

It is a reasonable assumption that academic preparation is a major deterrent of African American students persisting in scientific majors, however there are many African American students each year with competitive, or even higher SAT scores and GPA's than their white counterparts. These students have also participated and have been successful in advanced science and math courses, but the fact is that many of them also leave scientific majors (Seymour & Hewitt, 1997).

Academic success within high school is a positive asset to have when entering college. Every African American student majoring in a scientific field would prefer to enter into college with advanced courses taken in high school. They would love to enter with a high GPA, and they would love to have high SAT scores that reflect positively on their abilities because there is no question that all these assets can help any student achieve within a scientific major. In order for this to happen, secondary schools must and need to do a better job in preparing African Americans to face these challenges. If the success of an African American student majoring in science depended solely on his SAT scores and other academic achievements, then the low numbers of African Americans majoring and persisting in scientific fields would be easier to solve. Unfortunately these are not the only factors that will determine their success.

Studies inform the scientific community that academic achievement within high school, especially SAT scores, is a better predictor of white students' performance than for black students (Bowen & Bok, 1998; Ramist et al., 1994, Willingham et al., 1990; Breland, 1979). According to Maton, Hrabowski, and Schmitt (2000):

African American students with respectable SAT scores who under-perform provide evidence that factor's other than pre-collegiate preparation and native ability work to depress minority achievement and persistence. These factors may include academic and cultural isolation, motivational and performance vulnerability in the face of negative

stereotypes and low expectations for performance, peers not supportive of academic success, and perceived and actual discrimination. (p.630)

The problem is much deeper than a SAT score and cannot be explained away by only using data that has been quantitatively obtained.

Possible reasons of why there is such a lack of black participation within scientific majors is that African Americans often find themselves alone and isolated from other African Americans. While operating in such arenas, these environments can and often times become “psychological minefields fraught with subtle racial encounters” (Yeakey & Bennett, 1990, p. 12). African American success in science depends greatly on their capacity and compliance to correspond to those principles and actions that have been established European practices (Tatum, 1997), however while being expected to conform to the cultural principles placed on them by white Americans, African Americans have been deprived of full involvement in the science arena (Semons, 1991; Thomas, Phillips, Brown, 1998).

Race is salient in the lives of African Americans majoring in science. It may be argued that another factor that may account for the under-representation of African Americans in science is that predominant white universities, which are microcosms of society, do not see African Americans as individuals with individual identities, but as individuals with group identities. When a group’s identity is known as inferior, as is the case for African Americans, individuals of that group constantly have to prove their self worth.

Howard and Hammonds (1985) found that many African Americans avoided majors in which they were deemed inferior. Science related majors fit this description and thus the under-representation of African Americans in science is very predictable. These messages which are a part of the “hidden curriculum” (Apple, 1986), “include stereotypes of science being an exclusively Eurocentric construct that infiltrates the subconscious, causing students to acquire

negative perceptions of themselves and their learning environments” (Brand, Glasson, Green, 2006). Consequently, minority students recognize themselves and their contributions as trivial (Brand, Glasson, Green 2006).

The hidden curriculum includes influential messages about the norms of society and people’s places within society, and these subtle messages accompany the required curriculum in many classrooms (Brand, Glasson, Green, 2006; Anyon, 1981; Apple, 1986). According to Brand, Glasson, and Green (2006):

Since the hidden curriculum is taught (implicitly) through the kinds of participatory mechanisms that work so powerfully in out-of-school contexts, it is not surprising that sometimes the messages about social class and social roles in the hidden curriculum are understood by students more deeply than the messages about scientific concepts in the explicit curriculum. (p. 3-4)

Tidwell & Berry (1993, p. 466) believed that “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.” Many African Americans (like parts of society) believe that they are only capable of achieving in non-scientific fields. As a result, many feel the act of aspiring to intellectual challenges is pointless.

It appears as long as African Americans operate in “lesser” fields they are fine. Their numbers are on par and may even exceed expected numbers when in fields that are not “distinguished”, but due to the opportunities higher education provides in high cultural, economic, and social capital positions such as science, some African Americans are said to be encroaching, infringing, and intruding into spaces, jobs, and ways of life that belong to those who fit the stereotypical images for which they are reserved.

The system as is keeps those that have always had privilege at the top for generation after generation, while at the same time stifling the professional growth of those without privilege for future generations. African American scholars of the past predicted that African Americans would continuously find themselves at the bottom of this system regardless of the advancement made. “A science that is the reflection of a White ethnic-dominated, race-centered society that creates and nurtures it cannot help but view non-White others in a lesser light than those who are given, by virtue of skin-color privileges, divine qualities of superiority” (Stanfield, 1995, p. 229). The same value free science that was created by European men and confirmed by *objective science* continues to disenfranchise African Americans.

African Americans for well over three hundred years have been detached from the mainstream of this society and have been separated from practically every opportunity to even enjoy the right to feel as if they were equal to everyone else (Montagu, 1965). Throughout history, African Americans as a group have been made to feel as though they were not as intelligent as whites and not capable of certain achievements made by those of European descent. African Americans also have been made to feel that they are not worthy of the successes, the housing, the education, and the other privileges that whites are entitled due to the color of their skin (Montagu, 1965).

Actor Network Theory

Actor Network Theory (ANT) is an alternative way of making sense of the social structure of society. ANT was established out of the field of technology and the social studies of science. The theory, primarily used in areas of technology, is built around the concept that the world and the processes and entities that occupy the world function as a network. A network consists of “spatially dispersed elements that have been linked together over time and the linkages connecting networked elements are as important as the nature of the elements

themselves” (Nespor, 1994, pg 11). The theory looks at society in terms of relationships that are built and stabilized and how these relationships intersect with one another.

For example, if a person wanted to open a newspaper stand in the city, would that person set up shop at the busiest intersection or area within the city? Or would that person set up shop at a location that is isolated from most people? If money is the goal and if money is to be made, that person will be positioned in an area where there is plenty of traffic and pedestrians that can buy the products. Every person will not buy a newspaper or magazine, but the position makes the chances of a purchase greater due to the amount of people that will pass by or intersect with the stand. Over a period of time this stand will most likely become a stable fixture of this location, making it easier for money to be made. On the other hand, if that person sets up shop in an isolated area, not as much money will be made because the location chosen does not intersect with many people. A chance to stay in business exists because some days enough money may be made in order to survive, but the probability of staying in business over a long period of time is unlikely. Eventually that person will move on to another location or to another line of business.

The more a person intersects and builds relationships with people of power within a network, the stronger position that person will hold within the network. Like in the example above, the newspaper owner who intersects with more people of power has the greater chance of being successful. People of power as would be defined by the newspaper stand owner are those persons with the money to buy newspapers. ANT provides this alternative view of society. If one is able to position themselves in a position of maximum exposure within a particular network, meaning that their paths are able to intersect with those in power and they are able to build positive relationships, then the likelihood of that person becoming successful is more probable. Thus, if one were to view society using this theory as a lens, then it is not intelligence

alone but positioning that determines a person's success within this society. ANT gives the old adage, "it is not what you know, but who you know," validity.

Chapter Three: Methodology

Purpose

The purpose of this research was to examine factors influencing African American students' participation in scientific fields in lieu of the historical and political misuse of science and its modern conceptions. The study was designed to give voice to their perceptions of studying science in predominantly White environments. Thus, the research questions for this study are:

- 1) What factors influenced the decision of the African American student to major in a scientific field upon completion of high school?
- 2) What were the experiences and feelings of the African American student while majoring in a scientific field at a predominantly white university?
- 3) What factors led the African American student to the decision to change academic majors from a scientific field?
- 4) What factors influenced the decision of those African Americans who chose to persist on within their chosen scientific major?
- 5) How did the personal network of the African American student contribute to their failure/success within their chosen scientific major?

In this chapter, the overall design of the study is described in detail.

Research Design

This research was qualitative in nature because it was not only concerned with information that has been quantitatively obtained, but also with the ways that people construct, interpret, and give meaning to occurrences they have experienced in their lives (Gerson & Horowitz, 2002). This qualitative study focused on the perceptions of the participants by discussing what factors led to not persisting in science majors and the feelings felt afterward.

Also this research discussed those factors that allowed other African Americans to persist on within their chosen scientific major.

This research gave insight into certain behaviors that were expressed by the participants in hopes that certain patterns would be recognized and eventually stopped or enhanced depending on their influence. The research centered around the participants perceptions because it was the key to understanding what they experienced based on their perspective. The patterns that were found came from the perceptions of the students and were both internal and external to the students. Given that some participants were those who switched majors and some were those that chose to remain in their majors, their discussions made these patterns recognizable.

Qualitative methodology involves several different methods, but the methods that are used most prominently are participant observation and in-depth interviewing (Gerson & Horowitz, 2002), both of which will be utilized in this study. “In qualitative research, interviews are usually taken to involve some form of conversation with a purpose” (Mason, 2002, p. 225). The technique is used as a primary means of data collection and provides ways to achieve purposeful information through interactive conversation. The conversation, however, is focused around issues and topics pertinent to the topic being researched (Mason, 2002). Using this methodology, insight on the extrinsic and intrinsic factors influencing the participant’s lived experiences may be gained (Lawler, 2002).

The research methods used allowed each participant opportunities to discuss their feelings in relation to the research questions without being influenced by the researcher. By observing the demeanor of the participants and by using in-depth interviews, this research was made stronger because of the employment of multiple qualitative methods that will be used to extract information (Greene, 2000; Graham, 1997; Merton, Fiske, & Kendal, 1990). These methods also allow for a better triangulation of the data, which will help to validate the findings

of the study (Greene, 2000; Mason, 1996; Miller & Fredericks, 1994) and help reduce the researchers bias, allowing for a more accurate depiction of the students' perceptions and experiences (Silverman, 1985).

Although this study is not quantitative in nature, factors such as validity, reliability, and the ability to generalize are components that are also important (Greene, 2000). According to Scott (1995), these three components are accomplished by the researcher's impartiality. In order to ensure impartiality of the researcher, a committee of five faculty members who have varying levels of experience in qualitative research methods will examine the design and interpretations of the study (Lincoln & Guba, 1985). Each committee member is qualified to over see this research, for each has multiple qualitative studies that have been published or formally presented within the higher education community.

Lincoln and Guba (1985) believe that the following protocol should be followed when doing this type of qualitative research: 1) prolonged engagement, 2) persistent observation, and 3) triangulation (Greene, 2000). These three components explained in greater detail have been interpreted to mean: 1) make sure enough time is spent with each participant in order to make sure that their stories align, 2) investigate each participant's experience thoroughly, and 3) use various examples of information to describe what is being researched (Graham, 1997; Greene, 2000; Moore, 2000). "A program of cooperative research that utilizes more than one technique within the same research project compensates for the inherent weakness in both techniques and provides a means of triangulation" (Graham, 1997, pg. 83; Greene, 2000, pg. 35).

Research Environment

The research site for this research is LW University, a predominantly white university located in Southwest Virginia. On the campus of LW University, black students have a space in the student union by the name of the Black Cultural Center, better known as the BCC. This is

the site where many African American undergraduates and some graduates congregate to talk, meet, and study in between classes. This site appears to be a sort of support system for many students and is where many Black students congregate consistently on an everyday basis. The county where LW University is located is predominantly white also, and the majority of the county consists of farmland.

According to the Office of Institutional Research and Planning Analysis (OIRPA) on the campus of LW University, in 2002 the university had a total enrollment of 28,027 students on and off campus. The on campus enrollment at LW University is 25,819, with 21,413 undergraduates making up the majority of that enrollment. The remainder of that number is made up of 4,046 and 360 graduate and professional students respectively. The total full time faculty at LW University consisted of 81.8% (2148) White, 5.3% (138) Asian/Pacific Islander, 4.5% (119) Black, 1.3% (34) Hispanic, 0.3% (8) American Indian/Pacific Islander, and 6.8% (178) Non-Resident Alien.

Also according to OIRPA the student population at LW encompasses the following: White Students, 75.8% (19571); Asian students, 6.1% (1565); Native American students, .2% (59); Hispanic students 1.7% (446); and International and other students, 10.8% (2,781). The university uses the term “black students” in its representation of them. They comprise 5.4% (1,397) of the student population. It is not known whether the university uses the term Black to include all persons of color (African Americans, those students from the continent of Africa, and others with dark skin) or if the term Black is used only in reference to African Americans; that is, persons of African descent who were born, raised, and live in the United States of America.

The most complete data set in relation to graduation of students at LW University is from the year 1997 and it reveals that 195 black freshmen were accepted into the university with an average scholastic aptitude test score of 1040. Of that amount, 51.3% of them graduated in six

years or less as compared to 74% of the 3849 White students that were enrolled with an average scholastic aptitude test score of 1173.

Participants

In 2000 there were 257 black freshmen and 3818 white freshmen that enrolled at LW University according to OIRPA with an average scholastic aptitude test score of 1026 and 1186 respectively. After the third year, 80.5% (207) of African Americans remained within the university. Of that 257 freshman, 108 (42%) of them initially majored in science or engineering. Of the 3818 white freshmen, 1624 of them majored in science or engineering. Within three years, only 41% (44) of African Americans remained within those majors, as compared to 57% (920) of those Whites that majored in science or engineering. For blacks the biggest lost was after the first year at 31%, the second year lost another 16%, followed by the third year at 12%. For white students the pattern was 24% after the first year, 13% more in the second year, and 6% more in the third year.

The initial pattern for the attrition rate of black freshmen in science and engineering looked similar for 2001 and 2002. For this reason black students who switched their major within the first three years of arrival were contacted for this study. The retention numbers for LW University indicate that black women who major in a science (e.g. Biology, Chemistry, Physics) out number men by a factor of three to one. Within engineering, black men out number black women by a factor of two to one.

For this research, both engineering and science were chosen because LW University is known to be an engineering school. Also, both majors have a retention rate of black students that was around 40%. In 2000 there were 46 black freshmen that initially majored in science at LW University as compared to 62 in engineering. In science, those numbers remained relatively consistent through 2002. In engineering as compared to 2000, those numbers slightly increased

by an average of 37% in 2001 and 2002 combined. By including engineering majors with science from the years 2001-2004, the potential pool of applicants was increased by a factor of at least 2.5. As a result, instead of having 59% of 150 (88) science majors as possible candidates, 59% of possibly 382 (225) science and engineering majors were possible candidates.

Selecting Participants

At LW University there exists a list serve that consist mostly of black students by the name of Event Haps. Primarily all black undergraduate students on the campus of LW University get emails of events and other issues pertaining to them as black students. Participants were solicited for the study using this venue by sending out emails that explain the research. In addition, the researcher placed flyers in the black cultural center (another place where black students congregate on the campus of LW University) soliciting participation for the study. Participation for this study was voluntary.

Data Collection

Approval for this research was given from two sources. The first was the five- member committee at LW University who oversaw this research and the second was the Institutional Review Board on Human Subjects (IRB) at Virginia LW University. After approval was granted from both of these governing bodies, the data collection process began.

As described in the research design section, observation and interviews was the primary source of information for this study. However, each participant before the interview took place read the email concerning the study. Also, before the interview took place, a short conversation took place with the participant so that he/she would feel comfortable with the interviewer about their experiences of majoring in a scientific field at a predominantly white university. The reading of the email announcement and the prior conversation with the student gave the participant time to recall memories or experiences that may have otherwise have been forgotten.

Thus this process focused the student towards the subject matter before the interview took place, allowing for a richer conversation about the topic.

The study again focused on two groups of students: those that switched majors and those that were currently persisting within their scientific major. A total of twenty-four participants were interviewed for this study. There were eleven students that persisted with their scientific major as compared to thirteen students that did not persist. Each participant was interviewed once with the average interview lasting from one to one and a half hours. During the interview, notes were taken so that the interviewer could ask follow up questions or to ask the participant to provide clarification of a certain response. If further clarification was needed on a statement made, the participant was contacted. Twenty- four undergraduate students responded to the email and all twenty- four students were interviewed. The researcher recognized clear patterns that emerged between each set of participants after three or four interviews were conducted. The researcher continued with the interviews so that a saturation of data could be obtained.

The interviews took place in the spring of 2006 and were done at a location designated by the researcher at a time that was convenient for the participants. Each interview was video and audio taped, but before each interview began the participant was asked to sign an informed consent form that explained the research as well as their rights as a participant. The form explained anonymity and the benefits and risk of participation in this research.

Data Analysis

The interviews were transcribed and interpreted using the Actor- Network Theory as a framework. As previously discussed, the Actor Network Theory was established out of the field of technology and the social studies of science and the theory is built around the premise that the world and the processes or entities that occupy the world function as a network.

The participants' responses were coded and categorized into themes (Ely et al., 1991; Patton, 1990). From the qualitative methods employed, ideas emerged that were isolated into themes. Common ideas were grouped according to the dominant thoughts expressed within the statements. Over saturation of data sources was used to provide validation and to accurately portray the student's perceptions and view.

By looking at the different scientific networks that African American students have participated and exploring the field of science and engineering as networks comprised of actors that have acted as gate keepers of the network maintaining its' structural integrity, we examined how the design of the network (smaller and larger ones) itself as well as how the actors within the network (this includes African Americans) contributed to the lack of African American participation within science and engineering majors. Looking at the problem through the lens of the Actor Network Theory provided a deeper and better understanding of how the problem within science and engineering originated and why the problem persists.

Chapter 4: African American Experiences in High School Scientific Classes

Imagine two groups of students with similar academic backgrounds that both major in scientific fields once they reach college. Both groups have comparable high school grade point averages and scholastic aptitude scores, and both have taken advanced level courses in math and science. If all of these things are relatively equal, what is it that causes one group to be successful within a major and the other group not to be successful? To answer that question, the journey of two groups of students was traced from high school to college. This chapter gives an account of the experiences had in high school within science and math classes, as well as provides insight into behaviors that will be discussed in later chapters by students as they matriculate through their scientific majors.

Academic Background

A total of twenty-four students participated in this study. Thirteen students chose not to persist with their scientific major as compared to eleven students that did persist with their particular scientific major. The participants came from high schools that were diverse, and from high schools that were predominantly white or black. They also had taken advanced level courses in either science or math in high school. This information can be seen in appendices E and F.

The mean high school grade point average and scholastic aptitude test scores for the participants that did not persist were 3.65 and 1082. Within this group of students, five chose a form of engineering as their major, and had a mean scholastic aptitude test score and grade point average of 1160 and 3.6. The remaining eight students, that did not persist, had a mean of 1021 and 3.6 respectively.

The mean scholastic aptitude test score and grade point average for the participants that did persist were 1071 and 3.61. Within that group of students, six chose a form of engineering as

their major, and had a mean scholastic aptitude test score and grade point average of 1086 and 3.6. The remaining five students that persisted had a mean of 1052 and 3.6 respectively.

When both sets of students were compared against the entire university student population, the average scholastic aptitude test score and high school GPA of entering freshmen for LW University for 2000 –2004 was 1187 and 3.7. The mean scholastic aptitude test score and high school grade point average for all students entering engineering was 1258 and 3.7, and for students entering science majors, it was 1177 and 3.6.

In order to gain a clear understanding of the students that did not persist, we wanted to see how they compared academically to the students that did persist, as well as see how both groups compared to the university student body in regard to scholastic achievement. What was found was that scholastic aptitude test scores and high school grade point averages appeared not to factor into whether or not black students persisted within their scientific major. In fact, of those students that chose to major in engineering, the mean scholastic aptitude test score for those students that did not persist was seventy- four points higher than those students that did persist.

Support Systems

At this stage of their academic career, both sets of students expressed similar sentiments about their high school experiences within high school. The relationships and experiences of both groups of students appeared to be mirror images of each other.

Good teacher relationships

While in high school, the participants described positive relationships and experiences with their teachers. These relationships enhanced the educational experiences of these students and gave them a perspective on what a good teacher should be. The students articulated a description of attributes that defined a good teacher for them.

For example, Elizabeth described her relationships with her teachers in high school as positive. She described her teachers as persons that assisted her whenever she needed support on an assignment. The teachers were available at any time, and more importantly, made her feel like they did not mind doing so. Elizabeth portrayed her teachers in the following manner:

In high school, they were easy to get along with. I mean if you had questions, you could go to them and they would help you out, or they would give you steps along the way to help you solve the problem. If you needed to stay after school to make-up a lab, they would be there to help you and make sure you understand and get through the lab. They were there for the purpose of teaching. (Elizabeth, NP)

Elizabeth described her teachers as people that were patient, caring, and giving of their time. Elizabeth felt comfortable with her teachers and was not fearful of asking them for assistance when needed. They were always accessible, and made sure she grasped the material that needed to be understood.

Jonathan alluded to similar characteristics as he described his advance chemistry and calculus teachers. He described relationships that had a friendship component to them. His teachers were people he trusted and respected which contributed to him being able to excel. He stated:

Back then I was very close with my teachers for advance chemistry and calculus. I think they are the reason I like chemistry so much. Especially my chemistry teacher, we would always stay back and talk. She was like very down to earth. My calculus teacher was down to earth also, so that really helped me. My relationships with my teachers were very important to me because they were vital in choosing a major, and choosing colleges and all of that. They really worked with me. They saw my strengths and weaknesses, and talked with me about what I should major in, and all of that. (Jonathan, NP)

Jonathan described relationships with his teachers that made him feel comfortable. They interacted with him in a way that signaled that they were people that had his best interest at heart, and this was very important to Jonathan.

Jones articulated the same level of caring and accessibility in her description of her teachers. She stated:

I got along with the teachers and the students very well. The teachers really worked with you. I was one of the people in class that wanted to learn. If you wanted to learn, they work with you. We had a really good relationship. Like the teachers would invite the class over for study sessions, order pizza, stuff like that. (Jones, NP)

As long as Jones demonstrated that she wanted to learn, her teachers assisted her in the problems that she may have had in her studies. Her teachers related to her on a personal level which made her want to learn and work for them. Her teacher's encouraged by going above and beyond what was required of them.

Earl also described his teachers as always being there for him when he needed assistance. They were very supportive of his efforts. Earl stated:

The teachers were very laid back, and answered any questions you had about the course. They were very tight, the students were very tight, and both would not be there if they were not. I had pretty good experiences with those classes because the teachers were always willing to offer help. There was not a teacher who would not offer help. I do not think I would have done so well with the hard classes. They were extremely supportive, and they were there anytime, and made sure they were available, they understood. I had a real hard time with calculus, and it was troubling, so I would always go see my teacher. She was the most helpful teacher I have ever had in my life. She was extremely helpful. (Earl, P)

Maya Angelou also discussed having positive relationships with her teachers. Her response, like Earl's, about her high school teachers was characteristic of the responses given by all the students within this study. She stated:

They were very helpful. If I had to stay after and had to ask some questions, they would answer them. They were very strict but I got along with them pretty well. (Maya Angelou, P)

If help was needed, then Maya did not mind approaching her teachers for assistance and they willingly gave her the help that was required.

These examples were representative of the overall feeling that the participants felt about their high school teachers. In high school, the participants felt comfortable in going to their teachers for assistance because the teachers created an environment that was conducive for learning, and an environment in which the participants felt safe to ask for help if needed. The students were not fearful of their teachers because their teachers demonstrated that they cared for them. This action allowed the students to concentrate on their work because they felt their teachers were on their side.

The participants deemed being a good teacher on the basis of three things: (1) whether or not the teacher was willing to assist them when they needed it; (2) on the basis of whether it seemed like the teacher cared for them, and (3) on the basis of whether or not the teacher was truly able to explain difficult concepts clearly so that they understood. Whether that assistance came in the form of academic help, advising, letters of recommendation, or just someone to talk to about problems did not matter. The students deemed that person a good teacher.

It is important to note that as a whole, these students did not require much assistance with their work in high school. They seldom asked for assistance but when they did their teachers assisted them. For these students high school was not that difficult, so many of them operated

independently of the teacher. The teacher was someone who they had a good relationship with that presented information in a fashion they could understand. They liked their teachers and that made learning the material that much easier for them. Due to the level of the classes taken, some students like Earl did struggle a bit, but for the most part all the participants sailed easily through high school with no problems.

Bad teacher relationships

Some students did express having bad relationships with some teachers in their classes. The feelings expressed about their experiences with these teachers were opposite of what was described by students to be the characteristics of a good teacher. Only a few students described relationships that were negative, but those descriptions were not indicative of their overall relationships with all of their teachers. Their stories were about individual teachers whom they had trouble understanding.

Jo-Lisa described her physics teacher as treating the class as if they were already in college. This treatment did not meet Jo-Lisa's expectation of what her physics class was suppose to be like. She stated:

I hated physics. I do not know if it was because it was different or harder. I got a C in the class. The teacher acted like we were already in college. I like math pretty well.

Nobody really liked the physics class. In calculus everybody liked the teacher even though it was just a little harder subject. Some things were easier than others. (Jo-Lisa, NP)

Jo-Lisa made it a point to say that everyone liked the calculus teacher, which suggested that she really did not care for her physics teacher, or his style of teaching. She expressed not knowing whether the physics class was different or just harder, but the impression was that the teacher was at fault due to the fact that calculus was considered hard also, but because of the likeability

of the teacher, the calculus class was doable.

Lula expressed not being able to learn from her advanced placement calculus teacher because she felt the teacher was not presenting the information in a manner that promoted understanding. As a result Lula, and many other students, dropped out of the class. She stated:

I quit AP calculus. My teacher was not giving me information I needed. Learning was not happening in her class. A lot of people dropped out of her class. She did not know what she was teaching. I would look in the book and find what she was teaching, and what the book said did not match, and clearly the book had to be right. She had enough students in her class that were doing well, and I guess knew math well enough, so that it did not look bad on her part. She was like “Oh, slackers dropping the class.” (Lula, NP)

Lula portrayed a teacher that failed to meet the qualification of being able to give a clear explanation of the material being taught. For this reason, Lula had a poor relationship with this teacher.

Another student also described negative types of relationships with some of his teachers. Denzel, for example, felt that his relationships with his teachers were simply business like relationships. His response suggested his relationships were strained because each had a problem communicating with one another due to their respective races.

My relationships with the teachers were not really close. It was a classroom thing. I would not go to my teacher after class and sit and talk. I would go to class, they would teach me something, and I would go out. I had some friends in some of my classes. I grew up in a mainly white area, and sometimes I would be the only black in the class. Especially for the advanced level class like pre-calculus, calculus, advanced chemistry, and physics, I would be the only black in the class. If I needed help with homework I would go to the teacher, but I was not comfortable doing that. I was not comfortable

going to someone that I did not know that well outside of the classroom, talking to them about problems. (Denzel, NP)

For Denzel, being the only black student within his classes greatly affected him. He seemed to be fixated on being the only Black in his upper level classes and this appeared to effect his interaction with his teachers. Although he on occasion asked for assistance from his teachers, he was not comfortable in do so because he believed that his teachers could not relate to him, or his problems.

Denzel's actions suggested that he might have had some type of negative experience with White teachers, or people, in his past and this experience did not allow him to trust his white teachers easily. Another possibility was that his white teachers displayed some action that made him uncomfortable in approaching them for help. Regardless of the reasons, it was clear that Denzel did not trust his white teachers.

As the conversation continued, Denzel explained why he felt the way that he did concerning relationships between people of different races.

I had a couple of friends that I was pretty cool with that I hung around with and could talk to. If I had homework problems I could talk to them. However, I did not feel like I had a close friend that actually knew what I was going through. For one thing, I was the only Black in the class, and if I am black, and you are white, you do not know what I am going through. I feel like you have an advantage if you go to the teachers, and can talk to them, and they can understand what you are going through. With me being the only Black student, it is not the same when I go to the teacher. (Denzel, NP)

Denzel viewed his blackness as a disadvantage because everyone within his science and math classes was white. Denzel felt that the teachers, nor the students, could relate to him because they did not know how it felt to be black. For this reason, he felt that all the other students had

an advantage over him because they could relate to each other, and the teacher, in ways that he could not. Denzel's life experiences possibly could have led him to the conclusion that people from different races could not relate to one another.

Denzel's description of his feeling suggested that he felt isolated within these classes. He felt like did not belong, or like he was trespassing. These classes were uncomfortable to Denzel because no one else around was like him. Again, these feelings may have resulted from some negative experience that Denzel had with White people in the past.

Peers

Except for a few exceptions, the participants described the relationships with their peers as being positive in nature. The relationships described were supportive both socially and academically. The participants described their peer relationships as relationships where students depended on one another for support. As stated earlier, these students were academically bright; therefore, the relationships formed were more social support than academic support although, on occasion, they assisted each other with their work.

Brooke's comment supported this line of thought because she was not sure what her support system was academically, due to her not struggling with her classes in high school. She knew she had support, but being specific about how that support influenced her, and who served as that support, it was difficult for her to articulate.

My friends, and my parents, I do not know. I guess being with my friends supported me. I have really close best friends, and knowing I was going to be with them in class everyday, basically motivated me to want to be in school. So I would describe it as very helpful. I am not really sure these relationships impacted my performance because I knew that I had to do well in school whether they were or not. So I do not really know if they really influenced me all that much. (Brooke Alston, P)

Brooke's support from her friends came in the form of them motivating her to want to be with them socially. Due to her high performance and self-motivation, academically, she did not need them when it came to excelling in her studies.

Tony described his relationships with his peers as relationships that took the place of him going to his teachers for assistance. Tony had good relationships with his teachers, but he did not depend on them academically if he struggled with his work. He stated:

I had good interactions with my peers. We would talk in class, and talk about what went on in class, and sometimes that would help me to better understand. That might be why I did not have to go to my teachers for help. I was pretty close to my classmates. (Tony, NP)

Tony's peers provided him with clarification if needed on material that he may have had trouble with. He was close to his classmates and, for that reason, they were able to communicate, and understand each other in ways a teacher could not.

Jo-Lisa and Jones described their relationships as having personal friendships with the people they were taking classes with. Their peer-relationships were the same as their friendships. So if they struggled and could not get to or did not want to bother the teacher, these relationships provided them with the assistance necessary. They stated:

Most of the friends that I hung out with were the ones that were in my classes. We all tried to support each other. I could always ask my friends if they knew something about it, and I felt comfortable going to them. (Jo-Lisa, NP)

Yeah, we had a relationship because all of my friends were in my classes.

So it was a real bubbly thing. If we did not understand something, one of us had to know, so we all worked together. (Jones, NP)

Both Jo-Lisa and Jones had relationships where all their friends acted as a cohesive group that supported each other in ways where each felt comfortable in approaching each other for help. Their relationships extended outside of the classroom because of a bond that had been developed over a period of time.

