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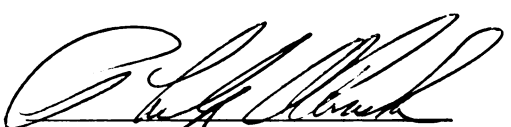

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A QUANTITATIVE STUDY OF GIFTED MINORITY STUDENTS' PROGRESSION IN THE PHYSICAL SCIENCES AND MATHEMATICS AT A LARGE RESEARCH UNIVERSITY

By

Dorothy Ann Stallworth Reed

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ABSTRACT

A QUANTITATIVE STUDY OF GIFTED MINORITY STUDENTS' PROGRESSION IN THE PHYSICAL SCIENCES AND MATHEMATICS AT A LARGE RESEARH UNIVERSITY

By

Dorothy Ann Stallworth Reed

The changing demographics of the United States will demand that more ethnic minorities be used in the science, medical, and engineering workforce. In order for ethnic minorities to gain access to these careers, they must first receive a degree in the sciences. Making it through an institution of higher learning has proven problematic for most ethnic minority students. Oftentimes, the higher the educational level, the fewer the number of ethnic minorities present. Many minority students find, that when they arrive at the university, they have less exposure to high order mathematics and science activities than their White peers do (Campbell, Wahl, Slayer, Moeller, Harouna, & Light, 1998).

The study reported in this dissertation examines the progress of students who have participated in a science enrichment program early in their academic careers at the university campus, the Charles Drew Science Enrichment Program at Michigan State University. The program was created in an effort to provide ethnic minority students the opportunity to perform successfully in the core science and math courses, and increase the number of ethnic minority students who complete degrees in the biological sciences, physical sciences, and mathematics.

Using data from ethnic minority students who entered fall of 1993 to fall of 1998, and participated in the Charles Drew Science Enrichment Program at Michigan State University, this quantitative longitudinal study examined the impact of a student assistance and academic support program that provides ethnic minority students the opportunity to perform successfully in core science and mathematics courses. A random sample of ethnic minority students who entered the college of natural science, but who did not participate in the program served as a control group. A random sample of White students with a major in the natural science, during the same time periods, was drawn as the second control group.

Data indicated that the controlled groups did not perform as well as the students who participated in the Charles Drew Science Enrichment program. The current study analyzed the relationships between degrees granted in the sciences; the relationship between first semester grade point average versus predicted grade point average; the relationship of grades in chemistry, math, and biology; to students' participation in the program. The study examined the percentage of science degrees earned, the graduation rate, as well as the final grade point average upon graduation.

Statistical analysis of the data indicated that the program played an important role in the matriculation of students in science and mathematics majors. The program enabled a higher percentage of students to receive a degree in the sciences and graduate with a high grade point average.

To my parents Lonnie (LJ) and Nettie Stallworth who sacrificed so much that my eight sisters and I might have the opportunities that we may have otherwise been denied.

To my eight sisters, Cynthia, Gloria, Janet, Brenda, Patricia, Lesia, Tracy and Jacqueline, the wind beneath my wings.

To my husband Willie, my rock, and my daughter, Kimberly, and my son, Brandon, who are my sources of inspiration, whose love, patience and understanding made it possible.

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For the support that I have received over the years in my effort to complete this degree I would like to thank Dr. Willie M. Reed for his patience and financial support. I would like to thank Charles Roberts and Sharon Griffin who worked as directors of the Drew Mathematics Program; to Marcia Ewers, the Biology Program director; David Flores, assistant to the director; Patte Wolf, the Program Secretary; the chemistry department and the college of natural science dean's office. Your encouragement and support made a big difference.

Finally, I would like to thank all the students who participated in the Drew Program over the six-year period, the Drew Crew. This dissertation was completed as a tribute to the great students you all were. Your contributions will enable educators to further the prospects for quality education in mathematic and

science for minority students at large research universities, and to increase the numbers of ethnic minorities who participate in the science and technology workforce.

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Chapter 1

Introduction

The Problem

A current issue in higher education is the under representation of ethnic minority students studying the physical sciences and mathematics in undergraduate and graduate institutions in the United States (Matthews, 1990). African Americans, Hispanics and American Indians are underrepresented, as a proportion of the national population, because of lower high school graduation and lower college attendance rates. This disparity is further amplified by the fact that minority students complete their degrees at rates lower than White students (Smith 1995).