Crystal discussed this familiarity in terms of knowing and taking courses with other students over an extended period of time. She stated:

As far as students go, I do not remember having much of a problem. It was a predominately white school, but I guess by it just being that way for four years, I knew students since my freshman year, and we went through the same classes, and were on the same track. (Crystal, P)

Earl expressed similar sentiments when he discussed his relationships with his peers also. He stated:

My relationships were very good. The students I related very well with. The classes in my high school were not extremely huge. I would say about 20 students, and with those I was extremely familiar with because I had been going to school with them since middle school. (Earl, P)

Scoop also discussed this familiarity amongst the students whom she attended school and classes with also.

Yeah, we had a close-knit relationship because again the majority of the students you went to middle and elementary school with them. Also you had summer programs with these kids. I am not going to say it was a cream of the crop type kids, but if you had been in Richmond, the majority of the time you are seeing the same faces for different programs. Like accelerated programs, after school programs, you are seeing the same faces. (Scoop, P)

The relationships described were indicative of the entire group. The relationships developed with peers were a support system to these participants due to the amount of time they spent with each other over the course of their secondary education.

To be a peer does not necessarily mean that one is a friend, but yet many students, at this stage of their education, viewed the two as one in the same. Their peers were friends who supported and helped when needed. In some cases, the people described by the participants were not just people who helped them with a calculus problem, or just someone of the same age or social class, but they were students these participants cared about.

The participants expressed being comfortable with their peers because many had been together since elementary and middle school in some cases. When students are bright, gifted, and smart in science and math, they are usually grouped together and placed in advanced classes. The profile of these students suggests that most of them were considered gifted, smart, and bright by their particular school district due to the high level of courses taken during their high school years. So regardless of whether they were just peers, or peers that became friends, they were a part of relationships that had been developed over time. These were relationships in which a foundation of trust was established that provided stability and a level of comfort for these students.

Family and community

The final support system discussed was the support given by family and community. These relationships were strictly motivational relationships due to the level of classes that many of these students were taking. Their parents could not provide the necessary academic support if these students needed assistance, and fortunately this did not pose a problem because, as stated earlier, high school truly was not that difficult for them.

Beamer described his parents as having high expectations of him even though they could

not help him with his studies. The level of classes that he took during high school far surpassed whatever knowledge they had on the subject. They supported him by encouraging, and providing him with whatever was necessary for him to succeed in his classes. Beamer stated the following when discussing his parents as a support system:

Neither one of my parents studied what I studied, but they were there to support me in school. As far as helping me with my classes, they really had not taken any of the classes that I was taking because they did not have the same interest. My parents influenced me a lot, because they expected me to get the grades without pushing me a lot. I wanted to go to college, and I wanted to be successful, so I also had self-motivation. (Beamer, NP)

Beamer had parents that were involved in his education since he started school. Even though they could not assist him in his academics if he had trouble, they did support him by giving him the discipline and structure he needed. He had self-motivation, which made supporting him on their part much easier.

Tony's parents supported him by encouraging him to do his best at all times. They also could not provide him with academic help if trouble arose, but they did provide him with the motivation to do well.

Probably my support systems were my parents. They pushed me to try to do well and knew that I had to have good grades to go to college. They were my support system. My parents were very encouraging, and they let me know as long as I work hard at something, I would be able to do it as long as I did not give up. That really helped me to have the confidence to not let classes get me down. If I struggled, I knew that all I had to do was give it some extra time, and I would be able to accomplish the task. (Tony, NP)

Tony's parents provided him with that encouragement that would not let him get down on himself when things did not go as planned. They encouraged good grades because they wanted

to see him go to college, and they helped him to have confidence in his abilities.

Jean's family was support for her in those things that had nothing to do with academics. Her academic work was easy for her, so her family provided her with the mental support, and constant encouragement that a teenager needs as they grow up.

I had my family, my mom, and grandmother. These relationships really did not impact me because it was not that hard. I did not have to struggle hard with those two classes in high school, so I did not have to experience difficulty or need for constant support. (Jean, P)

Maya also provided an example of how her family, specifically how her mom provided a support system for her as she went through high school. Maya's mom was a teacher within the system where she attended regular school. As a result, she was well known by the teachers from the relationships that her mom had developed over the years. She was essentially on a short leash within her school when it came to behavior and performance. If she did something wrong, or was disrespectful in any way, her mom would know. Interestingly, Maya appreciated this structure because it kept her focused. She stated:

I am from a small community where everybody knows everybody, so in high school I had a lot of teachers who knew me because my mom works in the school system. They were like: "you make sure you get your homework in", and they always were checking up on me and telling me that I needed to do the right thing in school. If I did something wrong, my mom would know about it by the end of the day. It was nice; very community oriented. It influenced everything. Like I could not cuss anybody, like my teachers, out or anything. I would not do that anyway, but you know my mom would know about it if I did. When I was there, there was always somebody watching me, so I just had to make sure I was always in line. (Maya, P)

Maya's support system was her entire school community because of the relationships that her mom had developed as a teacher within the community. She thrived, enjoyed, and excelled while attending her regular school because she had guidance, and support, at every corner.

Due to the strong connections that many of the participants developed over the course of their secondary education, their being black seemed not to have any bearing on the way they were treated within their classes. Sophia discussed how being black intersected with her high school experience by explaining how it had little to no effect on her.

Sophia attended a high school where black students made up less than 1% of the student body, so she easily stood out in her school and within her classes. However, being one of a few black students did not bother her because she had grown accustomed to it. She had become accustomed to it because that had been her situation since elementary school.

Going to a high school where I was less than 1% student population really did not bother me. It did not bother me, I guess, because it had been that way since elementary school, so by that time I was practically used to it. The town is pretty mixed, but as far as the schools are concerned they are not that well mixed, and mine had been that way since junior high so by that time I was fairly used to it. (Sophia, NP)

As the conversation continued, Sophia revealed that her level of comfort within this predominantly white environment was partly due to a foundation that her siblings had laid at the same high school before she attended. Before she walked into the school, she was viewed in a positive light because of the good reputations her siblings had established in previous years.

My sisters had gone there, my brother had gone there, so by the time I got there, and I am the youngest, I just felt like, like everyone just knew me. I do not know, I just felt like I did not have that hard of a time. My brother and sister laid a foundation for me. People knew who my brother and sister were because many of the teachers had been there 30-35

years, so they already knew who I was. It was like: “okay you are the baby”. But I was not the only one this situation applied to; I would say the whole school was like that.

(Sophia, NP)

Due to the foundation that was laid by Sophia’s siblings, being the only black in her classes did not bother her. This statement reigns true for many students in this study. A foundation of some sort had been established, by a parent who worked in the school system, a parent that was involved, a coach, a family friend, etc. that made being black within their classes not so important. This is not to say that students were not aware of their blackness within their schools and courses, but that their race was not so noticeable because of the familiarity they had with the people and environment. These students, as well as others, more than likely viewed themselves as just students that fit into the environment because they had participated within it for so long.

The responses given are representative of the students within this study. The students were grounded and invested within their schools and communities as well as supported by them. In addition, many of the participants actively involved themselves in activities within and outside of high school. Their parents, teachers, coaches, friends, etc supported the majority of the participants, as well as some of the participants having individual motivation to be successful. All these were forms of a support system for the students, but rarely did they discuss their support in terms of academics. The people in the students’ lives were like cheerleaders who encouraged them to do well in their studies.

Experience As Minorities And Proving Self-Worth

A few students discussed their experiences in regard to being the only black or one of a few blacks within their higher-level science and math classes. Maya Angelou and Kanye West reflected on being black, their feelings, and attitudes, in relation to their interaction with their peers.

Maya attended governor's school for part of her academic day and regular school for the remainder of the day. Maya viewed her relationships with her peers at governor's school differently from her relationships with her peers at her regular high school. Being black played a factor in the feelings she felt, and the distinction she made between the two was very clear. While at governor's school, she was isolated, had a work mentality, and did not feel connected to the white students even though she spent half the day with them. Her joy came when she was able to go back to regular school and be with her black friends.

Maya explained how this environment made her feel when she articulated an experience she had with another student that attended governor's school.

I know when I was in governor's school there was this really arrogant really racist white guy that I went to governor's school with, and we had to ride the van there so I would have to talk to him everyday. And you know we were talking about who was going to go to school where, and I was like: "you know I got accepted to Virginia Tech and I am going there." He was like: "Virginia Tech!" He said: "I thought you were going to go to some place like Norfolk State or Hampton or something like that." And I was like: "why would you think that?" He was like: "oh I do not know." In addition he always-said stuff about affirmative action. I mean, so whenever I feel like I want to quit, I think about him and going back home and showing my degree, and being like: "yeah so."

(Maya, P)

These assumptions made by Maya's peer further motivated her to become successful. Maya, in a sense, was viewed by others and perhaps even viewed herself as a foreigner with a student visa that had to go home when all was said and done. Once she received that knowledge she was allowed to cross back over the border to an environment that she was more comfortable in, an environment that had people in it that looked like her. She felt safe in this environment and felt

liked she belonged.

Kanye West competed against his white peers in his advanced level science and math classes. Kanye began his discussion by explaining that he was a competitive person, and that his magnet program was made up of mostly white students. He stated:

I was competitive in high school. I mean with the other students. In the magnet program, there were more white students than black students in the classes and that changed depending on where you went with lower level courses. So the courses were kind of competitive to me, and I ended up doing pretty well. I felt that it was important for me to do better in those courses because I am competitive. (Kanye)

Kanye continued with his discussion and revealed that although he was competitive by nature, something else motivated him to perform at a high level within his upper level courses. He stated:

I had to do better because they think they are smarter. The white students think they are smarter. My classes were about 75% white. The school itself was 95% black, but in my program it was 75% white. Yeah, see I even talked to my guidance counselor, and he said more or less that the magnet program was instituted in my school to bring the white students to the school. So most of the white students were in the magnet program, and that is how they got there even though the area is widely black. (Kanye, P)

Kanye's response suggested he was motivated by proving that he was smarter, or just as smart, as the white students in his science and math classes. The facial expressions and the tone in which Kanye gave this response suggested that Kanye was not too happy to know that his almost all black school, in his all black area, would not have a magnet program if it were not for the white students that attended his school.

Kanye got his satisfaction by out performing those white students that were responsible

for the magnet program being brought to his school. His competitiveness and motivation to outperforming those students was his way of saying to those in control that his school having a magnet program should have not been based on having white students attend the school. His feelings and demeanor suggested that he felt that they should have been able to get a magnet program based on their own merit.

In other statements made by Kanye, he noticed the differences in how he was treated as a black student in high school as compared to white students from other areas where he lived. He noticed the disparities that existed between the haves, and the have-nots, within the American educational system, and saw that this disparity put him at a disadvantage.

I feel disadvantaged basically because of the school that I attended. I have been to some really great schools in NOVA. They are beautiful schools, skyscraper tall, they have got computers in every classroom, all the students drive cars to school, they have got great teachers; they are nationally ranked and stuff like that. I did not have nearly half of that in my school (Kanye, P).

Kanye seemingly equated his being black to being disadvantaged, and not worthy, but this motivated him as it did the Maya. Kanye's complaints had nothing to do with his treatment by his teachers at his high school because by his accounts he was treated very well. Kanye's concern revolved around his unfair treatment as an African American student in a national educational system that he felt was designed to make him appear and feel less than he really was. That system, the system he participated in, put him at a disadvantage.

Crystal also raised how being black affected her within her predominantly white high school. Her response echoed similar feelings that Maya discussed when she discussed how being the only black affected how she interacted with others.

I did not have much of a support system in high school. It was predominantly white, so

any organizations or after school programs, I was the only black person there. Any AP classes, I was the only black person there. So my support system came from talking to other people in class because I did have few people in class that I considered friends, but I never saw them outside of class. (Crystal, P)

Crystal felt isolated in her school because she was the only black student in her science and math classes. Because she was black, she felt that her support system was limited even though she considered a few people in her classes her friends. However, these were friends that she only saw within the confines of her school had no outside contact with her. Her friendships with these students were totally based on academics and having to be around them, nothing more because they did not associate with each other outside of the school environment.

Crystal continued the conversation by discussing her frustration with being the only black student within her science and math classes.

It was a little frustrating, but I got use to it because I realized at an early age that I wanted to be an engineer, and my mother helped me face the fact that a lot of the times I would be the only black if I wanted to be an engineer. (Crystal, P)

Crystal's mom had prepared her for this type of isolation in previous years by letting her know that being the only black was something she had to deal with if she wanted to be an engineer. In a sense, Crystal's mom informed her that she would be and feel like a foreigner in science and math classes because those were territories that were exclusive to white people. Crystal accepted the fact that she would be alone, and became use to being the only black student when she was in her science and math classes.

As a result of becoming accustomed to being the only person of color within her classes, Crystal put a pressure on herself that demanded that she do well. Her blackness, in a sea of

whiteness, was what motivated her to perform at a high level. However, performing with, or taking on, that pressure did not come without a price to pay.

As a result of me being black, along with a combination of me being extremely shy in high school, my participation was very low, and adding onto the fact that I felt that everything I did represented my race, I did not know how to handle that myself, so I felt like it was best if I just kept to myself. (Crystal, P)

Crystal stayed the course and performed well in her classes but because she was the only black student within her classes, she felt that she was representative of the entire black race. Crystal had developed a group identity that connected the stress of performing well with the stress of proving to people that black people were intelligent too. She did not want to be the cause of people viewing black students in a negative way because she failed or did poorly within her classes.

The students highlighted in this chapter exhibited behaviors that were somewhat typical of the entire group of students. Within those students that were highlighted, as well as in some additional students that will be presented, patterns of behavior can be clearly seen as they try to navigate their way through a new environment. Their actions, and interactions, with those in their new environment played a significant role in determining whether or not they were persistent with their chosen major.

Chapter 5: University Experience Of African American Students That Did Not Persist In Their Original Choice Of Major

Choice of Major

The participants that did not persist had various reasons for choosing their particular majors after graduating from high school. For some, their choice in major was simply an extension of the subjects they excelled at in high school, as well as being influenced by those that held important roles in their lives. For others, their choice was also due to good experiences with subjects in high school as well as seemingly having a genuine interest in scientific subjects. The participants' choice of majors can be seen in appendix G.

Success in high school as a primary reason

Participants were asked to discuss their personal reason for choosing their major. Most of the participants gave several reasons for their choice and the reasons discussed varied to some degree. However, there were similarities amongst the participants. The participants showed a pattern of primarily choosing a major based upon their past success in science and math in high school. This pattern was not surprising, for one could argue that it is an expected pattern amongst all students because prior experiences suggest to them that scientific subjects were what they excelled in. People in their lives, as well as their performance in advanced level science and math classes, indicated to some of the participants that majoring in a scientific field was a logical progression of their educational journey.

When choosing a major, or when choosing what one wants to do in their professional lives, it behooves one to choose a major based on a genuine interest as well. In high school, these students excelled at, or were at least decent in all their high school courses; it was not just science and math. When a student shows an aptitude for science related subjects, more times than naught he/she is encouraged to pursue majors or careers in those fields because of the high

economic, cultural, and social capital that comes along with them. These students may have had an equal aptitude for other subjects in high school, but science trumped all due to the encouragement they received from teachers, family members, etc.

The statements of the students that did not persist showed a level of confusion and uncertainty when questioned about why they chose their particular major. In some cases, some participants seemingly had no clue of what major to select upon completion of high school. They were confused about the entire process of choosing a major, and as stated earlier, they primarily relied on prior successes from their high school experience. This criterion was met by eight of the students that did not persist with their chosen major.

Lula, for example, chose biology as her major based on her successes in it in high school. Her response indicated some confusion on her part in choosing a major. She stated:

My family was telling me to take some classes to see what I enjoyed, but I was not putting off selecting a major for that long just to take some classes, so I fell back to classes that I enjoyed in high school. Biology was one of them that I enjoyed the most. I also enjoyed algebra too, but for math you have to keep on going and I did not like the rest of them. So okay biology, I will do that. Okay I did it, and then I said to myself, I do not want to do that anymore. (Lula)

Lula appeared not to really have an interest in the major that she chose. She just wanted to declare a major so she fell back on what she excelled at in high school.

Influence of others

Nails also displayed characteristics of being influenced by others when explaining her choice in majors. Her response showed how other people influenced her decision in choosing a major. Her decision showed confusion even though she had an interest in space. She stated:

I majored in engineering because in high school everybody said I was smart in math and

science, and I liked it. I was interested in space, so I said I might as well. It was the only thing that I could see myself doing at the time. I had always been a space person. (Nails)

Nails response raised the questions of whether or not she was truly interested in majoring in engineering for herself, or if she chose the major because she was expected and influenced to do so?

Jonathan also displayed that same characteristic of being influenced by others as he described the confusion he felt when he chose chemical engineering as his major. His response gave an account of the confusion that he and other students feel as they choose a major. He began by saying that he chose chemical engineering because he liked chemistry and continued with how he was influenced to do so.

I chose chemical engineering because I liked chemistry so much, and I was told I would do great in engineering. They kind of went together and I could do it. I did not know too much and did not really know what chemical engineers did. And a lot of people do not even know when they decide on a major because they can do a variety of different things, but I think that is why I choose it because people told me I could do it, and I liked chemistry so much. (Jonathan)

Although some of this response by Jonathan can be viewed as him rationalizing his non-persistence by bringing others into the conversation, his own experience, and his experience with other students allowed him to make a generalization that many students do not know what professionals in their majors do, and they choose a major based on the advice other people give them. This generalization made by Jonathan can be applied to several students within this study.

Career preparation exclusively

In addition to high school success, and the influence of others, playing a role in the students' decision in choosing a major, the students gave other reasons as well. One reason given

was they wanted to attend medical school. Of the four students that gave medical school as a reason, three majored in biology, and one majored in math, and chose their major based on a means to an end. The interest they showed was not in the major itself, but in using their major as a springboard to get to medical school.

Dianne gave an example of this in her explanation of choosing biology as her major. Her desire to want to go to medical school was noble but she articulated no real interest in biology itself. She stated:

I majored in Biology because I wanted to be a surgeon, because every time I would visit someone at the hospital, I was tired of seeing how doctors and nurses treated their patients. It just was not right. They treated people like they did not care. Speaking to them in terms that no one understood, or like they just did not want to be bothered.

(Dianne)

Dianne again wanted to use biology as a means to an end to get to medical school and all three participants that majored in biology expressed this same feeling. Biology to them was what was necessary for them to obtain their goal. While the end goal for some students' maybe enough to motivate them to persist with their major, it was not enough for these students.

Of the participants that chose a major based on the above reasons, a conclusion could be drawn that some of the participants majored in a scientific field by default. Within the statements given, there did not exist that "something" that suggested a passion for the subject. A reason other than, *I was good at it high school*, or *someone told me I was good at it*, seemed to not exist. For that reason the participant's responses reflected a level of confusion and uncertainty.

A point must be made that at the time of the interview these students had already switched majors, and subsequently their perspective was given from the mind-set of someone that did not succeed. This may, or may not, have affected the reasons they gave to why they

majored in a scientific field because the mind-set of someone who is succeeding, or has succeeded, within their major is more than likely different from someone who was not successful. Initially, the majority of all the participants could have been excited and passionate about their major, but due to circumstances that may, or may not, have been beyond their control, that passion was extinguished and lost along the way. This in turn forced those participants to re-evaluate why they chose to major in a scientific major.

In trying to make sense of their lives, they may have justified their initial choice in majors. The participants may have been assigning blame to others by suggesting that they were led into their choice of a major by someone else. Another possible scenario is that the participants could have known exactly what they were doing when they chose the major and decided that they did not like the major, or they could have found that the major was too difficult. Either case would be plausible.

Seemingly genuine interest

There were students who did not persist with their intended major that expressed sentiments that captured a genuine interest in the major that they chose. Beamer, Denzel, and Tony all were engineering majors that did not persist. Their responses showed a passion they held for engineering, but in the process, that passion had been doused. Interestingly, these three participants were in the top tier of the twenty-four students when looking at grade point averages and scholastic aptitude test scores. Their responses indicated that at one time in their lives they had something within them that caused them to want to be engineers.

Beamer indicated that he wanted to design space ships for NASA and work on projects that focused on the design of space ships. He stated:

I had ideas of designing. I wanted to be an aerospace engineer and work for NASA. I wanted to design space ships and work on projects with these groups that went into space.

(Beamer)

Denzel expressed a similar passion for wanting to be an engineer. He was into the function of cars. Mechanical things interested him, and he wanted to do that with his life.

I decided that engineering was something I wanted to do because it was pretty much based on math. I liked the idea that if I got into engineering, it would be involved with more or less hands on stuff. Mechanical stuff, machines transportation stuff, I was always into cars and thought that would be a good thing. (Denzel)

Finally, Tony gave reasons for majoring in engineering that were similar to the thoughts given by Denzel. He too wanted to work with cars, but he was into the design of them and had ideas that he wanted to see to fruition. He stated:

I really wanted to be an engineer that designed cars. I was really into cars. I wanted to be able to design them, so that is really what the engineering would be for. I figured that would be a way where I could put my ideas about cars out there. (Tony)

These three participants, even though they did not persist within their engineering majors, expressed interest that went beyond choosing a major based primarily on being good at it in high school, or being influenced by others to do so. These three students chose majors for reasons that appeared to go deeper than the other students that did not persist.

Weak Academic Preparation

As highlighted in chapter four, the students that did not persist had similar academic backgrounds in regards to their high school academics with those students that did persist. The participants had advance level classes in math and science, similar grade point averages, and scholastic aptitude test scores. As a group, those students that did not persist had higher grade point averages and scholastic aptitude test scores than those students that did persist, but their fate was different.

Many times the participants that did persist with their major shared the same perception of those that did not persist about their peers, professors, and themselves. However, the students that did not persist handled their perceptions, good or bad, differently. Academic preparation or lack thereof, was the source from which many of those perceptions grew. More specifically, the negative perceptions that students held about themselves effected how they perceived and interacted with others.

The way students are prepared for college is just as important as the knowledge they obtain. For example, if a student came from a high school where the courses taken challenged the student intellectually in a way that made him/her study, work, and ask questions, along with providing him/her with the necessary prerequisite foundational knowledge that would be needed at the collegiate level, then the chances are that much greater that student would be successful at his/her chosen major. However, if a student came from a school where he or she was not challenged intellectually and were given assignments that really did not require him/her to use his/her brain for purposes other than memorization, then that student's chance of success at this university within certain scientific programs would be diminished. That chance at success would be diminished because, although the same foundational knowledge could be given to all students, the process at which the student obtained this knowledge would be as important as the knowledge itself. Simply put, the learning process is just as important as learning the knowledge.

This study did not concentrate on the rigor or ruggedness of the participants' high school's curriculum, but from the responses given by the participants that did not persist, it appeared that high school and all that came along with it was very easy for them. Some of these students truly struggled within their chosen major due to academic preparation they received

from the high schools they attended. The students that did not persist had an inflated sense of preparedness when they entered their programs.

Tony, for example, gave this description about his academic preparation. He stated:

At first I did feel prepared because I guess I did not think high school would be that much different from college. You have got to make that transition. High school was easy. I really did not study a lot for any of my classes and I got a 3.8 and I was taking hard classes. I thought I could be successful up here but it just did not work out that way because during the time I was going through my program, I did not feel prepared. (Tony)

Tony felt prepared as he started his college career. He took the hardest classes that were offered at his high school and passed them without having to study. He graduated with a 3.8 grade point average and did well on his scholastic aptitude test. To Tony, these were indications that his high school prepared him for college and his major of choice. However, once he was going through the program, he realized that he was not as prepared as he thought. He described this realization as a feeling of being overwhelmed.

It was just overwhelming a lot of the time. I think it was overwhelming having 15 hours.

It was definitely a lot of work I had to get done. It was a lot more than I expected even though they told me it would be very intensive. I just did not realize how intensive it would be. Once I got into it and realized, I just knew it was not going to work out for me.

If I had a more rigorous scheduled in high school, a scheduled that was based on what I was going into, I would have definitely been better prepared for it. (Tony)

Tony's high school curriculum, or the way it was taught, did not challenge him in a manner that prepared him for the rigors of college. His high school curriculum may have been taught in a way that promoted understanding from the students and that was why high school was easy for Tony.

Nails had a similar story to Tony in that she was not prepared for the amount of work that was required of her. She also became overwhelmed.

I did well in high school and I had a passion to do well, so I guess my drive made me feel prepared, but when I got here maybe it was too much work. When going through the classes, I did not feel prepared because it was too much. Was I supposed to work like this for the rest of my life? I cannot do it. I just felt like I did not have a life. I am a pressure person. I would be doing some work and thinking about everything else I had to do. So I am thinking, can I do this, how long will it take to do this assignment, I have ten more assignments to do. It was having that constant pressure all the time that stressed you out. (Nails)

Nails struggled with the amount of work that she had to complete. In high school she also could have had an enormous amount of work to complete, but there it may have been presented in a way that was clear and straight forward causing her not to feel stressed because she could understand what she was doing. Not necessarily because the work was easy, although it could have been, but because the work may have been explained in a manner that promoted understanding.

Jo-Lisa had no prior experience with programming, but thought she was prepared for computer science as her major based on her familiarity with computers from school and personal use. She found out that this was not the case for what she knew and what was being taught were miles apart.

I felt prepared for the math, but for the programming no. I did not feel prepared because I was not use to that. It is one thing for you to be proficient in word or excel, but it is another thing to write a C++ code. (Jo-Lisa)

Jo-Lisa made the assumption that colleges developed knowledge and taught information from the

ground up, but that was not the case". Colleges teach at a specific level because they make the assumption that students have the knowledge necessary to make the connection between what they are currently teaching and what they have already been taught. Jo-Lisa never possessed that knowledge so she could not make those connections.

Bell articulated this thought in her response about not being prepared for her math major. She stated:

I thought I was prepared, but then I got to class and I started realizing that I was learning stuff that I was not really learning because I was not really being taught. It is not really explained. It is just go home and read the textbook and go to class, take notes, ask a couple of questions, but you do not really learn math reading textbooks. It is all pretty much examples. It is not like history. (Bell)

Bell referred to not being prepared as not knowing what was going on within her classes as well. The material that she was being exposed to was completely new to her because she had no prior experience with it. She could not make the connection between what she was already supposedly taught to her current situation. As a result of not making these connections, she struggled and her response implied that she did not have the support needed to make those connections clear to her.

Millicent addressed why she felt so prepared when she entered this university. She stated:

I felt prepared because in high school I was involved in a lot of programs. I had some friends, not a lot. I was doing well in high school and I graduated 56 in my class. A lot of people I know that applied to LW University did not get in and many of those people were white. I figured since they were white they would get in before I did, but that was not the case. Also I was the only black student from my school to get into LW University. So I figured since LW University accepted me maybe I might be smart. And

once here I did feel smart in some of my classes, but not a lot. (Millicent)

Millicent felt she was smart and prepared because she was accepted into Virginia Tech when many of the people who were white at her high school did not get accepted. In addition, that year she was the only black student accepted into LW University from her high school.

Millicent felt proud because LW University by some is considered to be one of the top schools in the nation because it is ranked very high academically in comparison with other schools of its size. Many students conclude that for a college with the high credentials and standards of a LW University to accept them signifies that LW University believes that they are academically prepared for the challenges that await them, other wise they would not accept them.

There are times when a student graduates from high school with a decent grade point average and scholastic aptitude test score and that leads that student to feel that they are prepared for their major of choice. Students in this study came to find out in a short period of time that they had gaps in the knowledge they held. These gaps caused feelings of being unprepared because they came to realize that they did not have the prior knowledge needed that could have assisted them with being successful within their major. However, this researcher believes that academic deficiency was not the primary cause of non-persistence amongst the students because deficiencies can be overcome as will be shown with the students that did persist.

Experiences Within Major

The participants described experiences that were both positive and negative while participating within their particular major. In the articulation of their experiences, some students described many experiences as being filled with emotional turmoil. This section highlights the relationships between the participants and their professors, as well as their relationships with their peers.

Poor relationships with professors

There are probably not many negatives in students forming good relationships with their professors. Most would probably agree that forming positive relationships could only assist a student in their quest for success as well as assist the professor in keeping in touch with student's need. A positive relationship between professor and student yields a greater result than a negative relationship. Unfortunately, good relationships with professors for many black students can be problematic. More times than not, the participants that did not persist had relationships with their professors that were poor, or non-existent, with an occasional positive relationship that was encouraging.

Jones, who at this time was not persisting in her original major of biology, spoke of forming relationships with only some of her professors. Of the professors she did form relationships with, she spoke of one in high regard. She described him as one that showed an interest in her. She stated:

Only some of my professors did I form a relationship with. In freshman year chemistry, my favorite professor here was Dr. Whiteman. He always stressed the importance of coming during his office hours. He made you like him and I loved him to death.

Whenever I see him in the street, he can still say that is such and such from wherever you were from. He knows my name and he knows where I am from. I have his house number and I can call him and talk to him. He has met my grandparents. (Jones)

This particular professor made Jones feel important and at ease when she was in his class, but ultimately, she still struggled within her major because she did not have this type of relationship with the majority of her professors. Those negative relationships contributed to the reasons of why she left her major.

Although positive relationships with professors are not the only predictor of success for

students, it can be very important to some student's persistence and should not be under emphasized. For example, Jones' performance in a class was directly linked to how she perceived the professor to be. Her perception of her professors determined whether or not she felt comfortable with them.

I did better in those classes in which I felt comfortable with the teacher. I felt more comfortable talking to them. Some people are very smart, but they are not necessarily built for teaching you know. So the friendly ones, I would do better in their classes because they made me feel comfortable. Like coming to ask them stuff. (Jones)

For a vast number of black students, their perception of their professors determines whether or not they seek out and develop relationships with them. That relationship in many cases can be pivotal in determining whether a black student will be successful in his chosen major.

The students within this study referred to having a negative perception of their professors as receiving a type of *vibe*. If a professor gave off a negative type of *vibe*, then participants picked up on that *vibe*, and this interfered with their ability to learn. When the participants talked of their experiences and relationships with professors, some used the phrase: "you just get that *vibe* from a professor." That *vibe* signaled to them that the professor would not be helpful in their efforts to be successful. This *vibe* caused something to trigger within the student that led them to think in a negative manner towards the class and the professor. That action clutters up the student's mind with worries about the perception the professor has of them and whether they will be treated fairly.