There is a lack of minority students in advanced mathematics classes in the nation's high schools. On average, African Americans students make up ten to thirty percent of the enrollment in U.S. high schools, but seldom is there more than one African American student enrolled in the typical advanced mathematics course (Rowser and Koontz, 1995). At the pre-college level, data have suggested that minorities take fewer years of science and mathematics coursework, including advanced studies, than White students (Matthews, 1990). Tate (1995) reported that African American students were more likely to be tracked into remedial mathematics classes than White students. In addition, the number of minority students in a high school increased, the proportion of college preparation mathematics sections decreased (Tate, 1995).

Seymour and Hewitt (1994) suggested that a large portion of minority

students on predominately White campuses came from minority communities where they were outstanding students. Often they were valedictorians of their graduating classes. They found that students who excelled in substandard or even average high schools faced an uphill battle in the competitive environment of a research university (Seymour and Hewitt, 1994). These students and their parents soon discovered that they had over estimated their academic ability based on their limited academic background in more extensive math and science courses compared to the preparation of students who attended predominately White high schools (Seymour and Hewitt, 1994). Minority students, often overconfident in their academic ability, were at a loss to comprehend why they were not succeeding at the university (Seymour and Hewitt, 1994).

Minority students who enter college frequently have disparities in their preparation level for academic work. Matthews (1990) attributes this to a deficient exposure to and interaction with people who intended or planned to attend college and because of this they lacked the understanding of the value of a college degree (Matthews, 1990). Carmichael and Sevenair (1991) from Xavier University (the nation's top producer of minorities in mainstream health-professional schools) felt that the answer to increasing the number of minorities in the sciences was to strengthen the pipeline, "To begin to identify promising students as early as junior high school, and provide various means of support until they gain entry into health-professional schools" (Carmichael and Sevenair, 1991, p.55). Poor preparation in science and mathematics limited the appeal of and access to science for ethnic minorities who elected to study the sciences

at the university level.

Ethnic minority students become socialized through their families and educational system about what to value. This can produce various behavioral outcomes. Those who entered the sciences found it necessary to change their values. These included the obligation to serve the community, to act as a role model, the conflict between the student and family role, the educational goals defined by the parents, encouragement to be self assertive and autonomous (Seymour and Hewitt, 1994)). Those who were unable to discard particular values abandoned the idea of a science major. Everyone acquires a social identity that defines who they are and how they relate to other people. An internalized negative stereotype can cause students to seriously doubt their ability to succeed academically (Ford and Harris, 1996). When there were few numbers of ethnic minority students on a campus, they were culturally isolated and hard pressed to form a peer group. Isolation for minority students studying the sciences caused them to change their majors and heighten their perception of isolation (Fries-Britt, 1998).

Minority students in the sciences have found few, if any, campus wide minority programs that were effective in serving science, math, and engineering majors, or any type of academic assistance at the department level. The need for assistance was evident among minority students. Every minority student who stayed in a science major reported receiving some type of program assistance that was critical to his or her persistence (Seymour and Hewitt, 1994).

Gifted minority students faced issues such as social-emotional

adjustment, self-concept and acceptance by their peers (Fries-Britt, 1995). The literature has suggested that issues of race and culture are factors to be considered in the experience of minorities who achieve academically. Ford (1996) suggested that it may be difficult for minority students to integrate their giftedness because of perceived conflict of having a minority status and high academic achievement, which were associated with the majority culture (Ford, 1996). A balance of racial identity and cultural pride were essential for all gifted students. High ability minority students benefited when they established successful connections with other minority students who excel academically (Fries-Britt, 1998).

Ford (1994) reported that gifted minority students' academic success and retention were influenced more by the "person- environment transaction" and related socio-cultural influences than by intellectual and academic factors. These factors, such as positive self-concept, an understanding of racism, and the existence of support systems were better predictors of minority students' retention than academic ability (Ford, Webb, & Sandidge, 1994). Other researchers have noted that non-intellectual, psychosocial, and contextual factors, such as low test scores and grades, low parental educational level, living in a single parent household, low socioeconomic status, English as a second language and racial minority status are predictors of negative educational outcomes for minority students (Ford et al., 1994; Fries-Britt, 1998; Tate, 1995)

Seymour and Hewitt (1994) found that minority students left the university or changed their science majors when they experienced one or more of the

following difficulties: differences in cultural values and socialization from their white counterparts, internalization of negative stereotypes held about them by their professors and classmates, isolation from their family and friends and perception of racism toward them, and inadequate minority support systems (Seymour and Hewitt, 1994). Grades were also found to affect the student's decision to change from a science or mathematics major. Often times, gifted minority students received a shock to the ego when their grades in the gateway courses were lower than those that they received in high school (Seymour and Hewitt, 1994).