To a black student in a predominantly white environment, a negative *vibe* given off by the professor can be especially detrimental because it has the potential to make the student feel alone and isolated. That *vibe*, again, serves as a notice to students that the professor could care less about them, and about whether they pass or fail the class. Sometimes the negative *vibe*

would be easily recognizable due to the situation a student found himself and sometimes it was just an inherent feeling that the student had.

Jones, Denzel, Dianne, and Nails, all participants that did not persist, expressed perceptions of their professors that made them feel that negative vibe. As these students discussed their perception, they also discussed what they were feeling at the time because their perception and feelings were interconnected with how they felt about themselves.

Jones provided an example of how one professor made her feel dumb. This perception she had of her professor caused her to view him in a negative manner.

There was one professor that was not friendly in cell and molecular biology. Dr. Mean, he was not friendly at all. I do not think that he works here anymore. I went to him one time and he made me feel dumb, because he was speaking to me like or looking like I should already know this. And I was like that is why I am coming to you for help because I do not know. But it was like he looked down on students. (Jones)

This incident caused Jones to not seek help from this professor very often. His making her feel dumb prevented her from seeking the assistance that she needed at times to complete assignments, or understand concepts.

Jones continued her discussion by providing an example of another professor that she did not feel comfortable with. Her not feeling comfortable with him caused her again to not seek the assistance she needed within her biology major.

Well, another professor that I did not like, he taught Organic Chemistry, and it was the first class that I ever failed. And that was why I changed my major. I never went to him for help because I just felt like he would not help me if I went to ask him. He just did not look very friendly. (Jones)

The professor displayed something that caused Jones not to take a risk of trying to develop a

relationship with this professor. She went into a defensive type of position that kept her from taking action. She was trying to protect herself from the hurt that she concluded this professor would cause if she approached him for help.

Nails expressed feelings that were similar to Jones as she discussed her relationships with her professors in engineering. In her response, she articulated never feeling welcomed into her department. She felt like she did not belong.

I never felt welcomed. For some professors it is strictly a classroom relationship. You do not feel a personal connection or any thing. In the classroom this is how it is, this is what it is. They always seemed so busy too. (Nails)

Nails sounded like she wanted to develop a personal relationship with her professors, but due to the perception she had of them, this did not take place. She felt like they were always too busy to be concerned with her. This perception led Nails to feel she could not depend on her professors for support in times of need.

Nails frustration showed as she tried to communicate exactly what she was feeling in this next response.

It is pretty much, “We are going to learn this. This is the first step, second step” and that was pretty much it. My classes now “Do you have any questions, does everybody understand?” It was not like that. Here, it is focusing on whether or not you get it.

(Nails)

Nails believed her current major cared if the students understood the information that was being covered. She believed her old major cared nothing about her understanding or about her as a student. She also at times felt intimidated by the professors. All the work that had to be completed, the unfriendliness, and not understanding caused a level of stress that played a role in Nails not developing relationships with her professors.

Dianne expressed feelings about how her perception of her professors inhibited her from forming relationships with them as well. Dianne had an incident where a professor made her cry in his office because of the way he was treating her. She stated:

I have had experiences where this professor made me cry in his office because of how he was treating me. He kept harping on me: “What is the answer to this?” “What is the answer to that?” I was like: “I do not know and obviously that is why I am here.”

Basically after I cried, I left, I left that office. (Dianne)

Dianne continued her story by expressing her belief that when students go to professor’s office they really need help, otherwise they would not go. When Dianne went to her professors she did not expect to leave crying. She expected to leave with a better understanding of the material she was having trouble with.

Those perceptions that the previous students had of their professors were somewhat easily recognizable because their perceptions were directly linked to how they were treated. However, there were times when a negative perception was obtained from behaviors that were not easily recognizable.

Denzel, in his discussion about how he felt towards his professors, relayed a story where he just felt like something was wrong with how he perceived his professors to treat him. He started his conversation by sharing how he approached some professors for assistance, and they made him feel like he could come to them anytime if he needed assistance. He started to explain how that was not the case for all of his professors because some just wanted to answer his questions with as little of an explanation as possible so he could leave them alone. He stated:

I had a few professors that I felt that I could go to at any time and felt like I would not be bothering them if I went. With some of the professors I felt like when I went for help, it was like they were helping me, but it was like they were not really trying to. They were

helping me, but it was like they were not taking their time, they just wanted to get done with me. I would ask them a question and they really would not answer it. They would answer it, but I would not be completely satisfied. I would not completely understand what all my options were. I was persistent somewhat but I did not want to feel like I was bugging them. (Denzel)

Denzel felt turmoil when he approached professors that seemingly did not want to be bothered. He never would fully comprehend the help they were providing because he felt rushed by them, as well as a bother to them. They made him feel as if he was a bother to them when he sought assistance.

Denzel went on to say how those actions towards him made him feel, and how that affected his self-esteem. These actions towards him eventually effected how persistent he became in seeking help from his professors.

I know they are there to help and if I go and ask for help, they have to do it, or they are suppose to. If at the same time you do not feel wanted or if somebody does not want to help you, why would you bother? That got me down. If this is where I am going to school and if this is what I want to get my degree in and this university is all about helping me then when I go to get help, why are you not doing what you said you would do. If it was me doing something I was not suppose to, I do not know what it would be, but if I am going to you and asking for help and if I am not receiving the help I need then there is a problem, especially when you say you are all about helping me and we are all behind you. (Denzel)

Denzel expressed the sentiments of being betrayed by the engineering department and University because they promised they would help, but he felt like none was being provided.

The participants talked about the affect their professors demeanor had on them. The professors'

actions towards them made some feel dumb and uncomfortable. Some were made to feel like they were a bother to the professor when they sought help, and some felt their professors were just unwelcoming altogether. Past experiences with teachers did not prepare them for this type of treatment. Their experience's dictated to them that teachers were supposedly helpful and supportive, not closed off and unfriendly. The treatment of these students by their professors contributed to the lack of relationships that were developed.

Environment not conducive to forming relationships

Every student would like a positive relationship with his or her professors, and when that does not happen in the way the student envisions, he/she searches for reasons why. The characteristics of the environment contributed to students not developing relationships with their professor's. The size of the classes that students were attending within their major played a role in them not trying to form relationships. These students felt that the professors could not possibly care or have time for them due to the number of students within the classes.

Lula, for example, explained how she felt about her class sizes and how she felt the professor would respond to her if she sought out assistance. She explained:

I did not have any relationships with my professors and I did not like it. My freshman year, that is what I called home about a lot. Oh my gosh, these classes are too large. I was used to being the teacher's pet, however bad that may sound, but that is how you get your grades, because they understand what you are going through. They know what else you are doing, so if you come to them and say: "I am having trouble with this", they try extra hard. That is if they understand you, and know what you are doing, and know that you are trying. But when they have 500 students, they cannot know that. (Lula)

Lula wanted a relationship with her professors, but did not know how to form them due to her feeling non-important within the huge classes she participated in. She felt that due to the

enormous number of students within the classes, the professors could not take the time to develop a relationship with her. Lula felt as if she needed these relationships because she wanted to personally show the professors that she was trying to grasp the material and trying to be successful.

Lula's past experiences had taught her that when teachers see a student working hard, the more inclined they are to help that student. She needed that kind of relationship with her professors, but did not seek to develop them because she concluded that there was no way the professors could develop meaningful relationships.

Jo-Lisa, in her explanation of why she did not develop relationships with her professors, gave reasons that were similar to Lula's. Jo-Lisa believed had she been part of smaller classes, she would have been more adapt to try and develop relationships with her professors.

I do not think I was made to feel that I was not as smart as my white counter parts because a lot of time the classes were so big you did not have that one on one with the teacher and I did not feel comfortable going to the teacher. If it were a smaller class, I probably would have. Not forming relationships with my professors did have an impact on me in my computer science classes. I do not remember talking with them very much.

(Jo-Lisa)

Jo-Lisa realized that not forming relationships with her professors impacted her negatively in her classes. She just did not feel comfortable in approaching them for assistance when the classes were so large. There was a risk involved in trying to develop these relationships that she was not willing to take.

For black students, this fear or inhibition can be overcome if they are within an environment that makes them feel comfortable in seeking assistance. An environment, regardless of the class size, that provides the support needed that allows the student to expose their

weakness without feeling dumb or unintelligent. Unfortunately, due to the unsupportive nature of some scientific environments, many African American students within scientific majors do not take this risk.

Jo-Lisa continued with her conversation as she described her environment. She stated: I felt like the environment was cold and sterile because I did not feel like I had enough knowledge or background in programming. I did not want to sound stupid with my professors because they might expect me to already know something. I guess I felt that way because the professors I had, it was like all they did was program and code and that was their life. They expected it to be your life, but that was not my life. We did not have that connection like we were two nerds or something. (Jo-Lisa)

The environment in which Jo-Lisa participated was one that made her fearful of asking the questions she needed to ask because she was afraid of being viewed negatively in the eyes of her professors. She felt trapped, and this made the overall environment feel cold and sterile to her. Her silence indicated that she would rather continue to struggle than to take the risk of looking stupid.

Diane described her environment in negative terms because she too did not understand the material that was being studied. Unlike Jo-Lisa, Dianne went to her professors for help but had several situations where she was made to cry and where she felt she was treated unfairly. Diane's treatment made learning much more difficult.

My environment was hard, stressful, and challenging. Hard because every class was that way no matter what class I took. It was stressful because I did not understand the material in the classes, and challenging because it did not come easy to me. (Diane)

The statements that Jo-Lisa and Dianne made dealt with a lack of understanding of the subject they were studying. Their environments were this way because they did not have the support

needed in order to understand the information being presented.

Within multiple statements made by students within this study, a sense of fear was detectable. Not knowing how they would be treated if they approached their professors was a big concern, and this fear was enough to keep them away. The fear of looking dumb to their professors, or the fear of adhering to the stereo-types of blacks students not being as smart as White students, may have had an effect on their willingness to seek out help from their professors when needed. Class size influenced their decision not go to their professors for assistance, but feeling inadequate, or being made to feel inadequate by the disposition of their professors, almost certainly contributed to them not going to their professors as well.

Weed out Environments

Beamer described an environment that he just did not fit into. He came to this conclusion after being exposed to the students and professors within the environment. He believed that his personality did not fit in with the type of people he came into contact within engineering. He stated:

Engineering is a lot more serious, business like. I did not feel comfortable in it. It is so serious and stricter to the rules. It creates more stress because everything was so serious.

The professors are not as friendly. It puts more stress on you. (Beamer)

The demeanor and disposition of those within engineering caused Beamer's reaction. How the engineering major was structured, and the unfriendliness of the professors, indicated to Beamer that the engineering environment was not for him. His persona was totally different from the department, and his view of what engineering was about was totally different than what this department portrayed.

Nails spoke of being "weeded out" in terms of applying what she was going through presently to what she imagined her future to be like if she remained in engineering.

My environment was cold. It was just hard. Cold as far as, it was not open and there was not much help. Not many outlets. You do your own work and they did not really care if you did not know how to do it. It just was not very open. It made me rethink it a lot. Is it worth it to me? Is it going to be like this for the rest of my life? When I get into work are my co-workers going to act like this? Meaning, not willing to help. I am a very social person and it helps me to interact with people. Interaction helps me to learn. I could not stand the thought of being in a cooped up environment the rest of my life. (Nails)

Nails' environment made her think about life after graduation. She could not fathom the idea of being in environments where the type of behavior she was experiencing was the norm. The environment tainted her view of how she imagined the subject of engineering to be. Her department's representation of engineering, and the attitudes of the people within it, was what weeded her out of her program.

Denzel discussed the demeanor of professors and the stress that one encounters while in engineering. Denzel felt the overall environment of his major was intentionally harsh, cruel, and unfriendly, because those in authority wanted to weed people out of the program. Denzel described his engineering environment, as one that would put an obscene amount of work on its students to see which students would survive the process. This caused Denzel to view his environment in a negative fashion. He stated:

My environment was pretty much cold and sterile. They did not want anybody in there. It was a weed-out process. They wanted to see who was going to stick with it, work hard, and actually succeed. It was not like this is what we want you to do and we want you to succeed. No, it was not like that. It was you have this, that, and this to do, and on top of that you have a project to do and on top of this you have to do something else. Good luck doing it and I hope you make it. (Denzel)

Denzel implied that his environment was one that weeded people out. He believed that professors' gave enormous amounts of work, not for the purpose of understanding, but for the purpose of seeing who had what it took to make it through. This seemed cold to Denzel because he did not understand why or how that much work could be given without the support necessary to complete it.

Denzel continued by saying:

I would not say my environment was warm and inviting at all. They made it seem like they did not want you in there. Even if they said they were going to help you with any problems you had, it did not seem that way to me. I was very discouraged, and it seemed like half of the time I was depressed because I was trying so hard, but yet I still was not succeeding. I still did my work and studied, but no matter how hard I tried my work was not up to par. I was very discouraged the way the program was set up. (Denzel)

Survival of the fittest came to mind as Denzel spoke about how he viewed his department. What was required of him did not match his academic abilities, and his lack of academic support produced an environment for him that was almost impossible for him to succeed in.

Millicent, in her description, revealed some of the feelings she had while majoring in biology. She also was an unwilling participant of the process that some referred to as being weeded out, and described her frustration in this manner:

Hard, ruthless, and uncaring describes the biology environment. They just do so much to weed out the weakest in biology. What I did not understand is that if they did not want a lot of people in the major, why do they accept everybody. There was like 500-600 people that came in as biology majors, now they only have 200-300 left. They just try so hard to weed you out. In seminar class, if you are not there you are going to fail the class. You have to get an 80 on the exam to pass and if you do not, they come off as if you need to

change your major because you do not belong there. (Millicent)

Millicent's frustration resulted from not understanding how a program could accept so many students into a major knowing that the number of faculty on staff could not accommodate such a high number of students. This signified to Millicent that there was a concerted effort that weeded her and many other students out of biology.

Elizabeth described her weed out environment in chemistry as one that did not provide support. When she entered the program the people she initially talked to appeared to be supportive of her efforts to obtain a chemistry degree, but when she struggled within some of her chemistry classes, she found out this was not the case.

My environment was complicated, in-depth, and rigorous. It was difficult because it was like they were talking over my head at times and I would just have to sit there. You have to read, take notes, and figure out what they were talking about later when you got back to your room. You could go talk to your professor and see what they were talking about because sometimes you would just sit there lost. (Elizabeth)

Elizabeth was struggling within her major and at times she just sat in class and took notes without an understanding of what was going on. She went to her professors for clarification and her next response suggested that none was given.

Chemistry was not enough encouragement. You know people boost you up and say that is a good field to go in, but when you come to people who, when you come to them asking questions, they are like: "well that is what you wanted to do." Then you have questions like: "well should I stay in it?" They would say "well that is up to you." But when I first went in, they were like, "oh yeah you can do it" and all of that stuff. They do not give you encouragement if you are feeling discouraged about it. They do not say well you can make it or anything like that. They just say: "well if you do not feel like doing it,

you can always switch.” I was thinking that is not what I wanted to hear, but okay.

(Elizabeth)

Elizabeth felt betrayed by the faculty. She found herself not understanding the material that was discussed in class and had anyone to turn to for help. Every once in a while a student needs to be encouraged if they are struggling, but Elizabeth did not receive that kind of encouragement. She essentially received encouragement to change majors, instead of encouragement that could have possibly helped her to succeed.

Students described the feelings of being weeded out of a program. They described not fitting in, the workload, the non-supportive natures of their departments, and hinted at the characteristic of dishonesty on the part of those that were in charge. Some found themselves in situations where they did not have the necessary tools to perform the work that needed to be done and this affected their perception of their environments. Operating within a positive and supportive environment would have allowed them to take more chances in trying to develop relationships that may have helped them with their studies. They did not experience their environments in this manner, so without the necessary support their destiny was a failure.

Trouble forming relationships with peers

Typically the students that did not persist had peer networks that would be described as limited and weak. Some participants had problems developing any type of academic relationships because their previous experience with developing relationships with peers in secondary school had been established on the basis of knowing their peers for an extended period of time. Meaning, while the participants were in high school, they had developed strong relationships with their peers because many of them had been together since middle school.

The participants struggled in the development of new relationships causing them to feel isolated within their major. In order for relationships to be formed, these students would have

had to take the first step in establishing relationships for purposes other than being social and this was something many of them were not prepared to do. Instead, many convinced themselves that they preferred to be and work alone.

This reasoning appeared to be logical in a sense because although they had strong relationships with their peers in high school, they rarely needed help with their studies. This was their mode of thinking in high school and that thinking continued when they came to college. This strategy caused many participants to struggle unnecessarily with their studies. They did not realize those things taken for granted in high school were actually networks of support that made them feel comfortable within their environment. In high school, they may have not needed their peers, or teachers, to assist them with their work, but on the rare occasion they did need help, they knew that those people would be in place. That network of support now was something they had to negotiate for themselves, and many found that process to be daunting.

Bell, for example, met other students in freshman orientation that would be in the math program with her, but when classes started, Bell found herself alone and realized she was no longer in high school. Bell had no idea of what to do, or whom to turn to, when she struggled with her classes. Bell discussed how she really did not have a network of peers because she developed no relationships with them in her major.

When I got to LW University, I did not really have much of a support system.

I developed no relationships with my peers. I do not want to say it was a closed situation, but again when you get to college its worse than high school. If you do not know anybody to ask for help, they are definitely not going to offer it to you. Not having a relationship with my peers did not necessarily affect my psyche. To tell you the truth, I could have cared less about my peers because everybody is on their own level. However, when it comes down to it and you are sitting in class and you do not have anybody to

even joke with or poke in the side, it is not interesting. It turns into a (blah) situation. I know its college and you are getting ready for the real world, but you still need to have a little bit of laughter once in a while. (Bell)

Because of her lack of peer relationships within her major, Bell had no one she could struggle with. Although she said not having a relationship with other students did not affect her, her response read as if she really needed or desired some type of relationship with someone. It was also interesting how Bell rationalized being alone to how real life was going to be. She viewed her situation as one that was preparing her for life after college.

Sophia spoke about why she did not develop relationships with hers peers in mathematics.

I did not really, there was, I do not know, I would say not too much, there might have been one or two students that I would talk to on a daily basis, not too many though. I just feel like because sometimes everyone else, when you are in a math major, everyone else you are taking courses with are engineers and engineers are kind of, I do not know, you either like them or they will rub you the wrong way. It is like oh, I am an engineer. They feel like no one else is as important as them on campus because they have the biggest college and bring in the most money so yeah; I think that is mainly what it is. Especially when they are like, oh, I am an engineer. It was just the way they came across with things. (Sophia)

Sophia did not develop relationships within her math classes because she said that they were full of engineering majors, and her perception of them was that they thought they were better than everyone else. This type of attitude turned her off and she chose to work alone. One possible reason for Sophia's unwillingness to form relationships with engineering majors may have been that they intimidated because she actually did perceive them to be better prepared than she was.

Or she could have just not liked their demeanors because they did act as if they were superior to the other students.

Sophia continued her conversation by making reference to the other students that participated within her classes.

I really did not study with other students either because I am not one to study with other people. That is always how I have been. Studying in a group never worked for me because it ends up being like a social gathering more than studying. Going about it alone, sometimes it would be a little harder, but there was one girl if I ever needed help, she lived in my dorm too, and we would always help each other out. It just cannot be, if it is more than one person for me, it is just like chatting the whole time. (Sophia)

Sophia, in her past experiences in high school, never had to study with other students. If she did study with other students in high school, they were her friends, and friends typically talk more than study. It is possible that Sophia's prior experiences suggested to her that study groups were nothing more than a social gathering that accomplished nothing. She may have had no concept of forming academic relationships with peers that were not her friends. She admitted that doing things alone made it harder for her, but she did have one person that tried to assist her when she felt she needed assistance.

Tony talked in terms of being alone and not knowing anyone. He knew no one outside of his professors he could go to for help. He, like the previous two students, chose to operate alone because he felt like he had no choice but to do so.

Well freshman year, I did not really associate too much with my classmates. I did not have anyone in class to ask about the problems. I just dealt with the teacher. I think I was just adjusting to being here. Really my freshman year, I was really adjusting to being here. I did not know a lot of people and I was not interested in getting to know people

even to help myself out. I guess it was a readjustment thing, getting use to being here.

(Tony)

Tony associated only with the professors and made no effort in trying to get to know the other students. He was adjusting to an environment in which he was alone and for some reason wanted it to be that way.

Tony continued with why he felt that way:

Really the number of people affected me, because I am used to being around people that I know all the time and then when I got here, I did not know anybody. It was hard for me to make friends. I did not get into a position to try and get to know people. I just stayed to myself the whole year, but as time went on, I got out and started to meet people and everything started to go all right. (Tony)

The large number of people affected him as it did many students and it was difficult for him to try to make friends with people that he had never seen before. This life was his life for his entire freshman year. He isolated himself off from others and stayed in his room and studied.

Tony, like the other students, felt that he was not affected by not having any relationships with his peers, but due to his non-persistence in his major, one could make the assumption that he could have benefited from peer relationships that may have potentially helped him with his studies. Tony admittedly struggled with his studies, and that struggle possibly was a direct result of not establishing relationships.

Millicent, in discussing her lack of relationships with her peers in biology, revealed that she had lived her whole life without the comforts of friendships, so the situation that she found herself in was no different than what she was already accustomed to. She stated:

I did not really know anybody. I met a couple of people in my major but I did not really talk to that many people. Not knowing people really did not have an impact on me

because I was used to it in high school. I did not have that many friends because I was living in a small town where everyone grew up together and I was an outsider so no one talked to me anyway, I was use to being to myself. Within biology, when I was in class, people were so active, but I just came to class and took notes. People were so excited and asking questions and stuff, but I did not feel like that. I did not feel like I belonged there.

(Millicent)

Millicent, from switching schools so much in her early years, had always felt like an outsider, and people treat outsiders differently. Her experience in this new environment was no different than previous environments because she again knew no one. However, her response suggested that she wanted to be involved, and wanted to have fun and be excited about biology, but just did not know how to do so.

These participants were alone for numerous reasons and found that being alone was not especially good for them with regard to their academics, but forming relationships with other students would have meant that they had to take the risk of exposing their weaknesses and that was an action they were not willing to take. The old expression of “it is better to remain silent and be thought of as a fool, than to talk and remove all doubt” comes to mind.

Weak networks of support

Other students that did not persist described both positive and negative relationships with their peers. However, their description of positive relationships dealt primary with one or two people. They were not integrated into the environment of their major and this contributed to their non-persistence. Simply put, their networks of support were too limited, and they did not have alternate sources to get assistance from when needed. Appendix 3 attempts to highlight the individual networks of each participant.

Elizabeth, for example, talked of her relationships in this manner:

Once you get to know them and introduce yourself and start talking, you get used to people. I developed a real good relationship with one of the girls in my class, and we did homework and stuff. Yeah, she was actually a White girl but she is not here anymore.

She dropped out and moved to Chicago, so now she is at another school. (Elizabeth)

When questioned, Elizabeth only made reference to one white girl that she got to know. The problem was that this girl left school and Elizabeth mentioned no one else that she established a relationship with. She made reference to getting to know the students in her major, but never anyone else that she studied with.

Jones also had a limited network, but did develop friendships with four other girls in her major. That was a tremendous help to Jones because her peers assisted her in the comprehension of the material she did not understand in class.

I guess when I got to college, I did not know that I was not disciplined and I was not use to all of those people being in classes. That is my biggest thing, large class sizes. So having my peers really helped me out with some of the stuff that I did not get. It helped me because some of the stuff, I did not understand. So they explained it to me and then they helped me to remember when stuff was due. We helped each other, you know? Two other girls in particular: Dionne and Leida. Dionne was black and Leida was white.

(Jones)

Jones studied mainly with two other girls and by her own admission she was undisciplined when it came to her schoolwork. Jones struggled was made harder because she limited herself to these persons.

Although Jones described herself as undisciplined when it came to her work, it must be stated that often times when students struggle they will say negative things about themselves to save face because they are embarrassed because they are struggling. Students do this in part

because they have been conditioned to believe that if they do not succeed, they just did not work hard enough. However, the true reality of the situation may be that they participate within a system that is designed for them to fail and blame themselves for the failure. So to say one is undisciplined maybe an attempt to convince others that they could have succeeded if they would have tried harder knowing that they really tried their best. Either scenario or both could be true for Jones.

Denzel described his relationships with his peers as being positive, but examining his response suggested that he really had no relationship with his peers at all. He portrayed his relationships with his peers in this manner:

I would say pretty good relationships. Everyone that was in the engineering major felt the same kind of pain and agony from the work so we formed like a little bond. Getting projects in, knowing how much homework we had to do. We understood each other's downfalls. I studied a few times with my peers. (Denzel)

Denzel gave a picture of his positive relationships with his peers where he related to them, and they to him, due to the fact that they were all going through a difficult program, but that was as far as he, or they, went with the development of an academic relationship. He studied a few times with some, peers but what he described were not relationships that seemed concrete.

Denzel later discussed his relationship with his project group and uncovered the true dynamics of his relationships.

I cannot speak for others, but like for me, and my project group, we never studied together. I do not think the people in my group studied with anybody else. Sometimes we would ask each other questions to see if we could get help. As far as a group and sitting down together, we were not together like that. I do not think anybody else in the class was doing that. (Denzel)

Denzel may have studied a few times with peers but his statements suggested that for the most part he studied alone and believed that most people in his classes did the same. Denzel believed that he was supposed to be bright enough to handle his studies alone with minimal help from his peers, so that was what he did and believed others did as well. Therefore, he was in a network that was very limited and weak because it could not provide him with the academic support he needed. This was especially detrimental to Denzel's network of support since his experiences and perceptions of his professors were mainly negative.

Black only relationships

Some participants limited and weakened their networks of support by only associating with other black students. Their networks were closed to people from other ethnicities, and this coupled with other factors, contributed to the struggle of these students. They struggled in terms of academics, struggled in terms of being one of a few, and struggled with how they thought others perceived them.

Lula did not go out of her way to form relationships with people that were not already her friends, and these friends were typically black. Lula gave her reasons for this in the following response:

I did not go out of my way to form any big time relationships except with those people who were already my friends, and they were the black students of course in biology. I think in most of my biology classes my freshman year there was about 15-20 of us, and sophomore year there was not that many of us. Chemistry, maybe 2 out of 200 or something, so it was slack. Having two other Blacks with me did not help that much because I had a few classes in high school, where I was the only or only 1 of 2 or 3 in the class. I am use to being the only black kid in the class. It does not bother me unless there are 500 people in the class and there were only 3 of us, oh gosh. (Lula)

Again, class size affected human interaction. For Lula, the classes were so big that she only felt comfortable around other black students even though she had been accustomed to being one of a few blacks within a class from her days in high school. The difference was that in high school her classes probably had no more than twenty to thirty students, and that was quite different from being in a class of 500 people who looked nothing like her. This has the possibility of making one feel uncomfortable and alone.

Jo-Lisa came to LW University with several of her black friends. This had the potential to put her at an advantage because she actually knew people within her classes. The problem was that she only associated with these friends.

I had a group of friends that all came in together. We supported each other and struggled together. My peers were all black. We saw that we were all in the same major and just stuck together. We would have let others in; we just did not know anybody. We hung out with engineering people, because we took a lot of the same classes. I would try to branch out to other people, especially the ones that I had classes with. I would sit beside them or whatever and they were not necessarily black. It was good to have friends within the major because everybody was encouraging you and you were not by yourself struggling. It also felt good to have other blacks with me. I felt comfortable going to them. Sometimes they were helpful and sometimes they were not. (Jo-Lisa)

Jo-Lisa tried to extend her relationships by sitting next to different people in class but that did not work. Jo-Lisa, and her friends, wanted to expand their group because they did not mind having other people associate with them, but they just did not know how.

Jo-Lisa knew what she needed to do, but did not have the relationship building skills necessary for this to occur. Maybe she had a bad perception of the other students or maybe she perceived herself in a negative manner when she compared herself to the other students and this

inhibited her from forming other relationships. Regardless, Jo-Lisa struggled because she was in a network that provided her with minimal assistance when she had problems. Her group of friends consisted of people that were glad that they had others to struggle with, but could not necessarily help each other academically. Jo-Lisa also had non-existent relationships with her professors, which made matters worse for her as well.

Nails also primarily associated only with other black students. Her reason for doing so was a little more explicit than the other students. She noticed that there was a clear division of students within her engineering classes. The white female students stuck together, the white males stuck together, and the black students stuck together. Nails also highlighted the demeanors of each group in her response.

The females were nicer and the males were kind of... I did take some classes with people I knew that were black in engineering. We sat and did everything together. We did our homework together, we (the black students) knew each other, had things in common. The black girls in my class, you bond. White Girls were nicer than white boys. The boys were together, especially the smart ones. A lot of them looked at you like, why are you in here, but some were nice, you could tell. (Nails)

Nails raised issues of just having something in common with the people she attended classes with. She enjoyed the bond she had with the other black students. She also enjoyed the social and academic bond that she established with them because she was in a major that was segregated by race and gender and this provided her with a group to belong to as well. Nails also had problems with her professors and this contributed to her non-persistence in her major.

In general, when black students find themselves in an environment where they are greatly outnumbered, many try to find something or someone that is familiar to them. In order not to feel so isolated within their environment, many will interact with other black people if the

opportunity presents itself. Being one of few blacks in a class of two to three hundred white students has a tendency to make one stand out and in order to feel some sense of belonging; many black students will congregate and stick with one another if at all possible. The problem with that in this environment was that their majors contained a limited number of black students from the onset, so as they progressed through the curriculum, that number further decreased causing their network to shrink to an even smaller size. They needed other people, other relationships, but they did not feel comfortable in forming those relationships with students that were not black, nor did they know how to go about doing so.

Racial encounters

Millicent told stories in which she had racist encounters, as well as stories where she believed her race played a role in how she was treated. For example, she talked about being treated unfairly when she was assigned to a group within her microbiology class.

When I was in microbiology, the professor set up the class so that everybody would be in a group and we had assigned seats because there was group work everyday. I noticed when we had group work, my group would never ask me for any contributions because they thought I was dumb. When it was time to leave no body would say any thing to me. They just thought I was dumb. (Millicent)

In this situation, Millicent felt dumb because how her group members treated her. She felt they ostracized her from the beginning by not even acknowledging she was a part of the group.

Millicent continued her conversation about the group's treatment of her by relaying that they did not even trust her to do the simple things when it came to labs and other assignments.

In some of my lab classes they would not let me do the work because they thought I could not do it because I was black. We would have to come back and check on the Petri dishes. I said that I would do it and they would say: "No that is okay, you might not

know what you are doing, this is kind of hard.” How do you know that I do not know how to do it? It is like they do not say it to you, but you know it is because you are black. (Millicent)

Millicent believed that the treatment she received from her group was primarily because she was black. She reached this conclusion because she did not believe her group had enough information about her to assess whether she knew what she was doing. She felt dumb because they never asked her for input or anything else. They treated her like she did not exist.

As the conversation continued, Millicent gave an example of another friend that was going through a similar situation as she was. In synopsis, she described her friend’s situation as white students not taking him seriously and thinking that he was dumb because of his style of dress. She then began to discuss how the totality of all her experiences had caused her to really develop a disdain for white people.

You would think coming from a white high school that I would not have problems with white people. I never had problems with white people until I came to LW University. Right now it is almost like I hate white people. (Millicent)

Millicent could not understand what was going on because she had gone to a white high school and had no problems with white students, but here things were different.

Millicent could have gone into her classes expecting something negative to happen because her experiences, past and present, could have tainted her perception of reality. However, her group members’ actions and treatment towards her confirmed and supported her assumptions that because she was black, her white peers thought less of her intellectual abilities. Millicent’s negative experiences with her white peers caused her to develop contempt for white people. This, as stated in previous sections, caused her to create a defense system, or build a wall around herself that hindered her from trusting people that were not black.

Millicent lived in a reality where her peers treated her unfairly and unjustly. The question that arose from this treatment was: Why did her peers treat her in this manner? Was it something she did or was it all in her imagination? There are numerous hypotheses about why her white peers treated her in this manner. One possible hypothesis may be that because she was black, her white peers doubted her intellectual capabilities from the onset. Due to this doubt, they did not consult with her on what needed to be done, and did not trust her enough to let her do it.

Another possible hypothesis may be that her negative treatment was due to the fact that she really did not know what she was doing, causing her white peers to not trust or respect her opinions. She then attributed those negative actions towards her to be because she was black, when those actions were actually due to her performance. There are many hypotheses that could be suggested, and either one of the suggested hypotheses, if not both, could be true. However, due to her over all experience on this campus, one could easily see why she believed the first choice.

Millicent verbalized other experiences of how white students in general treated her outside of the classroom.

The way white people treat me is bad. I worked at the dining hall and they did not want to touch my hand. They would give me their Hokie passport to swipe and would not touch my hand; they would put it on the counter instead of just handing it to me. It was like they thought my color would rub off on them. (Millicent)

Millicent went on to describe how she was treated when she was living in the residence halls on campus.

People would write Nigger on my dorm room door, and people use to spit on my door, and stuff like that. Somebody wrote nigger on my door maybe twice. I would write messages on my door because the person that lived next door was my best friend. I

would leave a message on my door, “I am not here right now call me later.” Somebody would run their fingers through it and stuff like that. One time I went to shower and when I got back someone had written nigger bitch on my door. When I went to talk to someone about what was going on, they told me that I brought it on myself. (Millicent)

Millicent in a lengthier response later described other negative events she experienced, and how those in authority treated her when she brought her issues and concerns to their attention. In short, she was blamed for her troubles because those in charge believed that she brought what was happening to her on herself.

Millicent carried on after these events took place and tried not to let what was happening to her affect her detrimentally. Millicent’s responses suggest that although she had all these encounters, she viewed them as separate from the classroom. She believed she was given a fair chance to succeed. She stated:

Even though all of this has taken place, I think I am given a fair chance to succeed as far as the school is concerned, but the people in this school are racist. It is not that LW University is racist, but the people here are. I can take whatever class I want and there are not people telling me I cannot take a class because I am black, but the people in the classes will not sit next to me because I am black. I do not have a problem with the school, curriculum, or the academics. I have a problem with the people here, some of the administration, some faculty and staff, but mostly students. (Millicent)

Millicent viewed being able to take what classes she wanted without interruption as being treated fairly. She viewed the actions of the students towards her as racist but absolved the institution of LW University. Millicent’s response raised the question of: Can the structure of an organization be non-racist, while the people who make up the organization commit racist acts? Or vice versa? Can an institution be viewed separately from those who make up the institution?

Denzel had experiences similar to Millicent when it came to working in groups with students whom he believed thought less of him because he was black. Denzel described not being treated fairly when it came to the assigning of grades within a group project. He attributed his poor grade on the project to people treating him unfairly because of the color of his skin. Denzel, in working with this group, verbalized that he had participated with the project by making suggestions, and attending the group meetings that were scheduled. In short, he believed that he did his part on the project, but the group gave him a bad evaluation causing him to receive a lower grade than the rest of them.

At the end of the project, everybody had to turn in a peer evaluation. Apparently they had turned in a bad evaluation on me. We got like a 110 on the project, but like 30-40% was based on peer evaluation, which meant if you did not do anything in the group, you could not get that grade because you did not do anything. They gave me poor evaluation and I was upset about it. Why did they get A+ and I got a C on the project. I was very upset because I had been to the meetings, at least the ones that they told me about. I had help build the project; I went to the store with them and bought stuff to make the project. I had made suggestions and worked on it. It was upsetting because I was sitting there working with them and they wanted to be funny and do something stupid like that.

(Denzel)

Denzel went on to say that he approached his professor about his grade and was told that he had to get his group to resubmit an evaluation for him. He sent his group members a stern email about how he felt about what happened, and they told him they did not know that he was going to get such a low grade. They resubmitted his evaluation, but his grade was still lower than each individual group member, and he felt like the whole process was unfair and unjust.

Denzel knew that he also received lower grades than other people in the class with projects that were substandard when compared to his group project. Denzel discussed his feelings after this incident.

I was scared because I did not know why I had to fight to get what I deserved. It is already a fight just to get your work done. Why am I having to fight to do my work and fight other people just so I can get done what I am suppose to get done and to be treated fairly. That made me real discouraged and I was real upset that day. I had consulted other peers that were not in my group to see what grades they got, and there project was no where as good as ours, and I had a lower grade or the same grade as them even though our project was pretty much perfect and I had done my part on it. It was terrible, why am I having to fight this system, it is hard enough getting my work done, why am I having to fight other people, including the professor, to do it .(Denzel)

Denzel found himself having to fight against the other students as well as his professor in order to get a higher grade, and it discouraged him because he could not see why he had to fight when he had done everything that was asked of him. He was in a constant struggle with trying to complete his work, which for him was very demanding, and caused him to worry about whether or not he would be treated fairly. He, like Millicent, attributed these problems, and unwarranted treatment, to the color of his skin.

Dianne also spoke of a negative encounter that she attributed to being Black. In this response, Dianne talked about not understanding some material that her graduate teaching assistant (GTA) presented that she had to complete. When Dianne approached the GTA for clarification, she was treated like she was stupid. She stated:

I did have a problem with a GTA because when I told her I did not understand something in a lab, she started talking to me like I was stupid. Talking real slow and stuff like that.

She would say (real slow): “What you have to do is.” She was just talking to me like I was dumb. I asked if she could explain the material in a different way because the way she was explaining it, I did not understand. She did not want to do that. I went and talked to her but that did not help. (Dianne)

Dianne sought assistance but none was provided to her. The person in charge of the class talked to her in a demeaning fashion when she approached her for assistance.

Dianne continued by describing how she was treated when she took her complaint to the GTA supervisor.

I went to see her supervisor and her supervisor said that was just how she was. Basically they were not willing to do anything. She told me that I could write it down on her evaluation, but she was not going to be teaching next semester. I was upset, annoyed, kind of mad, because teaching was obviously not her gift. When you try to teach someone you work with them, not try to shoot them down. I am here to learn. (Dianne)

Dianne carried the issue to that person’s supervisor and nothing was done. This action basically invalidated Dianne and her complaint or experience with the GTA. Not being validated can make grasping material harder for some students because they may feel no one cares regardless of what they do. It is difficult for people to learn from those they do not care for because one has to fight through so many negative emotions to get to a place where they can receive the information that is being presented.

A positive and negative about being treated in a disparaging fashion is that one has the propensity to become use to the treatment. Dianne expressed this in this next response.

I do not think that situation affected me because I have dealt with this stuff since middle school, high school and on. I am use to stuff like teachers not being fair, or not treating me in a way that they should. (Dianne)

Dianne's response may be surprising to some individuals. Is it possible that one can actually become use to being treated unfairly? In general, the African American student experience is one that has trained them to become use to being treated in a negative fashion. Life has taught them that being black means that in their lives they will face situations that are not fair, and many times that unfairness will be a direct result of the color of their skin. Many black students come to expect something negative to happen to them when they are in predominantly white environments and their experiences have taught them to get through the best way they can. Some, in a sense, have become immune to their negative treatment.

Nails touched on how a she became immune to certain actions she experienced within her major and on campus. She talked about her classroom experience, and how it felt to be looked at in a strange manner due to the fact that she did not possess the same physical attributes as the majority of the class. She also expressed how this action was intimidating to her until she became accustomed to the stares. She began by discussing the simple action speaking out in class.

One experience was when you spoke up in class you were looked at more by your professors. You were given more attention even if you did not have the right answer. Certain people, some boys, looked at me like: what are you doing here? That is the impression I got, but I got a lot of that just being at this institution. At this institution when I first got here, I just felt that people looked at me in that way. But the older you get, the more comfortable you become and the more you realize what you are here for and you do not feel as intimidated. (Nails)

As Nails matriculated through her college years, she became more comfortable with the attention she received from being black. As time passed, Nails became immune to how she perceived she was viewed. It did not affect her as much as it did when she first arrived at this institution.

Expecting Racism

Others students that did not persist were actually surprised when they did not experience any noticeable racism towards them. Since they were expecting it, they prepared themselves for the worst but nothing ever materialized. For example:

I did not experience anything that was necessarily racist. I was shocked because you would go in thinking you are in a predominately white college and that you are going to get a whole lot of racism, but I did not see too much of it in my face and that shocked me. I was going into it thinking that I would see a little bit because it was an all-white campus and like engineering is mostly White people and you very rarely see blacks in engineering. (Jonathan)

I have not experience any racism yet. You kind of always have to expect things to happen. That is a negative attitude but that is kind of the way it is. Growing up you experience racist stuff, so you learn to expect it. I have not encountered any yet and I hope I do not, but we will see. I would like to think that this has no impact on me, but obviously it is on my mind. If I get a grade I think I do not deserve, I wonder if it is because I am Black, but I try not to jump to conclusions. (Beamer)

Beamer and Jonathan both expressed that they expected to experience racism within their majors but none was apparent. To not encounter racism for these students was more shocking than to encounter it. This behavior was one that was learned and expected based on past experiences as Beamer alluded to.

At times even when the racism was not directly experienced, past experiences dictated to some Black students like Jones that it was still around. For example:

I did not experience any racism toward me, no, I do not think. I mean there are hardly

any Black people in my classes. I do not think that any of the professors are like openly racist or anything like that but I am sure that some of them are probably like “I can not stand this”. But I think I am treated fairly. (Jones)

Jones was not confident in her response, leading one to believe that she may have some racial experience within her major but it was disguised in such a manner that she could not recognize it, but regardless she felt she was treated fairly. Interestingly, by saying that she does not believe that any of the professors are “openly” racist suggest that she does believe that some of her professors possess that characteristic, it is just hidden.

Black as a hindrance

Playing the race card as it relates to this discussion would refer to students who blamed their failure on people that hindered them in some way because they were black. Within the discussions had with the participants that did not persist, very few blamed their failures on people trying to hinder them within their majors because they were black. Some students felt that their failure in their particular program had nothing to do with racial encounters because they felt they were treated fairly.

One student in particular, Tony, took full responsibility for his failure and gave an interesting response to experiencing racism within his program.

I did not experience any racism at all. I did not realize or come across anything I thought was racist. To tell you the truth, I wish I had the race card to play. Truth is I could not use the race card because it was me not them. I could not say because I was an African American that my teacher did not like me and that was the reason why I am failed this class because that was not the case. There were other black students in there that were getting the grades so it was me. I was taking the test and they did not change my answers. (Tony)

What Tony described was a feeling of being unprepared for his engineering major. He did not attribute his failure to others treating him unfairly because he was black, but attributed his failure to himself, which showed a level of maturity on his part.

To come to the realization that one is just not good enough to handle a situation can be devastating to person's confidence, and this was the situation for Tony at this point in his life. Not being good enough affected him in such a way that he wished he could have played the race card, because using it would take away some of the pain, frustration, and disappointment he felt in himself. To have something, or someone other than himself to blame, would have made his failure easier to accept and explain. Tony did not assign blame to anyone but himself and accepted full responsibility.

In accepting full responsibility of his failure in accomplishing what he set out to do, Tony made remarks about himself and black students in general, when it came to succeeding at LW University.

I think it is difficult for blacks to come here and compete with the other white students. It seems as if we were accepted because they had to use affirmative action to let us in because there is a large gap between the ability of other students and mine. I know that.

That just makes me have to work harder to get out of here. (Tony)

The failure that Tony experienced caused him to search for the reasons he struggled so much within his engineering major. He started to believe that the only reason he and other black students were accepted into LW University was because of affirmative action. His thoughts suggested that he knew he had to work harder because he believed that the ability of black students was less than the ability of other students. This statement goes against the thoughts of many blacks for they believe they have to work harder, not because others are smarter, but because they know they will be judged differently. For that reason, many feel they must work

twice as hard, or harder, to obtain the same level of success as whites.

Tony continued with his thoughts by providing evidence that proved his point. The evidence he provided was his lived experiences of what he observed in his everyday life as an engineering student.

I am not sure if whites are innately smarter, but I know most of my white or Asian friends, they have no problems at all with the course or school work, but I do and I see my other friends that are black having the same problems as me. I know other white people and they do not even study that much, they might study the night before a test and get an A. I have to study at least a week and I will get a C, and they will get an A and study the night before. Sometimes that gets me. Some people are able to do that. Some people are that intelligent that they do not have to put in that much work. They just have it like that. (Tony)

Tony equated his not knowing or struggling with information to not being intelligent. His observation suggested to him that since he, and all the other black students, struggled within engineering then white students might just be innately more intelligent than Black students. The danger in this thinking was that Tony did not recognize the fact that many white students may have just been exposed to information or curriculum that he did not receive during his high school years, and that made them appear to be more intelligent.

Tony also may not have seen the networks that the white students could have set up with one another in an effort to alleviate some of the stress that comes with going through a program alone. Based on his observation of seeing the way one group seemed to continuously struggle, and the way other groups seemed to always have things under control, he concluded that other groups were just smarter than blacks when it came to certain fields.

Elizabeth spoke in similar terms as Tony when it came to her experience as a black

student. However, she seemed to recognize some of the social structures in place that gave one group a distinct advantage over another.

I had no experience with racism and that gave me a good opportunity because I had a chance in the race to go ahead and get that chemistry degree. After a while, when I was taking classes and stuff, I realized that this was not going to work out at all. It was a good and even playing field you know, it was just I realized I was not prepared for this. I think as African Americans we are not as prepared as a lot of people. I do not know if that makes sense, but they get more advantages than we do. As compared to us they get the help and things they need because a lot of times our parents cannot afford to get the materials we need to learn with. I think sometimes they have more of an opportunity and more of an advantage than we do to get ahead. Being black I think, sorts of hinders me.

(Elizabeth)

Elizabeth did not speak in terms of her intelligence but in terms of just not being prepared to handle majoring in chemistry. She felt that not being able to handle the requirements of her major was a direct result of being black. In general, she felt that black students were not as prepared as white students due to the poor economic conditions that affected so many of them. The poor economic condition causes many black students not to be exposed to things and materials that give others that advantage in the classroom.

Elizabeth felt that she was treated fairly within her major and did not experience any racist encounters. Her rationale was that had she been given all the advantages her white counterparts had early in life before attending this university, she believed she would have been better prepared for her major.

Chapter Six: University Experience Of African American Students That Persisted In Their Original Choice Of Major

Choice of Major

All the participants in this study excelled in math, science, or both. However, the participants' response to the question of why, articulated something that was different from many of the participants who did not persist. This difference in their articulation again, could be because looking back while succeeding is totally different than looking back after one has not succeeded. These students also expressed choosing their major based on prior experiences they had in high school. The difference however, was that these students also expressed genuine interest in the major from the onset. The primary reason for them choosing their major was not only because they were good at it in high school, but also because of the original interests that were nurtured. The participants' choice of majors can be seen in Appendix G.

Genuine interest in subject

The majority of students entering college probably to some extent chose their major based partly on past experiences they had in high school or parental influence. Throughout the participant interviews, they talked about being influenced by their teachers, family, etc. during their high school years; however, those students that persisted discussed their choice in somewhat different terms than those students that did not persist.

Seven participants that persisted (Johnny, Kanye, Maya, Earl, Richard, Sade and Crystal) gave reasons that seemed to possess meaning and substance about their major of choice. These students indicated that they imagined themselves in their particular majors from an early age and because of this, their explanations were richer and more vivid than those students that did not persist. They expressed a deep-rooted interest that, on the surface, was not detectable amongst those students that did not persist.

Johnny Bravo spoke about an interest in math and science that he had always held. He liked to pull things apart and put them back again to try and discover what made them function. As he matured and went through high school, he started to give serious thought about what it was that he wanted to do with his life. His interest in science, mathematics, drawing, design, and automobiles all played a role in him choosing mechanical engineering as his major.

Mechanical engineering, or engineering in general, is something that involves building, testing, and designing things. And in mechanical engineering I could do computer engineering, electrical engineering, and chemical engineering all within mechanical engineering. So out of all the engineering, instead of being focused on one particular theme or subject, I chose mechanical, because I could do everything. Not to mention that the acronym or the symbols, yeah the acronym I believe that is what it is called is ME, and M and E spells ME. I thought about that you know. (Johnny Bravo)

The thought that Johnny put into choosing his major was very evident from the statements he made throughout his interview.

Richard spoke of how his father supported his interest by providing him with the necessary equipment and information for him to discover whether he really had an interest in the things he said.

I have a creative background like in music and stuff, and that sparks creativity. Since I was going on the college prep route, most people go to school, get to college, and do not know what they are going to major in. In my 11th or 12th grade year, I was interested in robotics. Every time I would tell my dad something I liked, he would go ask people at his job and come back and give me some feedback. He was saying if you like robotics you should go to school for engineering. I like being creative and working on stuff and seeing how things work. (Richard)

Richard told his father things that he was interested in and his father did his best to accommodate his interest. While in high school during his junior and senior year, Richard became interested in robotics and his father again cultivated that interest by finding out what fields dealt with robotics. He discovered that it was engineering and the rest was history. Richard, in his explanation of why he chose engineering as his major, told a story that was again not solely based on his high achievements within science and math in high school.

Sade discovered what she liked to do while she was in high school as well. Her high school had activities that made her think about what she wanted to major in well before she attended classes in college.

At my high school one of the requirements was a prep class that was geared towards college. We had this term paper that made you think about what type of careers you wanted to do, what you were interested in and things like that. It was like an aptitude test of some sort. We had to write papers, research papers on careers, and I started to look into all sorts of engineering and that is when I choose industrial engineering. (Sade)

Sade researched the major she chose in high school. She did not enter the situation with the sole thought of “I am going to major in engineering because I was good at math in high school.” She gave thought to the major she chose.

Internship experiences

Crystal’s interest in engineering came from participating in programs that were designed to encourage minorities to go into scientific fields. Within her response, her excitement about the math and science in the engineering field could be recognized.

I decided I was going to be an engineer in middle school. I was a part of an organization called CROME that helped to encourage minorities to go into engineering. CROME was basically an organization of students just like me in science and math classes who

gathered once a week with a teacher. She showed us some cool math tricks, and showed us how to do science things. We took trips to Virginia Science Museum and did activities like that, and I knew then I wanted to be an engineer. I also knew from participating in a math contest, where I was the youngest to win and the only one from my school, and I just, it just clicked. (Crystal)

Crystal's natural interest in math and science had been cultivated and encouraged for an extended period of time. Her exposure to math and science was from an early age and she knew from her exposure to different things that she wanted to be an engineer.

Scoop as a high school student did an internship at Virginia Commonwealth University. Scoop wanted to attend medical school but planned in a way that indicated that she gave serious thought to what major she chose. Her plan had alternate routes if she decided not to attend medical school. Her choice in majors was influenced by what major would better prepare her for medical school, and by what other options she would have if medical school was not in her future.

I wanted to major in biology, and all during high school I wanted to major in biology because for some reason kids get the idea if you want to go to med school you need to major in biology. I was able to do an internship at VCU in the organic chemistry lab where I was around a graduate student who asked me what was my research interest. And my research interest were, I wanted to be a doctor, I wanted to be a surgeon, reconstructive surgeon, but I wanted to work more with like burns and artificial skin. I told him if I could not do that, I would like to do research in that field. And he told me that instead of looking at biology I might want to look at the choice of biochemistry, which would help me more in the preparation for med school because it's more chemistry involved. So that major is better and the background you get in biochemistry is more

lucrative for the working field. It is more flexible than just a straight biology background. (Scoop)

Scoop enjoyed biology and enjoyed her internship but realized after she finished her program, she might not want to go to medical school. From talking with a graduate student at her internship, she obtained enough information to make an informed decision in choosing a major that would prepare her for both medicine or graduate school.

The responses given encompassed the sentiments of the other participants about their reasons for choosing their particular major. Their innate interest in these types of subjects were fostered and nurtured by their parents, teachers, after school programs, and their own curiosity. No one told them to major in anything, and their choice in majors did not seem to be based on the process of elimination. In other words, their choice of a major was not by default. These students had a genuine interest in biology, engineering, computers, etc. and that interest allowed them to dream about becoming professionals within those fields.

Money

Only one student that persisted, Kanye, mentioned money as a motivating factor for him choosing a scientific major but it was not his sole reason. He viewed completing his engineering degree as something that could provide him with a secure financial future. Within the rest of the responses given, money was not interjected into the discussion of why students chose their particular fields, but it is reasonable to assume that many students choose scientific fields because of the money making potential that come along with possessing a degree in the field.

Experiences within Major

Relationships with professors

The participants described experiences that were both positive and negative while participating within their particular major. In their articulation, some students described many of

their experiences as being filled with emotional turmoil, while others described their experience as being totally fulfilling and pleasant. If they found themselves in a bad situation, they found alternate ways to accomplish the task that needed to be done. The main focus of this section is to highlight the relationships between the participant and their professors, as well as their relationship with their peers.

Positive relationship with professors

Participants described their relationships with their professors in terms of being negative, positive, indifferent, or all three. The participant relationships or their perceptions of their professors played a major role in whether some of them were successful in their chosen major. Some participants fixated on their perception of one particular professor and others gave more of a comparison between the attributes of professors they liked, versus the attributes of the professors they did not care for. In terms of relationships being positive, several students who were persisting described relationships that were encouraging as well as nurturing. Earl, for example, depicted his computer science professors in this manner:

My relationships are very good. I went to my professors a lot last semester because I struggled a lot. He was always there to help me to the best of his ability. He could not be unfair and give me extra help just because I was a minority student and having more trouble than another student. He had to be fair. He always answered my questions to the best of his ability and did all that he could to suggest whoever I needed to talk to. This is pretty much the norm throughout the department. (Earl)

Earl described one particular relationship with a professor as being a relationship that assisted him with his work. When he struggled, he felt comfortable enough with his professor to ask for assistance without hesitation. His perception of this professor was positive because he knew he would assist him as much as possible.

Students such as Lisa, Sade, and Jean expressed similar sentiments about their relationships with their professors because their professors helped them out when they needed assistance as well. However, they furthered their description by adding the characteristic of caring to their professors, which appeared to be very important to these students.

Lisa, for example, gave an account of how her positive relationships formed with her professors. She attributed the positive relationships she had within in her department to her first interaction with them when she arrived. She stated:

I have very, very good relationships with my professors. I do not know why my relationships with them are good. It might be their approach to me, and seeing how much they were interested in what I was doing or what I was not doing. So I am like wow, they really want me to do well so I took to that. I think that is probably how it formed. (Lisa Brown)

Somehow Lisa's professors showed her that they were interested in seeing her do well within her studies. They related to her on a level that made her comfortable, in manner that made her feel that she could trust them. They interest they took in her made her work harder which resulted in her helping herself.

Lisa went on to describe why she felt comfortable with her professors. Within this response she implied that at some point in her life she had a bad experience with a teacher. She described those characteristics that made a bad teacher, and compared them to what type of professors she has had thus far within her major.

I feel comfortable with my professors because they are not up tight, they do not rush you when you need to ask them about something. They are not just like, well go read this and come back you know, they will explain something to me if I need further explanation. I am sure, like every other professor, they have office hours and things like that and this

past summer a female professor, she was asking me if I was going to be here for summer school, and I said: “yes I will.” So she was like, please come visit me because you know I will be here and my door is always open so come by to talk to me. How many professors do you know that will actually say that? (Lisa Brown)

The openness Lisa’s professors showed her allowed her to become a part of the community. They made her feel like she was at home and welcomed within the department. The treatment Lisa received impressed Lisa so much that she could not believe the positive and welcoming environment she was a part of.

Sade brought up the attribute of caring in relation to her professors as well. She gave an account of how her professors make an overt effort in trying to get to know the students within the class. She stated:

I would say that all of my professors, in my major this semester, have gone through external effort to try to get to know all the students. They at least know what the students look like, their names, and ask questions in class. They say: “okay Sade do you have a question?” That is good because you can tell they care a little bit. (Sade)

Being recognized as a student, called by her name, made Sade feel liked the professor cared a little bit about her, and about her understanding the material that was being covered. She noticed the effort they were putting forth in getting to know her and the other students. This action made Sade feel comfortable and feel a part of the classes and community.

Jean described what made her have positive relationships with her professors as well. She described their positive demeanors towards her, and their willingness to be available when she needed them.

I love my professors in engineering. They are very easy to talk to. Very approachable, you can go up there any time and say I have a question or a comment. They will respond

quickly. I have never had any problems with my professors. It makes me feel I can go to them anytime no matter what. Sometimes people may feel reserved and do not feel they can go to their teachers and talk to them, but I feel like I can go to teachers, send email, stop by their office, and say hi or I have this question. I have never had any situations like that. (Jean)

Jean realized that all students did not have the same type of relationship with their professors, so she was appreciative of the relationships she held with her professors. The actions of her professors, their demeanors, their willingness to help, and their approachability, made Jean feel that they were her advocates.

Positive relationships with professor's can assist students in their goal of being successful in their major. When a black student has a positive relationship with his/her professors then that is one less thing that student has to worry about. That positive relationship is first built by how that black student perceives the professor in question. If that perception is positive then more than likely that student will be more prone to approach that professor and try to form a relationship with him/her. This relationship assists the student when trouble arises because he/she is not fearful in seeking assistance. Sade addressed this point in another statement she made regarding the matter.

If professors seem like they are inviting, it makes you want to go talk to them even if you do not have a question that is related to the class material. Obviously professors have a lot of experience, they have done research and are in the industry. If it is something that I am interested in, and not necessarily part of the class curriculum, I want to go talk to them just to see what their opinions are on the subject. Have you had any experience in this topic or whatever? Just for experience, it makes you want to talk to them. (Sade)

Sade summarized what many students feel when it comes to having positive and productive

relationships with professors. If a professor appears to be inviting towards a student then that students is more adapt to approach the professor when they need help. They are not as fearful because through the interactions the professors have with the class and individuals, the students are able to ascertain whether the professor would be an advocate or enemy against them. The experiences and successes the students discussed led to the conclusion that having positive relationships with professors increases a student's chance of persistence within their chosen major.

These students had perceptions of their professors were very positive. Their statements suggested that they felt professors within their major cared for them and their welfare. They described the professors' actions as making them feel comfortable. That level of comfort allowed them to seek assistance without the fear of being viewed in a negative manner. Simple actions by their professors like knowing their names, talking to them like they mattered, being friendly, and making them feel like they would take as much time out as needed for them to understand a concept, as well as other little actions validated them and played a role in them being successful within their majors.

Negative relationships with professors

Students that persisted also described having negative relationships with their professors. Interestingly, these students had similar views to those students who did not persist about their professors within their programs. They, like those students that did not persist, made reference to receiving *the vibe* from certain professors, and how getting that feeling effected their interactions and relationships with their professors.

Jordan explicitly stated what the vibe meant to them and how it made him feel. He stated:
I would describe it as being almost like a know it all. I know they are very educated, they know far more than I will ever know, but they give you a stuck up demeanor. You look

at this guy and say he is really smart. I need some help, so I will ask a question. When you do ask a question you get a very snide response, they are short with you. I understand they want you to think for yourself, but there is only so much you can do for yourself when you are lost and do not know where to go? (Jordan)

Jordan, in an earlier part of his interview, described a good relationship with one of his professors, but from this response, it appeared that the majority of his relationships with his professors were not as positive as the one he previously described. He, as the interview continued, began to describe professors that were non-supportive and arrogant. Jordan's perception of his professors, or the negative vibe he received from them, relayed to him that getting assistance from them would be difficult.

Jordan experienced a problem that was similar to those students that did not persist. The size of the class Jordan found himself in affected his relationship with his professors. Other students that persisted also had this problem as well. Jordan articulated his feelings about his professors, the effects of class size, and the vibe in this response.

They (the professors in biology) are kind of intimidating and the class is too. With the class size being as large as they are 500-600, the intimacy is not there. You get the broad nature, everyone sitting there taking notes and then they get up and leave. In other cases, some teachers just give off this vibe of not being welcoming. They say you can come talk to them, but they just really give off a really negative vibe. (Jordan)

Large class sizes intimidated Jordan and made him feel uncomfortable within his classes.

Because of the class sizes he felt that there was a lack of intimacy between the professor and the student. In addition, Jordan needed more from his professors but did not know how to negotiate the relationships he needed due to the negative vibe he felt. Jordan wanted a type of relationship that involved some form of communication and concern for him as a student.

Sade felt at times her professors did not care about students and their plight. She, like Jordan, attributed this to the large classes that she participated in as well.