Carmichael and Sevenair (1991) reported that the Educational Testing Service found that only twenty-four percent of "high ability" African Americans (defined as the top two percent of ACT or SAT) scorers who entered four year colleges completed a degree program and gained entry into any graduate or professional school. The fact remains that minorities were entering colleges and universities in increasing numbers and that the retention of these students presented a significant challenge to higher education and society at large. The National Science Foundation reported that for all students, nationally, the attrition rate for science, engineering, and mathematics majors was sixty (60) percent with the rate of loss estimated to be thirty-five (35) percent between freshman year and sophomore year. Therefore, the freshman year experience was critical in the retention of science, engineering, and mathematics graduates (National Research Council, 1991).

Minority students on White college campuses found themselves adjusting

to academic and social conditions on campus. The institutions found themselves adjusting to the growth of the minority student population, as well as retaining these students (Ford, 1991). Common concerns for first year minority students, were feelings of loneliness and isolation, racial/ethnic identity development, racial hostility in the form of harassment, alienation, and not belonging (Ford, 1991; Fries-Britt 1995).

The Study

The focus to retaining minority students in the sciences and mathematics must be targeted toward enrichment not remediation. Similar to findings of Seymour and Hewitt (1994), my observations have been that many minority students at Michigan State University came from predominately minority communities where they were outstanding or gifted students. They excelled in average or less than average high schools. Many of them and their families overestimated their capabilities based on their limited knowledge of the more extensive mathematics and science background of competing students who attended predominately White schools in better school districts. From these students' perspectives, they were at a lost to comprehend why they did not achieve in the university's environment. They deflected their academic and social issues to external causes. With this in mind, intervention for these students in the Drew program, was packaged as enrichment in order to preserve their pride and self -esteem and allowed them to take advantage of the resources that were made available to them. Furthermore, if aspects of the college environment can

be linked to minority students persistence in the sciences, perhaps institutions of higher learning can gain an understanding of how educational programs, peer group interactions and student involvement may impact the career goals of ethnic minority students who are interested in the sciences.

There may be several factors that explain the low retention of minority students in the physical sciences and mathematics. The question I investigated was, "do intervention programs during the freshman and sophomore year, such as the Charles Drew Science Enrichment Laboratory, for gifted minority students with an intention to major in the natural sciences or mathematics at a large research institution, have a positive effect on them remaining in the sciences and receiving a degree?" I hypothesized that the findings of the research would demonstrate that intervention programs during the freshman and sophomore years had a positive effect on gifted minority students remaining at the institution and obtaining degrees in the sciences.

This study explored the factors related to persistence toward science degrees for ethnic minority students, who as freshmen and sophomores, planned on pursing careers in the sciences. Specifically, the study explored the students' background, characteristics, and their college experiences, and their persistence toward degrees in the sciences.

For the purpose of this study, ethnic minority students were defined as African American, Hispanic and/or Latino, and Native American racial groups. Science majors were defined as the natural or physical sciences, nursing, engineering, and mathematics. The study reviewed the progress minority

students made in their attempt to study the physical sciences and mathematics. All participants in the research sample were at one time involved in the Charles Drew Science Enrichment Laboratory to assist them with their academic development. The laboratory sought to remove institutional barriers, such as perception of racism, lack of advising, and created a supportive environment. Michigan State University was the site for the study, which draws a large minority population from urban Detroit, Saginaw, and Flint, Michigan. Michigan State has an undergraduate population of approximately 34,000 and offers large lecture style classes in the introductory physical sciences and mathematics.

The variables in the study included: the students' standardized test scores (ACT or SAT); the students' high school grade point average (GPA); the students' semester grades in mathematics, chemistry, and biology; the students' MSU predicted grade point average at the end of first semester; and the students' actual grade point average at the end of first semester, as well as the field of study and degrees awarded by the university.