I have had the feeling sometimes that the teacher did not care either way. I have had that too from previous semesters. I would say that was probably in the general engineering category. Once I got in my major, they deal with a smaller group of students and it is probably easier for them to be more personal. If you are in a class with 150 students, I imagine it is hard for the professors. I have had professors just come in and talk at you or to the board with no acknowledgment towards you. You are just a number. (Sade)

Sade, at this point, was in lower level classes within her major and she felt no personal connection with the professors because the classes were so big. She figured if she kept progressing she would be able to have more personal relationships with her professors because the classes would be smaller, making it easier for her and professors to have those types of relationships. However, at the moment, she felt like a number because there was no acknowledgement of her.

Crystal began her description of her professors by starting with an example involving a business professor she had. Her description showed why she felt uncomfortable around this particular professor.

I have had one professor specifically, a business professor and he was really scary. He was someone that I did not want to be in a room alone with and I was not comfortable around him. His body language, the way he would talk to the class. He had a very thick accent, very difficult to understand and I just really did not feel comfortable. One of those vibes you get from people and it is just not someone you want to be with. (Crystal)

The whole demeanor of this professor, from the way he talked to the way he carried himself, really turned Crystal off. To Crystal, those things as well as others, gave a vibe that signaled to

her know that she did not need to deal with this professor.

Crystal went on to describe the relationships she had with her professors in engineering. Non-existent would be a good word to describe my relationship with my professors right now. I have given up, and it is really no point now. Even though they will remember my face because I am black and one of the few that will come see them, I feel they care more about their white students whom they have known over the years. Those that come to them for this and that, those working on their research with them, and those making an extra effort to get to know them. When I look at it sometimes, it seems to be sucking up to me, and I just do not do that. Professors actually, believe it or not, love it when you suck up to them and make them feel like they were the kings of the world, but like I said, I just really do not get into that. (Crystal)

The demeanors of Crystal's professors put her off in a way that inhibited her from forming productive relationships. Somehow her experiences with professors dictated to her that she had to suck up to them in order to have a good relationship with them. In short, what she thought she had to do, did not match what she was willing to do to form these relationships. Her persistence was not due to having good relationships with her professors but finding other ways to fill the void that her professors did not meet. She had other sources of help that assisted her with problems that arose during the course of her studies.

By delving deeper into her emotions, Crystal began to express why she thought her relationships were not positive with her professors. She revealed that she was also partly to blame for the dysfunctional nature of her relationships with them.

With my engineering professors my relationships have become more distance. In the beginning, I was shy when I first came to LW University, and I was afraid to talk to the professors. I did not know what to say, and I did not want to look stupid. I did not want

to stay after class; I just did not want to do that. (Crystal)

Crystal explained she was truly afraid of looking stupid to her professors. Her professors did not create an environment where she felt safe, or comfortable, in exposing her deficiencies.

As a result of being shy and afraid, Crystal did not develop relationships with her professors until later in her academic career. Crystal came to regret this action because she realized the process would have been far easier for her. She also realized not having those relationships put her at a disadvantage as it related to other students because as she neared graduation, she discovered that she had no workable relationships with professors that could potentially write letters of recommendation for her. She realized her shyness and lack of confidence over the years prevented her from forming meaningful relationships that could have really been beneficial to her future.

Overcoming the negative

As Crystal matured and gained confidence in her self and her abilities, so did her willingness to seek out help from her professors. Unfortunately, she now felt that it was too late for these relationships to help her in any meaningful way.

I feel like I have missed that opportunity to make those relationships. Now that I am graduating and do not want to stay here, it is really no point in that. However now, if I have a problem as far as work is concerned, I am more able, stronger within myself to go see the professors. I am not stupid and this is their job, this is what they are here for.

(Crystal)

Crystal had to go through a process to reach a point where she did not care what her professors thought of her. If she needed assistance from them she went and got it. She transformed into a self-assured person. Fortunately, she did not meet the same fate as those students that did not persist during her transformation.

Richard shared his perception of his professors and how he felt at times when he had to go them for assistance.

I do not think most professors will go out of their way to help a student. I think the main thing professors like to see is students that have exhausted all their avenues and then come in there. That is how it should be. You come in there and ask them for help, and sometimes you just do not get it. Sometimes you feel a little ashamed going in there and not knowing anything, you look dumb. You just feel uncomfortable at times. (Richard)

Richard did not talk of a vibe he received from anyone, his feelings were the result of how he felt about himself with regard to the information he did not know or understand. Regardless of what Richard felt about himself, he continued to go to the professors when he struggled with his material so that he could have a better understanding of the material. Although other students did not display Richard's sentiment about feeling ashamed directly, it raised the question again of, whether part of a student's feelings toward the professor, part of that vibe, was the result of the students knowing and being fearful of their own inadequacies.

Some participants handled the lack of intimacy they had with their professors in other ways. Maya and Scoop felt that their classes were also too big for them to develop relationships with their professors. A relationship where both parties felt comfortable around each other and a relationship that let them know as students they could approach them when they did not understand or grasp material. To get around this barrier or problem of oversized classes, Maya and Scoop took advantage of office hours. This action provided them with the additional assistance they needed when they ran into difficulties.

Maya described being overwhelmed by the size of her classes, but realized that if she was going to make it through the classes she needed to have the support of her professors. She circumvented the size of the class by going to the professor during the office hours that were

established. She made herself known to the professor, and relationships developed from her taking the initiative of doing what she had to do in order to achieve her goal.

My classes are so big you cannot really have a relationship; you are pretty much a number. But for one professor I had, I used to attend all of her office hours or go to all of her study sessions so that by the end of the semester she knew me by name. And it has been like that with a couple of my professors because I am really into office hours and working with them. I mean if I did not do any of the extra stuff, I would just be a number and a face. I take advantage of office hours because I want to make sure that I understand what I am reading, because when I first got here I would take tests and think I knew all of the material. I took the test and my grade would be pretty bad so now I am making sure I actually understand. (Maya Angelou)

Had Maya not taken advantage of office hours she would have struggled more than what she did, as she found out when she tried to go it alone. Because she did what was necessary to develop those relationships with her professors, her chances of being successful within her major increased. Maya did not worry about appearing dumb to her professors, because if she did not understand something, she was in their offices for clarification. If getting that clarification took going to her professors everyday then that is what she did.

Scoop also came to realize that getting to know the professors was in her benefit when it came to her course work. She explained that her relationships with some professors were so good that she would instant message them at times when she had questions, or was confused, about an assignment. She realized early, that those relationships with professors would have a big impact on her success within her program.

The communication I have with my professors has a big impact. I think because I am not afraid to go and pop in on a professor even though it is after office hours. I give them the

benefit of doubt and respect them, so I email them before hand you know. I think it is good if they know what I look like. It is already hard enough because I am probably the only Black chick in the class, but at least they know what I look like. You know they know my name and can put a face with it. (Scoop)

Scoop did not view being the only black woman in class as a negative. She viewed being the only black woman as a positive because this meant that she was easily identifiable. Being easily identifiable meant that she was different from the rest of the students within her classes and major. As a result, the professors in the major would know her.

Like other participants that persisted, these students recognized the value of having relationships with their professors and took the action necessary in order to develop one. They initiated the first step because waiting could have resulted in the establishment of no relationship making the process harder for these students.

Relationship with Peers

Student perception of their peers followed the same dynamics of student perceptions of their professors. If students viewed their peers in a positive light, they were more likely to try to develop a relationship with them. If that perception was negative, some would move on to another peer that had a better disposition towards them, or they acquired the help needed regardless of the feelings they felt towards the person that was assisting them.

Positive relationships with peers

Those participants that described relationships that were positive, described some as being more helpful than others. To distinguish which relationships were more social than academic between was difficult because students received various kinds of support that assisted them within their classes. Those students who were persisting seemed to have an array of peers they could approach for assistance. Their relationships appeared to be business like relationships

where each person involved got tidbits of information from other people that would be helpful in their studies.

Crystal, for example, gave the following response when asked about her peer relationships:

I found some good relationships but mainly they were academic only. I did not really see them much outside of that. Maybe I could count on my hands how many people I saw outside of that, in which we hung out on the weekend, or went to the movie kind of thing.

(Crystal)

Crystal made it a point to first establish that these relationships were academic only relationships. They were not friendships. Her academic relationships and friendships were two different entities that existed outside of each other.

Crystal's conversation described the dynamics of her academic relationships with her peers.

The students I went to were always ahead of me. At one point, we were in the same class and that is where I met them, but after that they were ahead of me because they had 18 credits some semesters. All the classes I was going to take, I did not take with them; I took it a semester after them so they were ahead of me as far as graduating. I could go to them and ask if they had the notes from such and such and class and they would say "Sure I still have those." That was great, but interacting with them on a daily basis became less and less. (Crystal)

Crystal described relationships with students who had surpassed her as far as coursework was concerned. She developed types of relationship with peers that allowed her to go to them for assistance when needed. This move was extremely important for Crystal because she did not have the best relationships with her professors. The support from her peers was very crucial in

her persistence.

Sade also had academic relationships with her peers and described them as such. She stated:

I do like to work by myself. I am the type of person if professors give you the option to do a project by yourself; I want to do it by myself. If a class is really hard and the material is really hard, the students tend to stick together, give each other tips, or work on stuff together, support one another. So I have a good relationship with my peers. (Sade)

Crystal preferred to work alone, however when problem arose she did have persons she could seek assistance from. She painted a picture of students within her major helping each other out when necessary.

Crystal and Sade had relationships with peers where they felt comfortable in going to them for assistance. They were not relationships that really had a social component to them; their relationships were business relationships established with the objective of succeeding in mind.

Two other students Lisa and Jean described their relationships with their peers as positive relationships that were very supportive as well. The relationships they described had more of a social component to them, but the social and the academic seem to mesh. Both Lisa and Jean had positive relationships with their professors as well, so having good relationships with their peers strengthened their chances of success.

Lisa described the type of relationships she had with her peers. She makes reference to one girl in particular in this response.

My relationships with my peers are good. My roommate is Stacy and she is Caucasian. She is at Pharmacy school now, but I formed a really close bond with her. She is really nice and we took some classes together and everything. We have socials. We have a

Food Science Club. We go to socials and we hang out and we do things. We sell stuff at football games. It is really great. (Lisa Brown)

Lisa's relationships almost seemed high school like in the sense that she had a friend that she socialized and took classes with. They were roommates that probably relied on each other for assistance when they did not understand concepts or problems. Lisa also had good relationship with her other peers and those relationships likely developed from her involvement in other activities. Activities such as participating in the food science club allowed her to meet, talk, and establish relationships with different people within her major. Lisa's positive relationships with her peers, was an extension of her positive relationships with her professors, and both contributed to her persistence.

Jean described her positive relationship with her peers in a slightly different way. Her response was interesting because she made a distinction between her friendships in terms of them being between blacks and white students.

There are not as many friends here as was in high school because there are not as many black students here. There are definitely not many black students in engineering. I have friends that I see, but very few close friends. My friends are of all races: African American, Indian, Asian, and Caucasian. To have an array of friends is really helpful because you get to learn about different people. People come from all over the world, people with different backgrounds, with different cultures. I never had access before college, so getting to meet them was interesting. Yes, to have an array of friends does assist me in my work. We are all really close, everyone I see is close. Everyone knows somebody who is taking a class, or had a class, so we can get help. We can go to them and ask them about the professors, homework, procedures, and test. Overall everyone is friendly. (Jean)

Jean began by saying that she did not have as many friends here as compared to high school because there were not many black people at this university or within engineering itself. Her past experiences dictated that her close friendships were reserved for those that were black and since this university, but more specifically her department, had a limited number of black people enrolled; she did not develop close friendships with people that were different. However, Jean still considered herself to have friends from all ethnicities and all of them assisted each other with their studies.

Jean reserved her close friendships for people that were black, but she did not close the door to other people who were not black because she developed relationships with them also. Due to this interaction with people from other cultures, Jean learned and experienced things she would not have if she only interacted with other people of color. This action thus far, has helped Jean to navigate successful through her engineering curriculum.

Negative or non-existent relationships with peers

Maya was persisting through her program but described relationships with peers in her major as non-existent. She felt her problems were the result of the size of the class, as well as, just not knowing and feeling comfortable with developing relationships that might be helpful. She had no history with the people within the class and did not know how to initiate that interaction.

I do not really have a relationship, like it is so big. I know I have an organic biochemistry class this semester where everybody who is in my year is taking the same class as me, but I do not know anybody in that class. I do not know anybody in that major. Like yesterday, I met a freshman that is in biochemistry you know, and I was like, if you ever see me in another class holler at me, or whatever, but yeah, I do not know anybody.

(Maya)

Maya, like many of the students that do not persist, felt isolated and alone within her classes. The difference was she had positive relationships with her professors and that alleviated some of the problems she faced as she matriculated through her program.

Maya had a network of support with her professors, but not having other peers to study with still affected her although she was persisting. Maya realized that having a network of peers could assist her but figured that her present situation was good practice to how she perceived future life to be in the sciences.

To not have anyone to study with within my major makes it hard because its like if I do not understand the question, I could just IM someone that I knew and ask them, you know to get them, to help me or whatever, but if you do not know anybody in your class, then you have to take twice as long to figure out an answer or you have to wait until office hours. You could not do your homework when you wanted to do it or something like that. But on the other hand, it makes you more independent so I guess it is not a bad thing.

(Maya)

Maya has never viewed those she took classes with as her friends. As told in a previous section, Maya was a high school student that was bused to governor's school. While attending governor's school she was alone and isolated within those classes as well. She was one of only two blacks in her classes and developed no relationships with the other white students because she felt they looked down on her. Maya situation was similar to her situation in high school because, within her biochemistry major, she again found herself to be the only black student.

Maya had experience in forming relationships with professors, but no experience in forming relationships with other peers within her science and math classes. As a result, not forming relationships with her peers did not affect her as detrimentally as it did many of the students that did not persist. Also, because Maya attended governor's school, it maybe a safe

assumption to conclude that the curriculum she was exposed to challenged her in a manner that better prepared her for college. Maya tackled her problems without the assistance of a peer group, but that caused her at times to take longer in the completion of some her work because she had to wait until the professor's office hours for clarification on certain concepts or problems.

In high school, Maya's relationships were with black students that did not go to governor's school. Her relationships took place when she went back to regular school because at governor's school she was strictly about the business at hand. Maya did the same within biochemistry; her relationships were outside of her major with other black students. The difference again, between Maya and most students that did not persist, is she developed good working relationships with her professors, and she possibly was better prepared to handle her current situation. Interestingly, Maya like other students that did not persist, equated being alone to being independent. Based on other student responses within this study, a conclusion can be drawn that some students felt like they were suppose to be able to go about it alone. To not do so seemed to be a sign of weakness to them.

Ignoring negative vibes

Two students in particular, Kanye and Earl, talked about receiving the *vibe* from several of their white peers through out the course of their studies. They discussed the *vibe* with a passion and a feeling that really demonstrated the psychological effects that negative perceptions can have on black students. Their responses were full of inner conflict and self-doubt. Although they were persisting, they were fighting inner and outer demons to do so.

Kanye associated primarily with other black students within electrical engineering. These were relationships he developed with the other entering black freshman students that were in his graduating class, who did not switch majors or fail out.

I have a few relationships with peers in my major, I would like to have more but I do have a few connections here and there. My relationships consist of I guess primarily African Americans but I do have a few friends that are not African American in engineering. The few that are African American in Electrical Engineering are the few that I pretty much came here with my freshman year. There were a lot of us my freshman year, but a lot of them left the major, or changed it, because they were never able to get out of the fundamental engineering courses. The few that are left are the people I talk to sometimes. When I talk to them it is mainly for some help on homework or for courses that they have taken before. That is usually all it entails. We do not sit around and talk engineering too much outside of that. (Kanye)

Kanye articulated that, at times, he had to develop other relationships outside of those that were black. He was not comfortable in doing this, but he was forced to seek out their assistance if he wanted to be successful within his major. Having to do this affected Kanye in many ways. The agony he felt became evident as he continued his conversation.

I do go outside my race for help and they are helpful at times. I will not say that I am at times not intimidated to go to them. The African American friends that I came in with my freshman year, at least I have known them for a while, and I can go back to them because I feel comfortable with them. If you go to a White student or anybody else in your class, you have to start a relationship up with them, and then there is the choice of trusting him or her giving you any advice, or answers, or help on work. Getting over that hurdle for me is hard sometimes and I would rather get the answer out of myself than try to initiate that. What I mean by trust is that sometimes they are hesitant to give you help on your work when you ask for it. Even if they are not, I still feel as though they are. I guess that is just inherent, that is just how I feel. (Kanye)

The act of forming a relationship with his white peers was hard for Kanye. He had trust issues with them and was not comfortable in approaching them for assistance. He, at times, would rather struggle by himself rather than go through the process of developing a relationship with his white peers.

Kanye was comfortable going to other black students for assistance primarily because he viewed them as people he could trust because they were black like him. They were not a threat to him so he did not have to be in a defensive position when he approached them for assistance, but with his white peers he had to be on guard. He had to take the defensive position because he never knew how they would react to him.

White peers were a threat to Kanye, and he did not like himself, or the feelings he had, when he was forced to ask for assistance from them. The act itself was very intimidating to Kanye and he explained why.

It is intimidating. It is like when you try to ask them for help you always feel like you are lowering yourself, that you do not know the answer and so now you have to go to them for help. And then I will feel like, instead of it being something that I cannot understand, just one thing, I feel as though they read me as not knowing anything about what is going on. So you feel like you are lowering yourself because they view you as all ready not knowing, if that makes any sense. It is like you always ask them a question and you always feel like they think you are dumb and you do not know anything and now they are like “yeah I got to help this guy now.” I do not know where I got they think I am dumb from. I got it nowhere in particular, just kind of an inherent feeling. (Kanye)

To ask for or seek assistance from others made Kanye feel vulnerable, weak, and exposed. The very act itself to Kanye was very intimidating because he equated getting help from his white peers as an act of lowering himself, and even by lowering himself, he still was not guaranteed the

correct answer because he did not know whether or not he could trust the information given to him.

Kanye also talked about an inherent feeling he had when asked where he got the perception that white people thought he or other black people were dumb. His response suggested that he believed that he was born with those feeling, but this researcher feels that his life experiences, good and bad, contributed to this belief that Kanye held. This feeling Kanye referred to as inherent was what other students referred to as that *vibe* they got when they sensed something was wrong.

Kanye continued his conversation by giving an example of a time when he experienced these vibes from his classmates when he had to ask them for assistance. Kanye also discussed not feeling and being as prepared as his white peers in some of his classes because of the high school he attended. He believed that his high school preparation was adequate but it lacked in many ways. Kanye felt his peers were exposed to computer software and applications that he never had the chance to use and that gave them an advantage over him. However, regardless of his limited exposure he was still expected to perform at the same level as them.

I have felt a kind of cold shoulder before. They will give me a little small piece of help but you know they know more than what they give you. They will give you a little bit to bite on. I had a partner last semester and by the way if there is any interaction that I have to do outside of African Americans it is usually because I have a partner in class. For example, what I notice about my high school once I got here is that academically it was okay but it was not great. In comparison, a lot of these kids come from better high schools where they do a lot of computer work and it is the type of computer work that I have never experienced until I got to college. They on the other hand have actually used it before and a lot of them are pretty savvy in that stuff, I am not. (Kanye)

Kanye noticed from his observations that he was far behind his white peers when it came to the type of computer software that was being used. Knowing that he was deficient was an indication of why Kanye felt more comfortable around other black students. Not knowing amongst people you do not know is totally different than not knowing amongst people you consider family.

Kanye provided a more vivid example of his experiences with his peers as he continued to discuss the computer software he referred to earlier.

I had to use some of this software to do a project last semester and since I do not know it as well, I am a little slower than they are. I feel that they are a little impatient with me because they are more familiar with the software since they had used it before. You start reading their signals a little, and feel that you are not on their level. Signals like I guess, the way they talk to you a little bit. It just sounds like they are talking down to me, it may not be down, but it just feels down. I just shrug it off. I feel like it is a little bit of them talking down to me, and a little bit of myself. Yeah, I definitely can say that I put it on myself to think that way, but I feel it is both parties because they do their part also.

(Kanye)

Kanye expressed how he felt he was perceived by his peers when he lacked the knowledge they had about a particular program that was used to complete an assignment. He felt they were impatient and felt like they talked down to him. Kanye felt this way due to the body language and the signals his white peers gave off.

Kanye recognized that his feelings could have come from within and he could have imagined that his peers talked down to him. This was a valid point made by Kanye. His feelings might have resulted from him being upset with himself because he did not possess the same knowledge as his white counter-parts due to the background from which he came. He simply could have felt inadequate.

Knowing this made Kanye struggle with the feelings he had towards his White peers. This struggle caused confusion within Kanye, for he later expressed that this uncertainty was what made him unsure of himself, and about how he felt others perceived him. What made the feelings so difficult for Kanye to comprehend was that he was sure that he had encountered this behavior towards him in the past. It was hard for him to distinguish between his doubt of himself, and what he perceived others to think of him.

I do not know why I think that way about myself. I guess if it never happened, I would never think that way, so I am pretty sure it has happened and that is what has got me thinking that way. (Kanye)

Kanye had a history of competing against white students to show he was just as smart as they were, and he gave a glimpse of this behavior within his advanced high school science and math classes.

In high school, he was really successful at competing against his white peers because there, no one knew anymore than he did because they all were being trained with the same curriculum. When Kanye entered college, the situation was different because many students here, and especially students within his engineering major, came from schools that had better curriculums that better prepared their students for the rigors of majoring in engineering.

Kanye was now in a new ball game in which he did not have the same equipment as the others players and not having that equipment put him at a disadvantage.

This affects me in this way. The real brilliant kids I kind of brushed them off as the abnormalities of the chosen few because everything the teacher says they have seen it before. One of the hard classes I took was Microprocessor and System Design, and many of the students had some prior knowledge with assembly language and they knew all that one zero type stuff. I on the other hand have not had any prior experiences with this type

of material. I have gotten better with computers lately but they are pretty smart at this class. I go in and some of the students have all the answers and they know this type of thing, language, memory maps and things like that. I would not say that I feel intimidated by them; at least I do not think I am, but I guess they make me feel that in some sort of way. (Kanye)

Kanye may have been a bit envious of his white peers, and that may have contributed to his feelings towards them. This is not to say that his peers did not talk down to him, but only to say that his high school experience put him at a disadvantage, he recognized that disadvantage, and some envy on his part may have emerged. That envy further amplified the behaviors displayed towards him by his white peers and affected his interactions with them.

Kanye later described how not having the knowledge he needed affected his confidence and competitiveness within his classes.

I am competitive in class, but for those few people that are really brilliant, I set them aside and I try to be successful for myself. They take me out of my competitive mode and I can try to be successful for myself as opposed to being successful against them. Which would be opposite for a math class where I can feel on the same level and be competitive against them in the class. But they have the ability to put me into a shell. (Kanye)

Kanye's desire to be successful, in addition to his self-motivation, was fueled by his desire to outperform, or to perform as well as his white counterparts within his engineering classes. When he found that he was not equipped to do so because of inadequate preparation, he retreated into a shell and had to use other forms of motivation to get him through. Simply put, he did not have the skills necessary to compete with his white peers in subject areas in which he had no prior exposure.

In subjects that his high school prepared him well in, like math, his competitive spirit was alive and well because before he entered college he had taken differential equations, which is a class after calculus three, so his foundation for anything math related was at minimum above average. This ability allowed Kanye to be confident in himself and that allowed him to be competitive within his math classes unlike those classes where he was forced into a shell because of no prior knowledge with the material. This lack of knowledge was why he felt that he was lowering himself when he had to ask his white peers for assistance in order to make it through some of his classes because in many ways he considered them the opposition and the enemy. How does one ask the enemy for help without feeling like they are lowering themselves, without losing a little pride?

Earl expressed similar feelings to Kanye when he discussed his feelings in regard to asking for help from his peers. Earl, a computer science major, explained his relationships with his peers in this manner.

They are all cool people and understand that it is a tough major and if we do not stick together there is nobody else there to help us with this program or that program. It seems like they are real cool people in there. They may not be like me and dress like me but the interaction is pretty good. It is not like they go away and say they do not like you because you are black. (Earl)

Earl seemed fine with the relationships that he developed within his department. He believed that the people were fine and that his interactions with them were good. He even stated that even though he dressed and looked differently than the majority of people within his major, he believed that people in his major did not hold that against him.

Although Earl stated the above, his actions suggested something different. His actions suggested that he believed a different reality. As the conversation with Earl continued about his

relationship with his peers, he commented on how he did not feel comfortable in approaching his peers for assistance when he had problems with his courses. He gave an example comparing his situation to his friends' situations that attended historically black universities with the same major.

I am one of the only blacks in computer science and that really does affect me. If I were like my friends at North Carolina A&T who graduated from computer science, I might have a different feeling if I were in a class of computer science majors of all black people. I might be more prone to ask somebody for help or I might feel more charged because these people are from my culture. This is really different because, I sometimes do feel isolated. Sometimes, if I am programming and I really need help, I cannot only ask black people for help. I have to ask my other peers from the classroom, but at times I feel I cannot go to them. (Earl)

Earl implied that his level of comfort within his classes or major was directly related to the number of blacks that surrounded him. Being the only black within his classes affected Earl because he felt he had no one that he was totally comfortable with when he had to ask for assistance. Earl believed that if he attended a black university, with black students, then his being hesitant to ask for assistance would not be an issue. He would feel comfortable asking his own people because there would not be a color barrier. Simply put, he would feel as if everyone in his class would be a resource to him because the majority of them would be black also.

Earl stated earlier that his peers in his department were cool and did not hold being black against him. Although this may be the case, for some reason he still did not approach them for assistance unless it was absolutely necessary for him to do so. Earl explained that sometimes he felt isolated within his environment, and that isolation was due to him being the only person of color within his computer science classes. Earl, like Kanye, viewed non-blacks as others, or his

opponents in a sense, and one does not ask his opponents for assistance. Earl explained his feelings in this manner:

Sometimes I felt like, it seemed like they thought they were smarter than me. Like they would not come off like that, but I can just vibe that off them at times. This is why I usually go to the professor first before I approach anyone. That is just a feeling I have. Like I am isolated like I said before and when you feel isolated, you do not want to go to any other people unless there is someone similar to you in the group. When they see 2-3 blacks walk in, it is like WOW. Sometimes I get that look like “he is in computer science?” Man, it is kind of like they are amazed that a black person is in computer science and he is still here. That feeling, that vibe of they are amazed that I am here, must mean they must not have thought I was not smart enough in the first place to be here, and that is where that vibe comes from. I just feel that vibe. (Earl)

Earl felt a vibe that signaled to him that his peers thought they were smarter than he was and he did not like that feeling. Rather than deal with his peers, Earl chose to deal only with the professor unless it was absolutely necessary for him to get assistance from his peers. Like Kanye, Earl could have viewed asking his peers for assistance as an act of lowering himself also. To do so would be to swallow his pride and ask those who thought they were better than him for help.

The question that Earl’s response raised was: “Was this truly a vibe that Earl felt from his peers, or was that vibe what Earl actually thought of himself?” Like Kanye, Earl’s lack of knowledge about a subject may have been enough to make him feel intimidated to ask his peers for assistance. This intimidation that resulted from needing assistance could have caused Earl to have a heightened sense of awareness of how people acted towards him. In contrast however, it also could have caused Earl to view himself negatively causing him to believe that others perceived him in a negative manner. Like Kanye, both statements probably played a part in his

perception of others, and regardless of whether one statement is more accurate than the other, either one would have made asking for help from his white peers very difficult.

If Earl attended a black university, chances are there would be black students there who thought that they were smarter and would have been smarter than Earl also. Would this hinder Earl from seeking assistance from them also, or does the fact that he felt these feelings about white people make a difference? If one has been conditioned to believe that whiteness is the standard for the American Educational System, meaning that if everything and every ethnicity that was not white was judged by what white people as a whole achieve, then it does make a difference. If Earl viewed himself as a pioneer against the system, as one who was paving the way for other blacks, then asking for help from persons whom he viewed as people who thought that they were smarter than he was would be a last resort.

Earl may have felt all of this inside, but just like Kanye realized that in order for him to gain success, he must at times get assistance from those persons that he viewed to perceive him in this manner.

I am a junior now, so personally when I struggle, I am stronger now in being more comfortable in the environment and things like that and I know I have to do something. I look past it because I am looking to get out of LW University with a CS degree, no matter what the circumstances are. If I have to fight what I am feeling because I feel like somebody thinks I am stupid or something, I look past that. I going past that fact and saying, look we need to work together, I need the help, you probably need help too, we need to get at this together and make it through. I do this because this is one of the toughest majors at LW University and I am not going to sit here and fail. (Earl)

This response showed how Earl fought the feelings he had and sought out the assistance he needed from his peers. The internal fight was and is difficult for Earl, but he does it because he

wants to succeed, he wants to graduate with a computer science degree. That means fighting the feelings he has about the peers within his major. Earl went on to reiterate about the vibe he sometimes gets when commenting on his peers response to him when he tells them that they need to work together to succeed.

They are almost like “I see what you are saying” I do not get them saying no I am not going to help you. But like I explained before, sometimes I just have that vibe, you get certain looks and sometimes this hinders me from asking for help from other students.

(Earl)

Earl implied that sometimes he was and is not successful at pushing his feelings and emotions to the side because that vibe still hindered him on occasion.

To further explain this phenomena of not feeling comfortable with asking for help from others would be comparable to family members that asked for help from one another before they went outside of the family for assistance. If Kanye and Earl possessed the characteristic of having a group identity with African American students, then they would view other black students like family. Within most families people are comfortable with one another, so asking them for help, or not knowing something that should be known, or not comprehending something difficult in front of family would be totally different than seeking assistance, or not knowing something, or not comprehending something difficult in front of people that are not family. In addition, having to ask someone for assistance when one feels that they are not liked or respected as a person is a humbling experience. This in essence was what Earl, as well as Kanye, described in their responses. Asking for help from white peers whom they perceived in a negative way was truly a struggle.

Networks of support

An analysis of the transcripts revealed a distinguishable pattern that emerged between

those students who did and did not persist within their major. Those students that persisted had networks (both academic and social) that assisted them within and outside of their major. The networks, for those students that persisted, were multifaceted networks of support that served these students in more than one capacity. Pre-college programs, tutoring centers, sororities, fraternities, clubs, organizations, extra curricular activities, etc. assisted them academically, as well as, socially.

Those students who did not persist participated within networks that were limited and these networks provided encouragement for the students but could not provide the academic assistance needed for them to persist within their particular majors. Appendix H attempts to highlight the different networks of each group of students individually. Analysis subsequently revealed that, on average, those students that persisted participated in networks that assisted them in both academic and social demands. Networks of students that did not persist appeared to be mainly social in nature, and consisted of people who could not provide the assistance needed.

Students that persisted were a part of networks that were both in and outside of their major. That participation played a significant role in their success within their majors. The more alternatives or sources of help that a student had available to them seemed to correlate positively to them being persistent with their major. Therefore, the type of networks participated in by persistent students were vital to their success.

Overcoming Academic Difficulties

Those students that did persist expressed similar sentiments of frustration to those students that did not persist. The difference was that they found ways to get overcome the problems they were having. Whether the problem was in the form of not being academically prepared or feeling isolated, these students found solutions that carried them through the difficult times.

Crystal, for example, expressed not being academically prepared for her engineering courses and how that made her feel.

Engineering in general I did not feel prepared. I felt like the dumbest one in the class. I felt like everyone had taken classes before me. Some would say: “I have used this project or that project,” and I would be like: “you used a what, a who, come again”. I felt like I came out of the boondocks into the big city and I did not know what was what. Everyone else knew everything else that was going on and that included some of my Black friends because they were in ASPIRE and they had connections with this or that. (Crystal)

Up to this point the Crystal story sounds similar to the other stories that were discussed by students that did not persist. However, her story deviates and differs from those students who did not persist, because Crystal refused to let her situation get the best of her.

I felt really lost in engineering and especially in my specific major, but I took the horse by the reigns, and did what I needed to do. However, even then no one led me in the right direction because I still felt lost. I coped with this by going to my mommy and crying. I found it hard, but I kind of just grew up and dealt with it. My mother helped me deal with that by telling me: “no one was going to do it for me, you just have to grow up and deal with it.” (Crystal).

Crystal found that she had to grow up and deal with the areas she found herself to be deficient in. If she wanted to graduate from Virginia Tech with an engineering degree, she had to take control of her situation. She realized from talking with her mother that no one else was going to do the work for her. As a result of that advice she, in her words, took the horse by the reigns, stop her pity party, and did what needed to be done to reach her goal.

Kanye expressed similar feelings about some of the classes in which he was struggling. He, like Crystal, did what he needed to do to overcome those obstacles that hindered him. When

Kanye arrived at Virgin Tech, he thought pretty highly of himself as far as his intelligence was concerned, and did pretty well his freshman year. However, he did run into some courses later on that challenged him because he had no prior experience with the material. He stated:

I thought I was prepared when I got here. When I got here I thought I was pretty smart. I did pretty well my freshman year. One course that did give me problems was a C++ programming class. Like I said earlier, some of the students that attend this university have a pretty broad software background. That is one thing my high school lacked. I never had a programming class before I left high school. We had a little computer information processing class, which was learning how to use word, and excel and access. But as far as programming went, I truly had no idea that you could sit at a computer and actually program code. I did not know you could do that. So this class was mind blowing. (Kanye)

Kanye had no idea of what was going on because he had never had to program before. His high school did not teach that particular set of skills, and for that reason, there was never a need for him to learn how to program. Kanye had no conceptual understanding that one could actually sit down and program code. Due to this lack of knowledge, Kanye struggled within this class.

Kanye had a choice to make. He could either, accept the situation he found himself in and give up, or he could deal with and overcome the problem he was having. Kanye articulated what he did in this next statement:

There was a computer science major that was a pole valuator on the track team that I actually went to for help. I also bought a couple of books to help me out (Kanye).

Although Kanye was not prepared for that programming class he did what he had to do to make it out of that class. His high school did put him at a disadvantage compared to other students

when it came to that particular class but he did not use that as an excuse to fail or to give up. He persevered and made it though.

Sade felt academically prepared when she left high school, but came to the realization that she was not as prepared as she originally thought. She handled her problems a similar way to Crystal and Kanye.

I felt prepared both academically and socially because my high school was so college prep oriented, and I had taken so many math and science classes by the time I had graduated. But that feeling was before I got here and started taking classes. I knew it was not going to be easy, but I felt very prepared when I left high school. When I got here everything was so difficult. My first year, I was not prepared. Socially I was fine; maybe I was too social my freshman year. Being in these classes was discouraging, definitely discouraging. I did well in high school and I knew or had been warned that college was going to be hard. (Sade)

At this point Sade had to make the same decision as every other student that persisted.

She had to answer the question of whether or not she wanted to be an engineer. If not, she could change majors or she had decide that she was going to do what needed to be done. Sade's next response indicated what decision she made.

I was discouraged, but I had decided that I had seen other students succeed so why could I not do it as well? Seeing upper classman and being in NSBE especially made me think about that. Just other minority students I have seen and other females in the college that you see around campus. It was enough to make me think that I could get through the program if I just sat though it, it would get better. (Sade)

Sade used other Black students that were making it through their programs as her inspiration.

She felt if they made it through engineering then she could make it through also, despite the

deficiencies she had. She did not use her deficiencies as a crutch, but took the necessary action to continue to make it through her program.

Jean summarized what it took for her to overcome her academic deficiencies in engineering. Sade articulated her experiences in following manner:

I could have been more prepared academically by taking more classes over the summer. I had never had any engineering classes or experiences before entering the program so I think taking more math and science classes would have helped. Socially, I do not think I could have been more prepared. It was a matter of meeting people, going out on limb to say hi to people and establishing a network of people you could talk to. (Jean)

Realizing that she could have been better prepared was the first thought the Jean had when she came to the conclusion of why she was having difficulty in her program. However, she found ways to focus that negative reality into actions that benefited her. She did what was necessary to overcome her troubles. Jean also concluded that to be successful, she needed to venture out and establish networks that would benefit her in her studies.

The students that persisted had the attitude of the Crystal, Kanye, Jean, and Sade. Their determination outweighed their lack of academic preparation, and that led to them taking the appropriate action to realize their goal. This, as stated in an earlier section, sometimes meant swallowing pride and fighting those inner conflicts that could keep a person from seeking the help or forming the relationships needed for achievement. This act was necessary for the survival of these students within their respective programs.

Positive Academic Environments

The type of environment a student operates in has great influence on the level of comfort that he/she feels within that environment. For example, if the environment is supportive of the student, then that student will more than likely seek assistance when help is needed because they

feel comfortable within it. Supportive, in the sense that the professors and students have positive dispositions towards them, as well as, the students being able to ask for assistance without feeling stupid, embarrassed, or demeaned.

In addition, support from those in authority can actually signify to a student that their departments are concerned about them. The student may feel that they are a part of that particular academic community. When environments are supportive in this manner, students perform better because they are made to feel at ease, and they let their guard down. This allows meaningful relationships to form that may assist the student in their academic progress.

Several students that persisted described environments that fit the above characteristics. Brooke was one of the students that described her environment as one that fit the characteristics of being supportive.

My environment is laid back, very laid back. Welcoming. The doors are always open. They are stern, but only when they think you are taking advantage of their help or something like that. That has a lot to do with why I like this major so much and why I do so well in it because like I said, other majors such as business or something like that, no one knows anyone. But within my major I feel very comfortable that I can go into my department and walk around and speak to everybody and they will know me. So that encourages me to want to do things with them because I know that they really have that, they are on a first name basis with you. That is what I like the most about my major. By they, I mean my professors. (Brooke)

Brooke described her environment in terms of support that assisted her with her studies. She was a part of the academic community, and her successes to this point were partially due to the supportive environment she participated in. She enjoyed her program, and that enjoyment was communicated within her responses.

Other students that persisted did not echo these sentiments in quite the same way as Brooke. Maya, Crystal, and Sade described environments that were, at least on the surface, similar to those students who did not persist within their major. The difference was that they used what many would consider to be negative, as motivation to help them through their respective programs. They transformed their personality to fit the environment to help them through difficult times. They did not let the situation, or environment, get them down so much that they could not perform what needed to be done. They actually thrived in these environments.

Maya exhibited this behavior as she described the biochemistry environment she participated in.

My environment could be described as very demanding and very intensive. Very demanding with your time because it demands that you study. You have to come to class every period, or else you are going to be behind. Demanding in that you have an assignment to turn in every week, so you cannot really slack off. This type of environment, I think, makes it better for me because I know I have things and assignments to prepare for, and that forces me to study. Also the professors and the other students for the most part are friendly. (Maya)

Maya thrived in this demanding environment. She liked that it was demanding, as well as intensive, because those qualities kept her focused and on task. She had good relationships with her professors, as established earlier, and this contributed to her enjoying the environment that she operated in.

Crystal had a similar view of her environment when it came to the intensity of it. She, like Maya, welcomed the challenge. She described her environment in the following manner:

Overall environment is challenging, overwhelming, frustrating. The challenging part kept, it kept me going. I like a good challenge so that was fun. Even when I chose engineering, I knew it would be challenging. I knew that it would not be a piece of cake. Being frustrated affected my relationships positively because I gained more relationships with other Black engineers. It is also frustrating when you have tried a problem over and over again for 2 hours and you still did not get it right and you still had other work to do, it is so frustrating. It becomes that way when you have this homework and two to three test a day. It is really frustrating because you can only do so much in one day. (Crystal)

Crystal loved the challenge. Though, at times, she was frustrated and overwhelmed by the amount of work she had to do, she still kept chugging along. This struggle provided her with more relationships with other Black engineers, as well as provided her with the structure needed in order to stay disciplined when it came to her studies.

Sade also spoke of how her environment forced her to stay disciplined. She, like Maya and Crystal, thrived in the type of environment that many considered demanding and difficult.

Trying and difficult describes my environment, but when it is all over you have a sense of accomplishment. I know now that trying keeps me in the game, and by being in the game, I can have that sense of accomplishment when it is all over. (Sade)

Sade spoke in terms of having a sense of accomplishment when she completed her assignments. She knew that the only way to stay in the game was to complete and do what was required of her. If she continued to do this, she would reach that ultimate accomplishment, graduating.

These students demonstrated an internal drive that fueled them through times of difficulty. Maya, Crystal, and Sade enjoyed the challenge because they liked proving that they were smart, and could handle whatever anyone threw at them. These students possessed a type of independence that was difficult to explain because, they were not so independent that they

would not seek assistance if they needed it, but independent enough to take charge of their own destinies.

Proving Them Wrong: Being Black As A Motivator

For students that persisted, being Black was their motivation to not give up, or give in, when they struggled in their particular majors. As a whole, the students that persisted could be viewed as having a chip on their shoulders, or an attitude, when it came to succeeding. That chip was a result of believing that society, and people within their majors, looked at them as being intellectually inferior to the majority. This belief motivated them to prove to everyone that thought they could not succeed within their scientific majors wrong.

The students that participated within this study liked disproving the negative stereotypes about African Americans. They figured there was no better way to do this than to succeed in a scientific major at a predominantly White university where the total Black population was less than 5%, and where more than 50% of Black students leave, or fail out of, their intended scientific majors.

Johnny described how being Black increased his motivation to want to do well within his major.

Being the only African American in class makes me want to do better, and helps me succeed because, if I was in a class where everybody in there was African American, I may not necessarily feel that I have to do better than everybody else you know. Because of the stereotype that, I am not sure where I got it from, but I just know there is a stereotype of African Americans are not doing well. (Johnny)

Johnny loved the fact that he was one of a few minorities within his classes. This drove him to work harder because he wanted to show that he was worthy, and just as good. He knew the stereotypes of African American students. And knowing those stereotypes while matriculating in

a sea of Whiteness allowed him to focus and work harder. Johnny felt if he were in a class where he represented the majority, he would not have worked as hard because he would not have anything to prove.

Johnny explained his thought process as the conversation continued about the stereotypes that plague Black students.

I do not want to live up to those stereotypes, I want to try and degrade them you know.

The simple fact that I believe the stereotype is true when I am in class with predominantly White people makes me want to do better and that is one of the reasons why I decided to go to Virginia Tech. I did not want to be with everybody like myself. I wanted to be able to go to a school where I was not expected to succeed, or excel, and prove everybody wrong. (Johnny)

Johnny explained that he sought out Virginia Tech for the reason of attending a university where he was expected to fail, and prove everyone wrong. In succeeding, he would be defeating some of the stereotypes that plagued Black Americans and Black students.

The idea of being better entered many of the conversations had with those students that persisted. The one thought that seemed to permeate through the interviews was the feeling of having to be better than White people in order to be treated equally. Richard expressed those sentiments as he discussed his motivation. Richard declared, "I was always taught from a child to be better than the white man. You have to be 2 times as good to get the same achievements. You have to be twice as good." By being better, one could possibly get the same opportunities as Whites, and at the same time, prove that one belongs. Out performing, or operating on the same level as White people while playing their game, indicates that one has intelligence, and must be treated accordingly. Several students expressed having this thought of having to be better ingrained into their way of thinking.

Jordan was another student that felt the need to prove people wrong when it came to his intelligence. He also felt, and knew, the stereotypes of Black people, and felt the need to disprove them.

The stereotypes of African American are that everybody likes fried chicken and watermelon. That we are more built towards being jocks, and that athletics drive us, and get us through education. With regard to my academic ability, I do not experience that. I try to prove to people that I am more than athletic. (Jordan)

Jordan wanted to be recognized as being more than athletic, he wanted to be recognized as being someone who had intellectual abilities as well.

Jordan was a star athlete in high school, and did not necessary see the distinction, or stereotypes that were placed on him by society because he was also a very good student. He was now in college, and not an athlete anymore and somehow began to recognize the fact, or came to the conclusion, that society only expected him to excel in those things that were athletic. Because of this stereotype, Jordan had the need to prove that he could excel in academics as well.

Jordan was persisting with his biology major although he was being challenged like never before, and was having difficulty within his program. At the time of this interview, he had no intention of giving up, or changing majors because he needed, and wanted to prove, he could get the job done and be successful within his biology major. Because he struggled, Jordan expressed concerned that he would be viewed as only being accepted into LW University because of affirmative action.

I feel there is that small faction of people that are going to say he is here only because of affirmative action. For the most part, I feel people have treated me fairly, and believe I have a right to be here, and I am thankful for that. But everyday I try to prove that small

fraction wrong (Jordan).

Jordan sincerely hated the idea of people thinking he did not get into Virginia Tech on his own merit, so he constantly tried to prove that fraction of people wrong. This thinking motivated Jordan to study and not give up.

Jordan equated his struggle to that of women for he believed they also were treated unfairly by society. He believed he just needed to and had to work a little harder, just like women, if he were to be successful.

I keep saying prove it to someone because I believe that is just how society is or has become for a black person. It is growing out of the time where black people are just look at as being low. It is still coming out of that. You just have to work a little harder to be accepted, prove yourself a little more. You have to be a little bit better than everyone else to get recognition. Kind of like women, they always have to be the best to get the job. It is kind of like that same burden. (Jordan)

Jordan also felt that because of all the negative stereotypes that were associated with black people he had to represent his people in a positive manner.

In being black I do represent my race. In being one of the few black students' here at LW University, I do have to represent myself, and my race in a manner that really proves to people that all black people are not the same. There is more to us than just athletics, thugs, and gangsters, people who are just filling up jails. There are normal black people out there and I try harder to prove I am not like what is on television. (Jordan)

Succeeding, and being the total opposite of how he perceived black people to be represented within society, was how Jordan proved to people that he was different. He also felt he proved that there are black people within society that do not conform or behave like the images seen on television.

Crystal had individuals that she wanted to prove wrong. Her main motivation was personal although how society represented her was motivation for her as well. Crystal talked about her mother being so proud that she was at LW University majoring in engineering. Crystal started to be motivated when people at her mother's job expressed to her that she should not major in engineering because it was too difficult. They told her that she would not make it through the program. This drove and motivated Crystal and she wanted to prove all of them wrong.

Crystal continued with expressing why, and how these thoughts motivated her not to give up when things got difficult:

Honestly, I can say it has driven me. I took forward to the day I graduate and I can say: "I have proven all of you wrong." Every person who said that engineering is hard, or why not try this instead because it is not as hard, or only men should do that, you sure you want to major in engineering. Especially the men engineers saying stuff like: "you are going to be the only female in the class," or "will you be able to handle that?" To all those people who said I would not be able to do it because of my race, or gender. To all who said I was not going to make. It will be like I proved all of them wrong. We can do this. This is not about your race, or gender. It is about what you are willing to do. Putting forth the effort. (Crystal)

Crystal can be viewed as being mad and disappointed that people believed that she could not be an engineer because she was a black and a woman. She did not buy into this thinking and believed that it was not about her race or gender but about putting forth the effort to get the job done.

Crystal continued by providing one last comment on experiencing suspect situations on this campus with regard to her being black. Crystal found it hard to recall any specific incidents

that caused her to think someone was being racist towards her but she knew that being excluded by others at times made her feel something wrong was happening. Although she could not remember any specific incident, she remembered the feelings she had very clearly.

Being excluded is a big part of feeling this way. Yeah it is really hard to explain because I cannot think of any specific incidents, but I can remember the feelings so vividly. Just one of things that make you want to crawl in bed and cry or go punch a punching bag like crazy. It is just an overwhelming feeling like someone has made me feel like I am not worthy of breathing and you do not know how to deal with it. It is frustrating. But it makes me feel challenged, it makes me want to keep going and show them that know matter what you think and know matter what you personally feel about me being in this major I am going to do it. I am going to do it well. It has kind of broken my heart a little bit knowing that people think like that. Knowing that people still have that mind set.

(Crystal)

Even though Crystal used some things as motivation for her to succeed, knowing that people still viewed black people in this manner upset her on a certain level. Regardless of what she felt she would not be denied her goal and as reported earlier, has since graduated, and now has the satisfaction of proving all who doubted she could do it wrong.

Kanye gave an idea of his thoughts as he matriculated through LW University. In a sense he believed he had to think in a certain way because of where he was, and that thinking, at times, served as his motivation to prove people wrong.

Sometimes I use it as a way to lay low, but make an impact in the class, and be good and use it as a way to show you that I can do something because you under estimate me at the door. My classroom experience makes me feel that I am under estimated when I walk in the door. Life makes me feel that way. The stereotypes about African American's make

me feel that way. That I cannot excel, except for on the playing field. Some stereotypes are true about races. Maybe it is statistics that say I am not supposed to succeed on your campus. (Kanye)

Kanye's experiences told him that he was underestimated because he was black. The fact that society underestimated Kanye informed him that he was truly not respected and he did not like that feeling. He did not want to be relegated to just excelling on the playing field and felt the need to prove his worth.

Proving to society, to people, and to proving to themselves that they could handle the work was a major motivator for the students that persisted. They have struggled and are struggling within their majors but they are persisting. Some have experienced negative attitudes towards them, racial encounters, etc., but they find ways to overcome whatever difficulty they face and used those things as motivation to succeed.

Race and its impact on the mind

Even though these students used the stereotypes of being black as their motivation to overcome their obstacles, the fact that they believed they had to do this was a problem because to use race in that manner conveys that internally one does not truly believe they are playing on a level playing field. The way society is, the way African Americans are treated, causes students to feel they have to protect themselves by thinking those who are not like them are, in some way, trying to get them and bring them down. This may, or may not always be the case, but they are forced to think in this manner for survival because to not do so could be detrimental.

Jordan believed that in order for a black person to be successful they must be perceived in a certain way. What he perceived determined how or what actions he took. Jordan discussed those issues in the following comment.

The way society has been set up you have to come across as being educated.

You have to come across as being.... I am not trying to act white or anything. Be yourself, and do not feed into stereotypes. People see the stereotypes and we are not like that, but after a seining it over and over they assign us those roles and believe this is who we are. They say stereotypes do not exist but they do exist. Stereotypes in some cases are real, and I do not want those stereotypes to apply to me. When I go to look for a job or career, I want to have the best outlook of me available to people. (Jordan)

Jordan came across as saying that black people, in a sense, have to act white or be perceived as white in order to gain a level of success. He felt he would be judged in a negative fashion if he did not conform to what he thought society viewed as non-threatening, and in his opinion society viewed white as non-threatening. Jordan statement suggested that although he believed he was not trying to act white, a part of him felt that if he was going to be successful, then this was what he had to do in order to achieve that goal. The problem, as he alluded to, was that in adopting that role, that was what one becomes. In short, one loses his/her identity in trying to conform.

Thinking about these matters concerning race constantly affect the mind. Kanye discussed how he thought about race as a student at this university.

My race is on my mind a lot at least when compared to other students. It is probably on my mind more than my white counter parts. So yeah, I have to think about it, I guess I have too. It is almost in grown. Because of some of the experiences I have had. I know where I am. I am at LW University in Blacksburg Virginia. It is not West Baltimore, or DC, or home. It is not my high school. I know in my mind where I am, and I know it is a possibility that I maybe judged unfairly because I am black, and I tell myself that.

(Kanye)

Kanye's experiences have trained him to expect bad even though, at times, he does not experience anything that warrants the concern. His feelings were in grown, innate so to speak, but those feelings, and that way of thinking impacts his mind and actions.

It impacts most of my actions or maybe more of my thoughts, but I do not let it worry me, I do not let it rattle me. I take my notes and I go home. I am a smart guy; I will figure out whatever I need to get it done. If I need help then I have got to find help.

Does it impact whom I go to for help? Yes. Does it impact if I talk to my teacher about it? Yes. So I guess those are some things that do impact me. (Kanye)

Although Kanye accomplished his goal of graduating with his engineering degree, will he continue to look at life in this manner? How does being motivated by proven someone wrong affects one's psyche? Is it healthy to go through life this way? What happens when one cannot prove people wrong and how does that affect the mind?

Chapter Seven: Data Analysis

Actor Network Theory

Actor Network Theory (ANT) is an alternative way of making sense of the social structure of society. ANT was established out of the field of technology and the social studies of science. The theory, primarily used in areas of technology, is built around the concept that the world and the processes and entities that occupy the world function as a network. A network consists of “spatially dispersed elements that have been linked together over time and the linkages connecting networked elements are as important as the nature of the elements themselves” (Nespor, 1994, pg 11). The theory looks at society in terms of relationships that are built and stabilized and how these relationships intersect with one another.

For example, if a person wanted to open a newspaper stand in the city, would that person set up shop at the busiest intersection or area within the city? Or would that person set up shop at a location that is isolated from most people? If money is the goal and if money is to be made, that person will be positioned in an area where there is plenty of traffic and pedestrians that can buy the products. Every person will not buy a newspaper or magazine, but the position makes the chances of a purchase greater due to the amount of people that will pass by or intersect with the stand. Over a period of time this stand will most likely become a stable fixture of this location making it easier for money to be made. On the other hand, if that person sets up shop in an isolated area, not as much money will be made because the location chosen does not intersect with many people. A chance to stay in business exists because some days enough money may be made in order to survive, but the probability of staying in business over a long period of time is unlikely. Eventually that person will move on to another location or to another line of business.

The more a person intersects and builds relationships with people of power within a

network, the stronger position that person will hold within the network. Like in the example above, the newspaper owner who intersects with more people of power has the greater chance of being successful. People of power as would be defined by the newspaper stand owner are those persons with the money to buy newspapers. ANT provides this alternative view of society. If one is able to position themselves in a position of maximum exposure within a particular network, meaning that their paths are able to intersect with those in power and they are able to build positive relationships, then the likelihood of that person becoming successful is more probable. Thus, if one were to view society using this theory as a lens then it is not intelligence alone but positioning that determines a person's success within this society. ANT gives the old adage, "it is not what you know, but who you know," validity.

Actor Network Theory and Scientific Fields

Science is a stable structure that has been reinforced for years by a stereotype that dictates that white males are the major participants within the field. The representations of science and how science is studied and controlled are all factors that contribute to the stabilization and perpetuation of a singular image of who has access to the field. Some members of marginalized groups do gain limited access to scientific fields because a few of them have learned how to negotiate their positions within the network of science, but this does not hold true for the majority.

When one group organizes itself in such a way that the perception of science only fits their image, then control of a network can be maintained making it harder for others that do not fit that image to participate. Callon and Law (1995) believed that networks are about relationships and thus suggest that no one within a network can exist separate from the rest. Nothing exists as discrete or detached entities because within a network everyone and everything is relationally defined. In science this holds true and the relationships developed

within the network of science seems to create a societal hierarchy that promotes a worldview that excludes the extensive involvement of minorities.

In the example given above about the newspaper stand, what was not communicated was that the person who wanted to set up shop at the busiest intersection in the city had to have some type of permit for business. The city, and possibly the other newspaper stand owners in that area or surrounding areas would not just let that person move into their territory because it will cost them money.

The questions are: Who or what determines the qualifications for the permit? What if those who granted the permit decided that only those that looked like them could have access to that location in the city? Suppose the requirements were legally structured in such a way that it only allowed for a certain group of people to sell newspapers at the prime locations in the city. Would those who did not possess these characteristics be as successful at selling newspapers in the city? If this process of doing things had been going on for years, then this process would seem stable and unchangeable. Scientific fields appear to operate in much the same way to groups of people that have been denied access to the financial life styles, prestige, and intellectual status that science can provide. It leads to the conclusion that certain nonobjective requirements have to be met in order for full participation to occur.

How is power and control able to be maintained throughout generations by certain groups of people? Slavery for African Americans ended 139 years ago. African Americans now have the right to vote, and they are now integrated within the public school sector so supposedly they are receiving the same education as their white counterparts. Many believe that African Americans and every other minority in this country have the same opportunities to advance in this society as whites, but because of their laziness and natural lack of intelligence many of them often find themselves in predicaments that are not beneficial to themselves or their race.

Looking at just the facts through the lens society has provided leads many people to draw these negative conclusions about African Americans and other minorities. African Americans are not represented in scientific fields because they do not deserve to be there. There exist an achievement gap between Caucasians and African Americans because time has proven exactly what has been known for a very long time, and that is one group is innately more intelligent than the other.

The problem is that African Americans are unfairly judged on the results of years and years of oppression. Looking at society in terms of the ANT helps to explain the discrepancies that exist about African Americans that have nothing to do with intelligence. ANT provides an alternative way of viewing or critiquing society and the facts, it gives us the ability to look at things differently because it, as explained earlier, looks at things in terms of relationships.

For example, Burt (2004, p 3) suggests that, “there is a network structure residue to social history, a network in which individuals are variably connected as a function of prior contact, exchange, and attendant emotions,” meaning that networks are comprised of individuals that share commonalities that have been developed partially out of the history that they share. This creates a “homophily bias in networks, which means that relations are more likely between people who share socially-significant attributes such as income, education, age, gender, and so on (also familiar in the old saying birds of a feather flock together)” (Burt, 2004, p 3). What Burt is saying, as well as what others like Bourdieu (1977) have said in the past, is that social and cultural capital can play a role in the success of people.

Viewing science from this perspective gives at least one other possible explanation for the lack of African Americans in scientific fields. Few African Americans operate in or come from networks that allow them to move freely and fluidly within networks of power such as science. This lack is present in all areas of education and professional arenas and creates a

problem for those that operate outside of networks of power. The terms cultural and social capital both refer to “an advantage created by the way people are connected” (Burt, 2004, pg 6). Therefore if a person does not possess the characteristics of those within the network that they are trying to become a part of, they are from the onset at a disadvantage. The question, at least in the field of science, becomes why or how is something so subjective manifested in a field that is supposedly so objective?

If positioning is just as important in determining success as intelligence, then why is the lack of African American and other minority participation within scientific fields such a problem? It would appear that all they would have to do is to find pathways within the network that would allow them to intersect with those persons in power, and build positive relationships with those persons to give them a better chance at success. Sounds simple, but what if those pathways were blocked in some way or by something? What if that something was not related to intelligence or to the social and cultural capital that may be needed in the formation of the relationships that can lead to better positioning within a network?

What if race was connected in some way to access? In other words, what if race actually mattered? Those people who are Caucasian that do not share many of the characteristics of those in power can easily fit in or fake the cultural and societal capital needed because they at the very least fit the physical image of those that control the network. African Americans do not have that luxury because the color of their skin cannot be hidden. They can possess many characteristics as those in control but they are always identifiable by the pigmentation of their skin. This is important again because their skin color is linked to negative stereotypes. If the stereotypes about African Americans somehow hindered the relationship formation that leads to success within a scientific network, then the lack of African Americans in scientific fields is partly explainable from this point of view.

Inclusion, or exclusion, from networks happens consciously and unconsciously by members of all groups. It cannot be avoided because everyone is influenced by society whether knowingly or not. As discussed earlier, all people tend to associate with people who come from similar backgrounds. Why is that? Was it choice or did it just seem natural? If it seemed natural, then why did it appear to be so? We cannot escape societies influence because it to is a network that is bounded by relationships that exist.

People within science like to think of it as fair and objective, but in using the actor network theory that this is unlikely because a network is formed by processes that are far from objective. The fact is that the majority of people cannot divorce themselves from the reality that they live because that is how they make sense of the world. All experiences play a part in how the world is perceived, so much so that this process becomes automatic. An example provided by Hanseth (http://carbon.cudenver.edu/~mryder/itc_data/ant_dff.html) that helps illustrate this automatic process is:

When going about doing your business-- driving your car or writing a document using a word processor--there are a lot of things that influence how you do it. For instance, when driving a car, you are influenced by traffic regulations, prior driving experience, and the car's maneuvering abilities, the use of a word processor is influenced by earlier experience using it, the functionality of the word-processor and so forth. All these factors are related or connected to how you act. You do not go about your business in a total vacuum but rather under a wide range of surrounding factors. The act you are carrying out and all of these influencing factors should be considered together. This is exactly what the term actor network accomplishes. An actor network, then, is the act linked together with all of its influencing factors (which again are linked), producing a network. This illustration shows that even the act of driving a car or typing is not separate or cannot be

disconnected from the rest of the world. How you drive has to do with the influences you encounter or have encountered throughout your life.

Deliberate Exclusion

The elements within an actor network are referred to as actors, and different actors can maintain or destroy a network's structural integrity. The actors can be human or non-human depending on what network is in question. The actors in a network can be influential to or influenced by different factors within the network they participate, other surrounding networks, as well as the overarching network in which all networks and actors operate because everything is connected.

In networks that deal with human interaction, all people do not have the same agency or power. In these networks, there are actors that are more powerful than other actors. Those actors that are powerful invariably control the network, the structure of the network, and those actors with less power within the network. The more powerful controlling actors maintain the network's structure or stability by enlisting other actors with similar characteristics as themselves, so the more actors that share the opinions, beliefs, and characteristics (whether consciously or unconsciously) of the controlling actors, the more resistant the network will be to change.

Much work goes into maintaining the stability of a network by the controlling actors. A network runs smoothly only if all actors perform in roles that they are assigned. The roles are given out based on the amount of agency particular groups hold within the network. The group of actors with the most power (e.g. the builders and guardians of a network) is assigned the roles that are deemed of high value and the group of actors with the least agency is assigned the roles with low value, with other groups falling in between based on how they are perceived by society.

A network can take a small percentage of actors with less authority gaining power, but in order for a network to run smoothly, the majority of all actors must remain in their assigned roles. When too many actors of less authority try to operate outside of their assigned roles and try to operate in those roles that were assigned to groups of actors with more authority, then that particular network will start to deteriorate or have problems, especially if they succeed.

Networks are not permanently fixed (although some seem to be a permanent part of society) because the elements that comprise them constantly change over time, thus changing the design of the network (Nespor, 1994). Deterioration occurs when the practices of a network that “seek to produce or maintain a certain configuration of social space by excluding or restricting some people and things from participation while recruiting and reconstructing others to fit into the network “ (Nespor, 1994, p 13) is now being challenged. If those groups of actors with less authority succeed, then power within a network will become more balanced, thus changing that network. When a network is changed other networks are affected also because all networks are linked; thus, if an actor gains more authority within a particular network, their authority within the over arching network maybe increased as well.

In order to maintain the status quo or structural integrity of a network, groups of actors that benefit the most, or groups of actors that like their position within a network, usually assign negative properties to those actors that are powerless. This act makes it hard for these actors to move out of the roles they were assigned because actors of higher authority highlight those negative properties in such a way that it becomes representative of their entire group. The truth is that those negative properties are the results of the practices of building and preservation of the network (Latour, 1993), just as positive properties about those actors who control the network are also the results of the practices of building and preservation of the network. Taking

this into account, “those properties can not count as the explanation of practice” (Pickering, 1992, p. 21) by either group.

Components of Actor Network Theory

Actor Network Theory as described by Callon (1986) in Nesper (1994, p 13-15), can be summarized and understood in four overlapping, but not necessarily sequential stages: problematization, interessement, enrollment, and mobilization. Problematization refers to how the builders of the network define the identities and interests of groups of people (Nesper, 1994). Often times within a network hurdles exist that are created by the network builders that will have to be jumped in order to meet a goal. These hurdles can be viewed as “a space-time intersection that students have to move through to accomplish the defined identities and interests” (Callon, 1986, p 204, 206) of the builders of the network. These hurdles in science are usually specific courses or people that are often referred to as gatekeepers. Professors and teachers of science (although the term is not limited to them) often control who succeeds within the field, so in order to gain entrance one must go through them.

Interessement refers to the approaches that are taken by the builders of the network that impresses upon and reinforces the way other actor’s identities within the network are defined through its problematization (Callon, 1986). The “key to this process is the creation of barriers that can be placed between the entities being networked (Nesper, 1994, pg 14) and “all the other entities who want to define their identities otherwise”(Callon, 1986, pg 208). Within science, this would mean that the gatekeepers reinforce in some way the negative stereotypes that exist and use those stereotypes to further marginalize particular groups, thus creating a separation between those who they deem fit to succeed.

According to Nesper (1994, pg 14), “Interessement succeed in fixing identities and memberships, enrollment interrelates those roles and fashions the identities into systems of

alliances.” Both interessements and enrollment have dual functions according to Callon (1986, pg 211) which are “to describe enrollments is thus to describe the group of multilateral negotiation, trails of strength and tricks that accompany the interessements and enable them to succeed.” Lastly there is mobilization which refers to “the method used to stabilized the enrolled coalitions in ways that ensure that supposed spokesmen for various relevant collectives were properly able to represent those collectivities and not betrayed by the latter” (Callon, 1986, pg 211 as found in Nespor, 1994, pg 14).

High School Network

The chart below applies the components of ANT to how students were positioned within their high school network. The chart gives a broad view of the stages that each student probably went through during their K-12 careers. The participant’s high school experiences interpreted through the lens of actor network theory revealed that most of the participants were positioned in such a way within their particular network that allowed them to be successful in high school. Using the components of ANT as described by Sidorova and Sarker (http://carbon.cudenver.edu/~mryder/itc_data/ant_dff.html), the participant’s high school experiences could be interpreted in the following manner:

Figure One: High School Experiences Defined in Actor Network

Components	Definition	Relevance to High School
Actor	Any element, which bends space around itself, makes other elements dependent upon it self and translates their will into the language of its own. Common examples of actors include humans, collectivities of humans, texts, graphical representations, and technical artifacts. Actors, all of which have interests, try to convince other actors so as to create an alignment of the other	Participants and peers are the actors within the science and math classes. They have formed relationships that have been stabilized over time. Due to their high performance most have been separated into groups where their interest have been aligned for them. The students may further align themselves within their science and math classes but typically

	actors' interests with their own interests. When this persuasive process becomes effective, it results in the creation of an actor-network.	those that are considered smart are placed together and support one another.
Actor Network	A heterogeneous network of aligned interests.	The high achieving students within science classes, the teachers of the students, parents, and the school.
Translation	The creation of an actor-network. This process consists of three major stages: problematization, interessment, and enrollment. Numerous actors within an organization may be involved in a different process of translation, each with its own unique characteristics and outcomes. For purposes of clarity, it is useful to focus on a single actor, from whose vantage point we wish to see the process of translation.	The teacher or the school system here is the focal actor. They defined the attributes of the students. They decide what type of classes the students takes and they help determine the path of the student.
Problematization	The first moment of translation during which a focal actor defines identities and interests of other actors that are consistent with its own interests, and establishes itself as an obligatory passage point (OPP), thus "rendering itself indispensable" (Callon, 1986).	The focal actor here is the school or the teachers. Those in power that defines the student as being good or bad and places that reputation on them. They are the gatekeepers that allow entry into upper level classes.
Obligatory Passage Point (OPP)	The obligatory passage point, broadly referring to a situation that has to occur in order for all the actors to satisfy the interests that have been attributed to them by the focal actor. The focal actor defines the OPP through which the other actors must pass through and by which the focal actor becomes indispensable.	The classes that the students take and their performance in those classes is the OPP. The teachers feel that the student is smart and the student meets and/or exceeds the expectation of the teacher on assignments given.
Interessement	The second moment of translation which involves a process of convincing other actors to accept definition of the focal actor (Callon, 1986).	As the student moves through grade levels, the reputation that was given in earlier grade levels by teachers has proceeded the student and now effects the way that student is perceived within other classes

		by other teachers. The student along the way has gone through certain classes (OPPs) that reinforce their position. This process goes on until the completion of high school unless the student does something to taint their reputation.
Enrollment	The moment that another actor accepts the interests defined by the focal actor.	Upon entering different classes, the student again meets the expectation of that teacher and the teacher accepts the definition of the student that was given in previous years.
Inscription	A process of creating technical artifacts that would ensure the protection of an actor's interests (Latour, 1992).	The student's academic records and the positive description given by the teachers.
Irreversibility	The degree to which it is subsequently impossible to return to a point where alternative possibilities exist (Walsham, 1997).	Student has been performing at a high level for long that any other action is impossible to imagine by others.

There is no network unless there are relationships, and relationships have to be developed in order for a student to gain entrance to and remain in a network. Some students talked of being part of families that had good standing in the community and some had siblings that attended school before them that had developed positive reputations as being good students. These things were their introduction into their particular network and their performance kept them there. In high school the students established relationships with their peers and teachers over an extended period of time. These relationships allowed them to feel like they belonged, and allowed them to feel comfortable within their particular classes. As mentioned earlier, many times within the public school system students with similar abilities are frequently grouped

together and those students usually stay together for an extended period of time or until graduation.

The stability of an environment like this allowed relationships between friends and faculty members to become stronger over time, and those relationships influenced the performance, participation, and attitude of all that were involved. As found in Brand, Glasson and Green (2006), those positive relationships that occurred between students and their teachers signified to these students that they were accepted and that their teachers had confidence in their abilities as students.

Typically, with the progression of time comes the building of the reputations of students. In advanced classes and especially in advanced level science and math classes, most students develop a reputation of being well behaved and motivated. They are also perceived as students whose parents are serious about their education. Even before one of these students begins a new class, these attributes are assigned to them by their teachers and by other students. This reputation carries with it certain privilege that is probably not enjoyed by the rest of the student body. Bourdieu (1977) and Burt (2004) would equate this privilege that is partly based on reputation, to social and cultural capital that is held by these students because they had an advantage created by the way in which they were connected.

One of the tenets of the actor network theory is that if one is able to position themselves in a position of maximum exposure within a particular network, meaning that their paths are able to intersect with those things that are symbols of power as well as with those in power and, if they are able to build positive relationships, then the probability of that person becoming successful is greater. Participation in advanced level courses secures entrance into other networks and serves as a symbol of what to expect from these students. These symbols along with their parent's involvement and support of their education, as well as their relationships

with teachers, coaches, and friends, all contributed to the success of these students. These interactions with different symbols increase the probability of success for the participants in high school.

Being black at this level did not matter for most of the participants because their position had been solidified within the network well before they entered high school because of the positive capital that had established in previous years. These students participated in networks that had been stable for a number of years and positive characteristics were assigned to the entire group. Since these students were a part of the group, those same characteristics were assigned to them even though they were in predominantly white high schools or classes. Due to the advanced level classes that most of them were involved in, intelligence was automatically bestowed upon them as well.

Those negative characteristics discussed earlier that typically are assigned to black students did not apply to or affect these students because they were considered to be anomalies by their teachers, peers, and society due to the high level of classes they were taken. They were considered to be anomalies because as students matriculate through the educational system, they begin to take notice of race, social class, and perceived intelligence, and start to separate accordingly. They are assisted with this action by the schools they attend for the schools themselves appear to separate kids based on that same criteria. As they mature and move through the system, they are affected consciously and unconsciously by society and clear lines of separation within the schools become very distinct. These students were on the positive side on that separation.

Within the advanced level courses there is a disproportionate number of white students as compared to minorities and often this disproportion correlates to social class and race. The participants were able to transcend the color and possible social class barriers because they had

the ability to out perform most students in their school at their level academically. Because of this, they were able to participate within networks that granted them opportunities and privileges that were not enjoyed by other black students and by the majority of the student body.

The majority of all these students in high school participated in networks that allowed them to be successful. Although all participated within this scientific network and most had no issues related to their race, some did express having issues with how their race affected their participation within their network. These students were well aware that they were the only or one of a few blacks within their network and it affected their interactions.

Networks have individuals within it that share socially significant commonalities with each other. These commonalities can be race, income, gender, etc. The students that expressed concern did not feel as if they belonged or did not feel comfortable within their networks based on some of the commonalities that existed between most of the students that were members of the network. Within these networks the students' participation was not validated because they spoke of being isolated, disadvantaged, and shy. They did not feel as if they had the power to move freely and fluidly within the science network they participated in because they in some way did not share the commonalities of the other students. These students (Denzel, Kanye, Crystal, and Maya) did not describe the same positive type of peer relationships as the other students. Bourdieu (1977) and Burt (2004) would interpret these students as not having the social or cultural capital needed for them to feel totally comfortable within their particular network.

The other individuals that participated in the network probably had no intentions of making the black students feel this way. The problem is that networks that are homogenous produce this effect whether intended or not. When someone enters a network that does not share commonalities with any of the participants, then that person may feel isolated. These

participants felt these outcomes, because their educational environment was one that was homogeneous in its makeup in regard to ethnicity. They felt like minorities and not part of the dominant group. The other participants did not feel this way possibly because they participated in networks that truly supported and validated their participation making being a minority less of an issue for them.

These feelings are an intended result of the network in general, for the structure, formation, and maintenance of it give evidence to that fact. Some participants within certain networks probably are unaware that their network and composition of it make others who do not share the same characteristics feel isolated and uncomfortable. Although this may not personally be their intent, due to the network's homogenous nature, its results are very predictable when the support that can possibly offset these feeling is not in place.

Within a person's close personal network, he or she determines the participants. They in essence are the creator and builder of the network. In short they serve or act as the gatekeeper. The people within this network more than likely have similar characteristics with each other. Each person is similar because they were picked based on some criteria that the creator of the network established for entry. People who did not meet the creator's established criterion did not gain entrance into the network.

Imagine that the creator now wants to diversify his/her personal network after years of it being homogenous or made up of the same type of people. The creator now wants to expand it with a person who is different from the rest of the group. This person is from a different social class, religion, race, etc.; they just do not fit in because the network was not established with them in mind. That person still may choose to participate even though they are not comfortable if participating is beneficial for them. Some may feel that the result of feeling uncomfortable is

unintended but again it is a result that is very predictable based on the original criteria that people had to meet in the beginning.

Some of the participants in this study fell into this situation. They entered the science network not meeting the criteria of being white, and not meeting this criterion made them stand out and feel at a disadvantage within these classes. These students may have not met other criteria as well but being the only black within their classes was the one they chose to discuss. In short, within networks in general, the dynamics of how the network is configured can result in the uncomfortable feelings that are experienced by those that do not fit if the proper support is not given.

The majority of the students within high school formed relationships with teachers and peers that secured their position within their science networks. The negative characteristics associated with blacks students, and black people in general, did not inhibit the participants in the formation and maintenance of these relationships. As stated earlier, the students and their families were a part of the community in which they attended school and the students were linked together over an extended period of time due to being in school together and from the level of classes they were taking. These things created a stable environment where the participants were supported and validated as good students.

College Networks

As these students entered college the support systems that emerged from them being part of a stable environment for so long no longer existed. As a result, many of the participants began to be affected by the negative images and characteristics that are associated with being black. Those negative characteristics had a direct impact on their experiences within their major in that it affected how they formed relationships with professors and peers. Those experiences led to their decision of whether to persist or not within their chosen major.

Non-persistent students

The students that did not persist had actor networks that were very limited in nature. The following chart describes how they were positioned in their networks using the components of the theory:

Figure Two: College Experiences of Non-persistent Students As Defined in Actor Network

Components	Definition	Relevance to College
Actor	Any element, which bends space around itself, makes other elements dependent upon itself and translates their will into the language of its own. Common examples of actors include humans, collectivities of humans, texts, graphical representations, and technical artifacts. Actors, all of which have interests, try to convince other actors so as to create an alignment of the other actors' interests with their own interests. When this persuasive process becomes effective, it results in the creation of an actor-network.	The participants and the others students were the actors. The university and the faculty members are also actors
Actor Network	A heterogeneous network of aligned interests.	The peers and professors the students associated with along with any other entity they received academic assistance from. Most times the actor network of the non-persistent student consisted primarily of other Black students. Their network was closed off and only contained students like themselves.
Translation	The creation of an actor-network. This process consists of three major stages: problematization, interessmant, and enrolment. Numerous actors within an organization may be involved in a different process of translation, each with its own	Society has defined the students as not being intellectual enough to handle scientific majors. Society looks at African American students as not being capable. Society has provided the definition so society is the focal actor.

	unique characteristics and outcomes. For purposes of clarity, it is useful to focus on a single actor, from whose vantage point we wish to see the process of translation.	
Problematization	The first moment of translation during which a focal actor defines identities and interests of other actors that are consistent with its own interests, and establishes itself as an obligatory passage point (OPP), thus "rendering itself indispensable" (Callon, 1986).	In the eyes of the participants, society has defined them or perceived them with the negative characteristics that are associated with being Black. Society created the negative characteristics and now has influenced people to believe the negative things that it has created.
Obligatory Passage Point (OPP)	The obligatory passage point, broadly referring to a situation that has to occur in order for all the actors to satisfy the interests that have been attributed to them by the focal actor. The focal actor defines the OPP through which the other actors must pass through and by which the focal actor becomes indispensable.	The university and professors establish classes as the OPP that the students must pass through. Students must meet the professors' and universities' expectation in order to pass the class. Students refer to some classes as weed out classes. Professors and classes are the gatekeepers.
Interessement	The second moment of translation which involves a process of convincing other actors to accept definition of the focal actor (Callon, 1986).	Society has convinced others actors that Blacks are lazy and dumb with the constant negative images that have permeated through society since the 17 th century. White professors, students, and the participants themselves start the process of accepting the definition because of poor performance.
Enrollment	The moment that another actor accepts the interests defined by the focal actor.	Their professors, their peers, and in some cases the participants themselves believe the negative characteristics that have been assigned to them. They now have enough empirical evidence to accept the negative characteristics as truth. This makes forming relations very difficult.
Inscription	A process of creating technical artifacts that would ensure the protection of an actor's	Craniometry, IQ testing, Standardized testing, SAT scores, crime, and uncivilized behavior are

	interests (Latour, 1992).	all indications that Black people fit the description and definition that has been established. A long trail of evidence that led people to draw negative conclusions about Black students. Society has now protected it's network from those they consider to be less than.
Irreversibility	The degree to which it is subsequently impossible to return to a point where alternative possibilities exist (Walsham, 1997).	The message about Black people not being intelligent enough to handle scientific majors has permeated through society for so long (and in some people's mind proven) that any success by Black students in these majors is viewed as an anomaly. The image of not being intellectual enough appears to be permanent fixture in society where alternate possibilities seem not to exist.

The chart attempts to show that the positions held by the students that did not persist within the network of their major were not strong enough for them to persist. The students were unable to develop significant relationships within the network because of the negative characteristics associated with them that could have assisted them in their efforts.

The participants graduated from high school and began new chapters' in their educational career. The networks they were a part of in high school were irrelevant now because they were in a new place in a new situation. Everything now was new so they had to essentially start from scratch in building modern networks of relationships that would assist them in their quest to be successful.

All students, when they enter college, have to form new relationships with people in order to build networks or participate in existing networks that have already been established. Within chemistry there is a saying that "like dissolves like." When trying to dissolve one substance into another, the substances in question must be alike chemically in order for

dissolution to occur. Either the substances must be polar or non-polar in order for them to dissolve into one another. This is the reason that oil and water do not mix. The polarities of the two differ and when combined, one is easily recognizable from the other no matter the amount or proportion of each substance. Students and society at times operate similar to chemical compounds.

A black student entering a predominantly white university usually seeks out relationships with people that possess the same observable characteristics as themselves, especially if they do not know anyone. They seek persons that are black because many feel like they do not mix, combine, or fit with those that are physically different from them. The problem with this reasoning is that on the campus of LW University, less than 5% of the total population is black and that 5% is dispersed among various majors making forming relationships with only black students very disadvantageous.

Forming black only relationships is also disadvantageous because when trying to obtain academic success, the more people of knowledge one can interact with, the better chance that person will have for success if they struggle with certain concepts or subjects. White students on the other hand may not have that problem because if they chose to only associate with white students would be fine since the majority of everyone on campus looks like them. Therefore fitting or mixing in, based on that criterion, would not be a hindrance.

Many participants expressed an inability to form relationships with others that were not black and that is not surprising because people of like ethnicities tend to associate with one another. This can be seen on college campuses, in churches, in the secondary educational system, etc. People that share a common history seem to connect better with each other and thus form a network based on this criterion. Burt (2004) discussed the way people are connected and the networks that they form in his book *Brokerage and Closure*. In this book he

too suggests and believed that “networks are comprised of individuals that share a social history that are variably connected as a function of prior contact, exchange, and attendant emotions” (Burt, 2004, pg, 3).

If a student is part of the dominant group within a network that student has various sources from which to get information or assistance. This is assumed to be the case for the majority of white students on this campus because the common bond of being white is shared. For example, suppose a white freshman student only associated with other white freshman students within science and engineering. Now suppose that white student needed assistance with one of their science or engineering classes, but for some reason, the white student that he/she chose to ask denied them assistance or just did not know how to help. If that student entered this university in the year 2000, that student potentially has 1623 other white freshmen majoring in science or engineering to ask for assistance. However in contrast, if that student were black within science and engineering, they potentially would have only 107 other black students to ask for assistance. Burt (2004, p. 6) refers to this as: “an advantage created by the way people are connected.”

Emerson in 1972 developed a theory based on the social exchange of people within a network. This theory as cited in Molm, Peterson, and Takahashi (1999) is commonly referred to as the power-dependence theory. Their analysis of his theory in conjunction with social relations identified three basic characteristics of actors within a network: “(1) actors are dependent on one another for valued outcomes; (2) benefits obtained are contingent on benefits given ‘in exchange,’ and; (3) actors engage in recurring exchanges with the same partners” (pg. 877). If these environmental conditions exist within departments, black students really can be at a disadvantage when they major in scientific fields.

The first statement deals with dependency upon one another for valued outcomes. This

is a major problem for many black students within scientific fields because many of them only look to each other for assistance. Statements given by several of the participants indicate that this was the action that many of them took when it came to seeking out assistance; they only looked to each other if they needed help. And in the cases where the student did turn to “outside” help, he/she was uncomfortable in doing so. If a system is able to limit the number of persons that a student feels he/she can interact with, then that system has put that student at a disadvantage because the student may feel they have no other alternatives.

The second characteristic refers to a reciprocal relationship in which each person has to give something in order to receive something. If the perception of the black student is that they are intellectually inferior, then what could he or she possibly offer in return to a white student that feels there is nothing that a black student could conceivably know that will exceed their existing knowledge. If this is the case, having a reciprocal relationship probably will never benefit the black student because white students from the onset will perceive their contributions as irrelevant. This is not to say that this is how white students are, but only to say that this is how some black students perceive their actions and attitudes towards them to be. Many of the students in this study spoke of having to continuously prove themselves repeatedly and they attributed having to do this to being black.

The third characteristic deals with people interacting with others they know on a reoccurring basis. If one were to look at this phenomena strictly in terms of black and white, then what possible reason would a white student ever have to approach a black student for assistance on a predominantly white campus? As stated before, if a student entered LW University in 2000, then that student would have 1623 other white students within science and math to seek assistance from. What difference or effect would adding another 108 black students make to his/her success? In short, they would have no reason to approach or try to

develop a relationship outside of other white students. There is not a need for them to ever feel uncomfortable in trying to form a relationship with black students because forming relationships with students that are not white would statistically have no bearing on their academic success.

Within a network and within the structure of a network, actors have power. That power is the result of the position that an actor holds within the network and that position is the result of having something others want or need. Actors obtain power when others are dependent on them for services that only a limited number of people can provide. Molm, Peterson, and Takahashi (1999) summarized Emerson analysis of the process in this manner:

Emerson (1972a) proposed that the mutual dependence of actors provides the structural basis for their power over each other. In an exchange relation between actors A and B, B's dependence on A increases with the value of benefits that A can provide for B and decreases with B's access to alternative sources of those benefits (e.g., alternative dating partners or alternative sources of expert advice). A's power over B derives from B's dependence on A and vice versa. Unequal dependencies produce an imbalance relation in which the less dependent actor has a structural power advantage (p. 877).

This model suggests that the more alternatives that a person has for obtaining the information they need the less dependent they are on any particular source. Within this study some black students chose to only associate with one another for various reasons. Some of those reasons include an inability to establish relationships with professors and other students due to class size, their own self- efficacy, and professors' and white students' negative disposition towards them. Regardless of the reasons, the decision made by students to not persist was partly guided by the fact that they did not have enough alternative sources to get information from.

Students at every level have an idea of who is "smart" within their classes. They are very observant in this manner because they judge how they are doing against who they consider

to be the brightest in the class. At times many students who are struggling and students that are seeking other students with similar intellectual capacities maneuver in such a way to try to establish friendships with those that are considered elite or equals. However, the friendship does not materialize unless the person in power sanctions it. The majority of the time, the friendship only happens if the person in power recognizes some benefit in forming the relationship. The person seeking the friendship has to have something that is of interest to the person in power, they have to have something to offer. That could be the exchange of knowledge or something else that is of interest. If that person who seeks the friendships has nothing to exchange, then that friendships will not materialize because the person in power has no need in forming a relationship since it is of no benefit to them. They recognize no value in it.

Secondary and collegiate teachers recognize who is and who is not comfortable with the material being taught. Students to a certain degree have that same type of instinct that allows them to discern who is struggling and who understands the material. Even if they do not have that instinct, after working or talking with someone for a while, they are able to tell whether or not they would benefit from forming a relationship.

In the case of the students that did not persist, their limited network suggests one of two rationales, or both, when it came to establishing relationships with professors and non-black peers. The first is that they were perceived by their peers and professors as having nothing to offer academically, therefore other students saw no need to form an academic alliance with them and professors saw no need in investing the time into them. The second is that these students viewed themselves as having nothing to offer academically to other students, so they were fearful of trying to establish relationships outside of their race because the risk of being viewed as dumb or unintelligent was too high.

Those same two rationales can be applied to those students that persisted as well with the major difference being that they fought and managed their feelings of inadequacy. In addition, despite a belief and perception that others doubted their academic ability, they established a network that ultimately allowed them to maneuver in such a way that allowed them to be successful within their majors. Simply put, once someone is convinced that they are not worthy, no achievement will take place because they mentally have brought into the notion that they are not worthy. The students that did not persist, in some way, allowed this to happen.

Why and how does this process take place? Why do more than 60% of the African American students that enter scientific majors fail or change majors? Some feel it is because many African American students are not committed to what it takes to be successful within a scientific major; they are lazy and want things handed to them on a platter. This may very well be the case for some African American students and this is why they fail or switch majors, but is it not that way for students of all races. To prejudge and assign the negative characteristic of lazy and non-committed to every African American student in the sciences is unjust as well as unfair and to consider those that do succeed anomalous, is so as well.

Lazy or unmotivated would describe some of the students that did not persist within their scientific major and those that were lazy readily admitted that this was the case for them. However, some did not display the characteristic of being lazy or laziness because many of them seemed to try hard until it became too much for them to bear. These students struggled more as a result of the environment that they were in rather than from laziness. Some of the negativity these students experienced in their environments was a product of them limiting their networks and not having faith in their own abilities. On the other hand, at times the environment and the people in it caused some students to view it as negative and, as a result, their perception of it affected them adversely.

Certain elements about an environment can cause African American students to have vibes that cause them to be distrustful of an environment and the people in it, so much so that it can keep them from seeking out the assistance they may need. This distrustfulness, compounded by the fact that some are not properly prepared for some courses along with many times being one of a few African Americans within their particular scientific major at a predominantly white university, can restrict them from participating in those networks that could be beneficial to them. Being unprepared can cause one to view their environment in a negative way, as was the case with some of the students within this study. This can be overcome within an environment that is supportive, encouraging, and caring, if the student is willing to work at their deficiencies. The problem is when the environment causes question within the student that triggers them to become distrustful of their surroundings and those in it.

Some students do not or cannot find it within themselves to take the actions that may be essential for them to survive within their majors because their environments are not conducive for this action to occur. Some feeling of safety must be felt before they could take a risk that could possibly make them look or feel stupid in the eyes of their professors and peers. For many African American students, a number of scientific environments at this institution were not supportive enough for them to take that risk and because of this many switched to other majors that provided this support.

Persistent Students

Figure two can also be used to describe the experiences of those students that persisted as well. The major difference between the two sets of students was that these students fought assertively against how they perceived society, white peers, and professors to think of them. They also fought assertively against how they at times perceived themselves. They fought aggressively against the process of translation, inscription, and irreversibility and as such they

were now anomalies on the collegiate level just as they were on the secondary level. They were anomalies on this level because they again would be performing and persisting in areas that were thought to be above their capabilities and, like in high school, they found themselves to be one of a few minority students that participated within these types of classes.

The students that persisted had networks that were more extensive than those students that did not persist and held positions within their networks that allowed them access to information they needed for survival. The participants were successful because they had various sources to get the information they needed. They did not limit themselves by only associating with other black students even though at times they wanted to but realized they needed assistance from professors and other students if they wanted to remain in their chosen majors. They essentially were not dependent on one particular group for assistance and this action resulted in no one group having complete power over them.

The more points or people a student interacts with or exchanges information with, the more likely he or she would be in a position where the knowledge needed for success would pass by them at some point. This means that person and knowledge would eventually intersect. The students that persisted were part of networks with weak ties. They were not just apart of one or two academic networks because doing so would have placed them in the predicament of the students that did not persist.

Students that persisted, for the most part, had wonderful experiences within their major where they felt welcomed, supported, and cared for as students. For them the negative images that are associated with being African American did not affect them within their major. These experiences were a direct result of the relationships they had with the professors in their majors. As shown in a study conducted by Brand, Glasson, & Green (2006) that involved high school students perception of their science teachers, a negative view of a teacher by a student can lead

to poor outcomes, and bad experiences by that student in the classes taught by that teacher.

Although this study takes place on the collegiate level, the same findings apply. These students had positive experiences and perceptions of their professors and that directly affected how they felt about the class, their ability to perform within classes, and over all experience within their overall major. The opposite occurred for the majority of the students that did not persist.

There were also students who persisted that did express concern with how they believed their professors and peers perceived them, but that did not stop them from seeking assistance. Some of the persistent students had no relationships with their professors but strong relationships with their peers and vice versa, and some had mediocre relationships with both. Regardless, the combination of relationships had by these students, along with going to tutoring centers and doing other activities, was enough to keep them persisting within their major.

Students that persisted felt as if they were given an equal opportunity to succeed within their major. They felt they were treated fairly by their professors and had little to no complaints when it came to experiencing racism. Several made reference to situations that they could have perceived as racist towards them but chose to give the other persons involved the benefit of the doubt because they could not say for sure whether they act was racist or not.

The students talked of professors being mean and distant towards them, but they believed that the professors were like that with all the students, regardless of color. Some reported not getting fair deals by the professors when it came to questionable situations, but then could rationalize how the professor could reach such a conclusion. Some talked about by not being encouraged by some professors but they again did not necessarily equate the behavior to being racist.

The students that persisted were so involved and focused on completing the task at hand that they did not recognize whether actions towards them were racist or not. The thought

lingered in the back of their minds but they tried their best not to succumb to those thoughts and feelings by reaching that conclusion. They wanted to believe they were playing on a level playing field and did not want use racist actions as an excuse for them to fail. Anything viewed as questionable or racist was used as a fuel for motivation to accomplish what they believe society thought they could not.

Those students who were persisting through their major noticed race and racial disparities within their departments. These things were easily recognizable because in many cases, they would be the only black student within their classes. As time passed, they noticed more and more of their friends would leave their intended majors. But regardless, they tried to not let their mind and their thoughts lead them in the direction of racism. Every once in a while they did encounter things that were suspect. Their senses were sharpened because at times they were the only black or one of a few black students within their department. In general when people find themselves in situation where they easily stand out, they tend to take notice of what is going on around them. It is human nature because they view themselves as being different.

These students wanted positive relationships with their professors and peers because when positive relationships are in place, students do not take defensive positions against their professors; instead, they view the professors as allies and not enemies. When a student has a negative perception of their professor more than likely no relationship will be formed and the opposite occurs. As a result, learning becomes much harder because the student's mind is not fully focused on the things that need to be done.

If a professor in a class had a negative disposition, then these students relied more on their other networks unless they did not have a choice but to approach the professor and sometimes that was the case. If their peers had a negative disposition towards them, then they either fought whatever internal feelings they were having about the peers in question and asked

for help anyhow. They also found peers that were not so negative, attended a tutoring center for help, or they went to the professor for assistance.

Within these students responses, a sense of fear was detectable with them because not knowing how they would be treated if they approached their professors or peers was a big concern for them. However, this fear was not enough to keep them away. The fear of looking dumb and the fear of adhering to the stereotypes of blacks students not being as smart as white students were also on the mind of these students. It did at times cause them to be hesitant in seeking out the assistance, but it did not stop them.

The existing literature documents that persistence plays an intricate and integral role in students' academic success in higher education (Moore, 2001; Scott, 1995; Tinto, 1975, 1982, 1988). Irrespective of obstructions or challenges, persistent students seem to be comprised of intrinsic distinctiveness that allows them to deal with and persist in academic environments that are considered unwelcoming, intimidating, and unaccommodating (Moore, 2000). Persistent students are just as affected by these environments as those students that do not persist, but the difference lies in the fact that they tend not let negative experiences, attitudes, and perceptions impede their academic performance (Moore, 2000b). Instead negative experiences, attitudes and perceptions fuel their desire to want to succeed at all cost.

Proving to society, to people, and to proving to themselves that they could handle the work was a major motivator for the students that persisted. They have struggled and are struggling within their majors but they are persisting. Some have experienced negative attitudes towards them, racial encounters, etc. but they found ways to overcome whatever difficulty they faced. Stereotypes, negative perceptions they have of people, and negative perception that people have of them, impacted them just as it did the students who did not persist; however, these students were situated within the system in a way that they were able to move on. They

were not to be denied their goal because they found ways to overcome the obstacles that they faced.

Chapter Eight: Conclusions

Implications

The purpose of this study was to examine factors influencing African American students' participation in scientific fields in lieu of the historical and political misuse of science and its modern misconceptions. The study found three major factors contributing to African American persistence and non-persistence as they participated in scientific majors at a predominantly White university.

The persistence of students had more to do with open and closed networks they participated in rather than their intellect.

As previously noted, those students that persisted academically had slightly lower scholastic aptitude test scores than those students that did not persist, so if academic intellect is judged on that criteria alone then many of those students that did not persist should have theoretically made it through their respective programs, but this was not the case. The students that persisted had networks that were open in nature, meaning they did not limit themselves to obtaining information from just one source. Many had networks that involved professors, peers of all races, tutoring centers, athletic teams, and graduate students, etc. Participating in these various networks provided these students with the necessary academic support they needed in order to sustain themselves in their majors. Each student that persisted did not have all the above networks but they had enough to sustain them at the time this research was conducted.

Those students that did not persist kept to themselves or only associated with other African American students. They participated within networks that were closed in nature and this type of network could not sustain them within their academic major. These students as a whole could be described as having no relationships with professors or non-black peers. This limited network and not their intellect is what truly led to their non-persistence in their major

because they were just as smart (at least in terms of high school grade point average and scholastic aptitude test scores) as those students that did persist within their major.

The student development of networks aligned with their ability to overcome the negative images associated with them in science

The negative stereotypes that are associated with African Americans are a direct result of the misuse of science. Those negative characteristics, in some form or fashion, affects or have affected every African American in this country. That image is something that goes along with being black and some African Americans handle those negative characteristics better than others. Some are able to go about their day-to-day business giving little regard to what others think of them, while others seemed to be more inhibited by the characteristics that are said to define them; but regardless, both are affected

Students within this study fell into both categories because both sets of students were affected by how they perceived society to think of them. However, those students that did persist fought those negative images by finding the assistance they needed regardless of what was thought of them. As noted in previous chapters, this process proved to be very difficult for some because they felt that their white professors and peers tended to think less of them as African American students. Regardless of that they swallowed their pride and got the assistance they needed.

Several of the students that persisted participated within environments that were very supportive, so overcoming negative stereotypes associated with African Americans was not a problem. Forming networks with professors and all types of students did not pose a problem for students in this type of environment because everyone appeared to everyone else to be successful. Other students that persisted just had the need to prove that society's definition of African Americans within the field of science was wrong so they did whatever it took to reach

their goal. They looked at their networks as business relationships that provided them with the information they needed in order to get the desired outcome on a particular task.

Those students that did not persist did not have the ability to overcome the negative images that were associated with being black. Their blackness appeared to make them fear and withdraw from their environment. They were intimidated by their large class sizes and by some of the negative demeanors they perceived their professors and other students to have towards them. They needed some positive reinforcement if they were to form the networks they needed for success. Some tried to develop networks with their professors but were made to feel dumb when doing so. Some felt so isolated and afraid within their major that they just did not know how to ask for help from professors or peers because the environment from their perspective did not appear to be one that was caring and supportive.

Students development of closed networks were a means of protection

Students that did not persist could not overcome negative images associated with African Americans because they were afraid that they would give credence to those stereotypes that they felt their professors, peers, and society in general held of them. For this reason they chose to participate in a closed network that involved themselves and other black students because in that circle no one would attribute not knowing something to the color of their skin. If they did not know something, they just did not know. Being black and not knowing had no relationship, it was just “not knowing”.

For these students, to seek help meant that they had to divulge that they did not know something or that they needed help. At times many students expressed not knowing anything that was going on within the classes they were taking. They described it as the professors talking over their heads; this implied they had little understanding of what the professor was talking about. To go to a white professor or peer with little understanding would have in their minds

validated the notion that African Americans did not belong in scientific majors. They were not willing to take that chance because the demeanor of those within the environment signaled to them that this could be the possible outcome if they were to approach professors for help. As a result, they only associated with other black students as a form of protection for themselves and their race.

Some students that persisted had the same concerns as those students that did not persist and at times they too chose to work alone or ask their black students for help. However, ultimately they found the help they needed regardless of where it came from because they wanted to graduate within the major they had chosen. As stated earlier, at times they also felt intimidated about approaching others for help but realized that failing or switching out of their major would validate the stereotype of African Americans not being intellectual enough to do science.

Many people may find it hard to believe or understand that the perception of others can help or inhibit the success of people. Actually it is not the perception as much as it is a person's internalization of the perception that really inhibits or helps a person. If one comes from a group that is said to have positive characteristics then they may not understand how negative perceptions may affect one's actions. What if there was a way to test how negative perceptions would affect people that had always had been associated with positive perceptions.

Aronson, Lustina, Good, and Keough (1999) found two sets of white men with strong mathematics skills. They suggested to one group of white men that Asians were better than whites at math before they gave them the test and told the other group of white men nothing. They found that the group of White men that had been given the information about Asians before hand scored significantly lower than the group of White men that had been told nothing. This was one test that showed how negative perceptions affected performance. These men may

have lived with the perception of Asians being better for one day, but African Americans have been living with being perceived as less for generations.

The students that did not persist at the time this research was done found other majors that better supported them in the efforts to obtain an undergraduate degree. Eight of the thirteen students that initially chose a scientific major switched to majors that are described as the soft sciences and the remaining five switched to other scientific majors. I described these students as non-persistent students within this study because they did not continue with the major that they originally intended. However, they are persistent in the fact that they did not give up; they are just finding alternate routes to get to the places that they want to go in life. However, it is sad to know that they perceived their environments and the persons within these environments as places where they could not let their guard down to find the assistance they so desperately needed.

Those students that persisted deserve recognition for being able to withstand all the negative characteristics that society has assigned to them. They are indeed proving their doubters wrong. The problem is how long will they have to prove them wrong? It is doubtful that the negative characteristics that are assigned to African American people will cease when they obtain their degrees. In general, African Americans (educated or not) will continue to face challenges in regards to the color of their skin because they can never escape the reality in which they live; that reality, whether perceived or real, relate to African Americans that their treatment is an indication that they are not valued within this society. Going through life in this manner causes emotional conditions that potentially are damaging to a person's health, spirit, and sanity. Will the time ever come when a black person's failures will not be assigned to the entire group and their successes counted as anomalies?

Recommendations

The findings of this research have the potential to provide the faculty and administration

at LW University and other institutions with valuable information that can assist them in their efforts to retain and obtain more African American Students within scientific majors. The findings of this research also have the potential to provide African American students currently within scientific majors, valuable information that can help them have better experiences within these majors.

This research was about African American students and their experiences within their scientific majors. The participants told their stories from their point of view and from their experiences within their major. These students, more than anyone, would know what challenges they face or have faced within their majors. They would also have recommendations on what could be done to provide them with better experiences. Within each interview conducted, I asked each participant for their recommendations on how to improve African American retention within scientific majors. The following list is a combination of the participants' thoughts and the researcher's thoughts intertwined on possible ways to help with the retention of black students in scientific majors. These ideas should also provide better experiences for the students as well.

- 1) The need for summer transition programs geared towards minority students who want to major in scientific fields. Grant early admission to those students who want to come to LW University their junior year and have them come over the summer and take specially designed courses in their area of interest so that they can gain a better knowledge base of what will be required. Have the process continue in a transition program after high school to further increase their knowledge base. Also, have information sessions about majors so that the student can make an informed decision about what major to choose. Most students have no idea about majors such as Food Science, or Human Nutrition, Geology, etc. They just think of the core majors such as chemistry, biology, math, etc.

- 2) Each student's transcript should be reviewed to make sure that the level of classes taken corresponds to the knowledge that is required to go into a particular major. If the student needs some additional type of courses, then a course of action should be recommended to the student so that he/she can take the proper action to acquire those skills.
- 3) African American students come in expecting racism, or at least it is in their minds, because they are on predominantly white campus with predominantly white majors. Knowing this, professors should make an extra effort to welcome the students to the major and assure them that they will be treated fairly and supported in their efforts. The professors should have a caring demeanor and a concern about the students' well being as well as let them know that they can come to them if they need assistance. A supportive environment should be created. To accomplish this, the university should provide and the faculty should be required to take workshops on projecting positive demeanors because students learn from the non-verbal things professors do as well.
- 4) The student should have a moderate course load their first semester so that they can become accustomed to what will be required of them as well as reduce the number of students within each class. Students feel overloaded their first semester and began that downward spiral of not doing well in their classes and that is partly due to the stress of working in a new environment.
- 5) Have information sessions on how to make it through the major as well as events that students can fellowship with one another so that they will not feel so isolated. This will provide them the opportunity to develop networks with their peers who are not African American.
- 6) There is a need for more African American faculty within the scientific majors.

Sometimes African American students feel they need someone they can talk to about problems they have and feel. Many feel that African American professors can relate better to their situation having been through the process themselves. With an African American professor, they feel they can let their guard down and possibly received the type of counseling or advice they need. The students make the assumption that because the professor is black they will care more about them as students and that makes it easier for them to approach them for help without the concern of adhering to some stereotype. That may or may not be the case depending on the personality of the professor. What the students are truly looking for is that ethic of caring discussed in recommendation number three, and any professor can provide that if they are interested in the students no matter their race. However, increasing the number of black faculty and diversity within scientific departments in general can possibly indicate that the university is serious about diversity issues. Adding more black faculty, and in some departments just adding black faculty, in these areas would at least give the students options if they feel they can not approach white professors.

- 7) Develop a tutoring center that specifically targets African American students. In a place designated for black students, the students will be more comfortable in seeking assistance because the people will not judge their not knowing as a product of being black. This would be a place where they can let their guard down, exposed their weaknesses, and get the proper help needed in order to be successful.
- 8) Programs should not be allowed to accept an excessive amount of students within their programs and then try to weed them out. The maximum amount of support should be given to all students so that all have the opportunity to be successful, especially in those courses that are known to be the weed out courses. Students

change their minds about what they want to major in and for that reason programs may accept 20% over the amount of students that faculty can handle.

- 9) If the faculty and university does everything in it's power to help the black students already here graduate, then more African American students would want to come because they will see that the university is serious and committed to supporting African American students within those majors that are considered to be difficult for African Americans to make it through.
- 10) Assign academic mentors to each student when they enter the university. These mentors would be junior to senior level high achieving students who do not mind assisting entering African American students with academic problems that may arise during their freshman and possibly sophomore year of study within their major.

The recommendations above are possible ways to help increase the retention of African American students within scientific majors. The recommendations are what these students feel would provide other African American students with positive experiences and the support needed to be successful within those majors. Many of the suggestions given can be used in helping all students, regardless of their color, be successful in their majors.

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Appendix A

Factors that Cause African Americans at Predominantly White Universities to leave Scientific Majors

Purpose

This research focuses why African Americans at this university leave their scientific major. This study focuses only on African Americans because the data gathered from the office of Institutional Research and Planning Analysis indicates that only about forty percent of those who initially major in a scientific field actually complete their program. This signifies a need to study why and what is causing this to happen leading the study to focus on such concerns as: What were and are the experiences and feelings of African Americans that are majoring or have majored in a scientific field at this university? What was their support system like? What could have been done in their opinion for them to remain within their scientific major? Mainly, what difficulties did they face while majoring in science at this university?

Procedure

African American students in the natural sciences and engineering from this institution will be interviewed for this research. Participants will be recruited from the population of African American students in their second or third year of study in a scientific field and those who have left their scientific major in addition to those students that have a scientific degree from this institution.

A list serve that consists mostly of black students by the name of Event Haps will contact the first two groups of this study. Many African American undergraduate and some graduate students on this campus receive emails of events and other issues pertaining to them as Black students. I plan to solicit participants for my study using this venue by sending out an email that

explains my study. In addition, once the interview process has begun, I will ask each participant of other African Americans that may potentially be interviewed for this study. Also I will ask each participant the names of African Americans from this institution that they know are degreed within a scientific field. In addition, I will contact various African American organizations on campus such as fraternities, sororities, etc. for information that may lead to potential participants. Upon obtaining this information I will try to find contact information for these persons from offices on campus, personal contacts, or as a last resort, the Internet.

At least forty students will be interviewed for this study and it is anticipated that each interview will last about one hour, but may be longer or shorter depending of the depth of responses given. The interviews will be done in a place convenient for the participant and the interview will be audio/video taped and transcribed for the purpose of the study.

The interview will focus on how these African American students negotiated their participation within these majors and how the structure of their programs led to their successes or failures within their major. We will explore the different networks these students participated in while majoring within these fields in hopes to gain a better understanding of what can be done by this institution, and other African Americans entering this university majoring in these scientific fields, to ensure a better experience and a better chance of retention.

Benefits and Risks

There are no benefits for participating in this project and there is no more than minimal risk involved. At the time of the interview, the participants may feel discomfort in answering some of the questions (e.g. questions concerning changing programs). Every effort will be made to make the participants as comfortable as possible.

Extent of Anonymity

The results of this study will be used for the completion of the doctoral requirements in Science Education. The results may be published but the information provided would have pseudonyms used instead of the real name of the participants, however the participant may be recognizable by the videotaped interviews that may be used when presenting the findings of this research. Upon completion, the results of this research will be shared with those persons having a direct relationship (dissertation committee members, professors, etc) with the study, as well at various conferences if accepted. Before any video clips of the participants are used within a presentation, a second consent form containing their signature granting me the authority to use it will be provided to them. If the participants feel the information contained within the presentation will be detrimental to them in anyway, then they will have the right not to give me their permission to use the selected video clips.

Appendix B

Virginia Polytechnic Institute and State University

Participant Consent Form

Title of Project:

Factors that Cause African Americans Majoring in Scientific Fields at a Predominantly White University to Change their Academic Major

Investigators:

Andre' M. Green & George Glasson
Department of Teaching and Learning

Purpose:

The purpose of this study is to explore the possible reasons of why African Americans at Virginia Tech decide to leave their scientific majors.

Procedures:

The study involves you participating in an interview that will be focused on your experiences within your scientific major at a predominantly White university. The responses given will be confidential and you reserve the right not to answer any question that you choose. The average time of the interview will be around one hour but may be longer or shorter depending on the length of the answers given. The interview will be recorded by audiotape and by video. An example of questions that will be asked is as follows: As an African American what were the most challenging aspects of majoring in science or engineering at a predominantly White university?

Benefits and Risks:

There are no benefits for participating in this project and there is no more than minimal risk involved. At the time of the interview, you may feel discomfort in answering some of the questions (e.g. questions concerning changing programs). Every effort will be made to make you as comfortable as possible.

Extent of Anonymity:

The results of this study will be discussed by those persons having a direct relationship (dissertation committee members) with the project, used in a dissertation, and will be presented at various educational conferences if accepted. The results may also be published but the information provided would have pseudonyms used instead of your real name, however you may be recognizable by video taped clips that may be used when presenting the findings of this research. Before any video clips of you are used within a presentation, a secondary consent form containing your signature granting me the authority to use it will be provided to you. If you feel the information contained within the presentation will be detrimental to you in anyway, then you have the right not to give me your permission to use the selected video clips.

Freedom to Withdraw:

At anytime during the interview process you have the right to withdraw from the study. If such a decision is made, you should contact Andre’ Green at (angreen2@vt.edu), Dr. George E. Glasson at (glassong@vt.edu), or the chair of the IRB David Moore at (moored@vt.edu).

Participant’s Signature Date

Researcher’s Signature Date

Appendix C

Interview Questions

Background

- 1) How well did you do in High school and on your college admission exams?
- 2) What science classes did you take in High school?
- 3) What were your experiences in them? With Teachers other students?
- 4) Describe the support system you had in high school.
- 5) How did this influence your performance/participation?
- 6) What was/is your major?
- 7) How did you decide on this major?

Networks with your major

- 1) Describe the support system you had/have within your major.
- 2) Describe the relationships you formed with your peers within your major.
- 3) What impact did these relationships have on you?
- 4) Describe the relationships you formed with your professors within your major?
- 5) What impact did these relationships have on you?
- 6) Describe a typical week within your major? How did you spend your time?
- 7) What factors governed or influenced the way in which your time was spent?

Networks outside the major

- 1) Describe the support system you had outside of your major?
- 2) What were they and what role did they play in your life?

Structure of the program

- 1) Describe the structure of your program, meaning how was it organized and run?
- 2) What was required of the students? What was expected?
- 3) Did you feel prepared when entering your program? Why or why not?
- 4) Did the structure of the program encourage group interaction? Explain
- 5) Describe the overall environment within your major and how did it influence your participation/ performance?
- 6) Did you experience any behaviors in your chosen major that you consider/considered racist in nature? Explain.
- 7) What impact if any did it have on you?

Additional Questions

- 1) Do you feel being African American helped, hindered, or had no effect on your successes of failures in that major? Explain
- 2) Why did you choose to leave the major?

- 3) What factors ultimately led to your decision to leave the major?
- 4) In your opinion what could be changed about the structure of the program, or the environment to elicit better experiences and retention of African Americans?
- 5) How did you think of yourself before attending this school? Give me some words that described you? Explain
- 6) Did those words apply to you while you were majoring in science or engineering? If not what words did apply? Explain
- 7) How do you think of yourself now? Give some words that describe you.

Appendix D

Email Address To Students

Fellow Students:

My name is Andre' M. Green and I am a doctoral student in Science Education. I am doing a research project on why African Americans leave scientific majors here at Virginia Tech. For this reason I am looking for African American students that are at least into their second year of study within a scientific program (Chemistry, physics, engineering, biology, etc.). I am specifically looking for those students who changed their major from one of a scientific focus to one that is non-scientifically based, or to a scientific field which is believed to be easier.

There is a need for this research because nationally as well as at this university, half to around two thirds of African Americans who enter scientific fields either switch majors or fail altogether. If you are interested in sharing your story please contact me at angreen2@vt.edu. Below you will find a description of the research study and I thank you in advance for your cooperation.

Purpose

This research focuses on why African Americans at Virginia Tech leave scientific majors. Data gathered by the office of Institutional Research and Planning Analysis indicates that only about forty percent of those African Americans who initially major in a scientific field actually complete their program. This signifies a need to study why and what is causing this phenomena leading the study to focus on such concerns as: What are the experiences and feelings of African Americans in scientific fields at this university? What are their support systems like? What difficulties do African Americans face while majoring in a scientific field at this university?

Appendix E

Academic Background of Non-Persistent Students

Student	Type of High School	Science and Math Classes taken	High School GPA	SAT Scores
Jo-Lisa (NP)	Predominantly White, 95% White, 5% Black	Up to physics, Up to Calculus	3.4	940
Sophia (NP)	Predominantly White 1.6% Black	AP physics, AP Biology. AP Chemistry, Advanced pre-calculus	3.85	980
Bell (NP)	Mixture of students	Biology, Chemistry, Physiology, Physics, up to Pre-calculus		1090
Lula (NP)	Predominantly White	Up to physics, up to calculus		1080
Jones (NP)	50/50 White to Black	Up to physics, Up to trigonometry and geometry	3.913	1080
Dianne (NP)	Predominantly White	Up to physics, human anatomy, physiology, Up to calculus	3.3	<1000
Millicent (NP)	Moved around a lot. Last high school was Predominantly White, 98%	Chemistry, biotechnology, up trigonometry	3.6	1000
Elizabeth (NP)	Predominantly Black 75% Black, 20% White, 5% other	College biology, Statistics, Up to calculus		1100
Jonathan (NP)	Predominantly Black, 5% White	Up to advanced chemistry, up to advanced calculus	3.6	1170
Denzel (NP)	Predominantly White	Up to physics and advanced chemistry, up to AP calculus	3.7	1080
Beamer (NP)	Predominantly White, 95% White, 5% Black	Up to physics, up to Calculus II	3.85	1280
Tony (NP)	Predominantly White	AP Biology, Earth science, AP Earth science, Chemistry, Up to Calculus	3.8	1100
Nails (NP)	Predominantly White, 60/40	Up to AP physics, up to AP calculus	3.5	1170
Average			3.65	1082

Appendix F

Academic Background of Persistent Students

Student	Type of High School	Science and Math Classes taken	High School GPA	SAT Scores
Earl (P)	Predominantly White	Up to honor physics, Started in AP Calculus but stooped	3.2	1050
Maya Angelou (P)	At the Governors school Predominantly White, one of two blacks in her class, in regular school a mixture	AP Environmental Science, AP Chemistry, AP Physics, Up to Calculus	3.64	1210
Scoop (P)	Predominantly Black. An alternative high school	AP Biology, AP Chemistry, AP Physics	4.23	1100
Michael Jordon (P)	Predominantly White	Up to advanced biology, advanced level math courses	High GPA	1080
Lisa Brown (P)		Chemistry, college prep biology, everything else was general	3.4	820
Johnny Bravo (P)	Predominantly White	AP Physics, AP chemistry, up to AP Calculus	3.6	1110
Sade (P)	Predominantly White technical school that had majors. Had a mixture of students	Up to physics, Up to AP Calculus		1210
Kanye West (P)	Predominantly Black	Up to chemistry, Up to calculus III and Differential equations	3.9	1200
Crystal (P)	Predominantly White	Up to physics, Up to Calculus		1000
Jean (P)		Up to physics, Up to geometry and trigonometry		1000
Richard (P)	50/50 mixture, but classes mostly White	Up to physics, Up to calculus	3.3	1000
Average			3.61	1071

Appendix G

Choice of Academic Major

Name of Participant Non- Persistent (NP)	Major Chosen	Name of Participant Persistent (P)	Major Chosen
Jo-Lisa (NP)	Computer science	Earl (P)	Computer science
Sophia (NP)	Mathematics	Maya Angelou (P)	Biochemistry
Bell (NP)	Math	Scoop (P)	Bio-chemistry
Lula (NP)	Biology	Michael Jordon (P)	Biology
Jones (NP)	Biology	Lisa Brown (P)	Initially University Studies then Food Science and Technology
Dianne (NP)	Biology	Johnny Bravo (P)	Mechanical Engineering
Millicent (NP)	Biology	Sade (P)	Industrial Systems Engineering
Elizabeth (NP)	Chemistry	Kanye West (P)	Electrical Engineering
Jonathan (NP)	Chemical Engineering	Crystal (P)	Engineering
Denzel (NP)	General Engineering	Jean (P)	Industrial systems Engineering
Beamer (NP)	Engineering	Richard (P)	Engineering
Tony (NP)	Engineering		
Nails (NP)	Engineering		

Appendix H

Comparison of Student Networks

Student (NP)	Network	Student (P)	Network
Jo-Lisa	<ul style="list-style-type: none"> - Peers (all Black, limited) - Women's computing Association (study groups) - Church - Family (in the area) - Boyfriend - Job 	Earl	<ul style="list-style-type: none"> -Professors (Office hours) - Peers (Black students that were older and White peers) -Advisor -African American Brotherhood -Black Student Alliance -Student Government Association -Joint Committee on Diversity and Multicultural Affairs - Center for Academic Excellence (CAEE) Tutoring
Sophia	<ul style="list-style-type: none"> - Emerging Scholars program - Math Club - Advisor - Peers (Limited) - Residence Hall Federation 	Maya Angelou	<ul style="list-style-type: none"> - Professors (Office hours) - Undergraduate Research - Research mentor - Advisor - Peers - Impact (Religious Organization for African Americans) - Omega Delta Gamma (Multicultural Religious Organization) - Religion - Family
Bell	<ul style="list-style-type: none"> - Professors (Limited contact) - Peers (on occasion) - Track (athletic support for academics) 	Scoop	<ul style="list-style-type: none"> - Professors (Office hours) - Undergraduate research - Research mentor - African American Graduate students - Other Graduate (Students that worked in the lab) - Three different multicultural minority programs - MAOP - Mid-eastern alliance for minority participation - CAEE Tutoring
Lula	<ul style="list-style-type: none"> - Peers (only Black, limited) - Black mentor - Family 	Michael Jordan	<ul style="list-style-type: none"> - Peers - Religion - Family - Subway

Appendix H Continued

Student (NP)	Network	Student (P)	Network
Jones	<ul style="list-style-type: none"> - Professors (Mediocre relationships) - Peers (Limited) 	Lisa Brown	<ul style="list-style-type: none"> -Professors (Office hours) - Other students - Advisor - Graduate students - Undergraduate Research - Research mentor - Works for Food Micro-biology lab classes - Food Science Club - Her puppy
Dianne	<ul style="list-style-type: none"> - Professors (Office hours) - Peers (limited) - Mid-eastern Alliance for Minority Participation (undergraduate research, did not like it) - Gospel Choir - Impact (religious organization) 	Johnny Bravo	<ul style="list-style-type: none"> -African American Graduate Students -ASPIRE Engineering Program -Professors (Office hours) - Peers - Tutoring Center (Hancock Hall) - African American Brotherhood
Millicent	<ul style="list-style-type: none"> - Summer Transition Program - Boyfriend 	Sade	<ul style="list-style-type: none"> -Professors (Office hours) - Peers - Family/ Friends - Advisor - Tutoring Center - NSBE
Elizabeth	<ul style="list-style-type: none"> - Professors (review sessions) - Peers (Limited) - CAEE Tutoring (did not like it) 	Kanye West	<ul style="list-style-type: none"> - Athletic department (Personal tutors if needed) - Mandatory Study hall for athletics - Professor (Office hours) - Peers - NSBE - Tutoring center (Hancock Hall) - Kappa Alpha Psi (Fraternity) - Summer Internships in Engineering

Appendix H Continued

Student (NP)	Network	Student (P)	Network
Jonathan	<ul style="list-style-type: none"> - Kappa Alpha Psi (Fraternity) - Peers (only project groups, limited) - ASPIRE 	Crystal	<ul style="list-style-type: none"> -Tutoring center (Hancock Hall) - Peers -National Society of Black Engineers - ASPIRE (engineering program) -CAEE Tutoring - Engineering Internships - Director of Engineering Tutoring Center
Denzel	<ul style="list-style-type: none"> -Professors (bad to mediocre relationships) - Peers (Limited) - Tutoring (seldom) - Church - Friends 	Jean	<ul style="list-style-type: none"> - Professors (Office hours) -Peers - CAEE services (Tutoring center, Test taking skills, time management skills, etc) - Undergraduate research - Research mentor - Work-study - Advisor
Beamer	<ul style="list-style-type: none"> - Football team (athletic support for academics) - Professors (seldom) 	Richard	<ul style="list-style-type: none"> - Professors (Office hours) - African American - Graduate Student mentor - BEST Teams (Black Engineering Student Teams) - Tutoring (Hancock Hall) - Marching Virginians (band had other engineering students) - Church/Religion - Friends
Tony	<ul style="list-style-type: none"> - Tutoring - Professors (office hours) - Advisor (thought he should switch) 		
Nails	<ul style="list-style-type: none"> - Peers (only Black) - African Student Alliance - Hancock Hall tutoring (seldom) 		

Appendix I

Themes Developed From Interviews

Academic Background (High school)

Type of High school and racial makeup

GPA/SAT/ACT scores

Science and math Classes taken

Experiences with Teachers and impact on performance

Experiences with peers and impact on performance

Support systems

Choice of Major

Major

Reason for choice

Experience Within Major and Outside of Major

Relationships with professor and impact on performance

Relationship with peers and impact on performance

Support systems within major and impact on performance

Support system outside of major and impact and impact on performance

Time Management

Typical week within major

Governance of time

Structure of Program

Program's Structure

Expectations of program

Appendix I Continued

Feelings of Preparedness for Major and Environment

Academic ability after high school and impact

Weeding out/Classes

Overall Environment

Race

Experiences with racism and impact

Race as a help or hindrance

Affirmative Action

Reasons for Leaving of Staying in Major

Changing major

Factors influencing decision

Persisting in major

Factors influencing decision

Change to affect retention

Self-Efficacy

Feeling about self before entering major and VT

Feeling about self while in major

Feeling after leaving or persisting with major

Difference Between New and Old Major

New major and why

Support systems after switch

General Feelings