Overview of the Dissertation

Chapter 2 presents an extensive review of the literature addressing issues and concerns of gifted minority students as related to the problem of being gifted and pursing the natural sciences and mathematics. The literature review begins with the broader concept of the lack of minorities pursuing science careers and professions. This follows with a description of the specific barriers minorities face in the sciences, such as, what are the barriers for minority students from K to 12

and beyond? The chapters move into the topic of the retention and achievements of minorities in the physical sciences and mathematics and addresses past successes and intervention programs. The identification of gifted minority students was addressed as well as the specific needs of minority students. The literature review concludes with a discussion of gifted minority students' development in the physical sciences and mathematics. Chapter 3 previews the methodology and research design. The methods included secondary analysis of institutional data of six cohorts of students who began in fall 1993 and graduated by 2001. Analysis of variances compared the performance of Drew students to a representative sample of non Drew minority students and White students all with the intent as freshmen to pursue majors in the sciences. Correlation analyses were used to measure the strength of relationship between input, intermediate, and outcome variables. Chapter 4 presents the results for all cohorts included in the study. Chapter 5 discusses the interpretation of these results and implications relevant to the need and operation of intervention programs. The analysis of the data supports the hypothesis that program participation is associated with a higher frequency of retention and science degrees granted to minorities. This study provides one of the most thorough analyses of institutional data available on programs that aid minority student's retention in the sciences at a large research institution.

Chapter 2

Review of the Literature

Underrepresentation of Ethnic Minorities in Mathematics and the Physical Sciences

The ethnic diversity of the United States population has been increasing, but not the diversity of the science, medical, and engineering workforce. Over the past 25 years there has been a variety of educational efforts to address this. These efforts have been met with some success, but there remains a great deal of work to be done. The higher the educational level, ethnic minorities are underrepresented (NSF, 99-320, 1999: NSF, NRC, 1993). The 1999 report of the National Science Foundation cited that ethnic minority participation in higher education has grown, but their involvement is not equal to their representation in the U.S. population of 18 to 30 year olds (NSF, 1999). In 1995, African Americans were 14 percent of the U.S. residents; Hispanics were 13 percent; and American Indians were 0.8 percent (NSF, 1999). However, in that same year, 7 percent of science and engineering bachelor's degrees were awarded to African Americans; 6 percent to Hispanics, and 0.6 percent to American Indians (NSF, 1999). The proportion of science and engineering doctorates earned by these groups were even smaller, 3 percent earned by African Americans, 3 percent by Hispanics, and 0.4 percent by American Indians (NSF, 1999).

Underrepresentation of minorities in the sciences becomes obvious in high school. Minority high school students are less likely to earn high school credit in

science courses including chemistry, physics and calculus (Campbell, et.al., 1993). In addition, they earn lower scores than whites on the math and verbal portions of achievement tests (Campbell, et. al, 1993). Then by the junior years of college, 65 percent of the minorities who enter a science or mathematics major switched, as compared to 37 percent of white students (Seymour and Hewitt, 1994).

NSF reported that in 1994 African Americans made up 11 percent of the total undergraduate enrollment at all institutions; Hispanics were 9 percent; and American Indians were up 0.9 percent (NSF, 1999). Black and Hispanics were most underrepresented at four-year colleges and universities (NSF, 1999). Undergraduate education does not fare well for ethnic minorities who want to study science and engineering, but there are signs of improvement. Given this, the report further cited that between 1980 and 1995, bachelors' degrees in science and engineering increased by 62 percent, from 31,950 to 51,844 for ethnic minorities (NSF, 1999). Graduate education, between 1985 and 1995 showed some improvement as well. Despite the increase, African Americans accounted for less than 6 percent of science and engineering graduate school enrollment, Hispanics accounted for slightly over 4 percent, and Native Americans for 0.5 percent (NSF, 1999). Status reports on minorities in sciences and mathematics indicate that minorities are still underrepresented in sciences and engineering, both in employment and training (Clark, 1999; Derlin and McShannon, 1996; NSF, NRC, 1993). The changing demographics have a great impact on the technological workforce. By the year 2030 the total elementary

school age cohort of the United States could be equally divided between Whites and all other ethnic groups combined (Clark, 1999). In the future, minority students will be the growing population from where a highly skilled workforce will be drawn. This is critical because minorities are underpresented in mathematics and physical sciences from elementary school to graduate school (Derlin and McShannon, 1996). The theory is that as the nation's economic base shifts increasingly toward technology, participation and achievement in the physical sciences and mathematics by minorities is critical. As Clark (1999) emphasized, "If minority students do not study the sciences they are depriving themselves of many critical career choices, as well as access to White male dominated, high salary occupations" (p.1). Adequate preparation in sciences and mathematics enables students to develop intellectually and socially and participate fully in a technology society as informed citizens (Tomlinson, 1995).

Demographics predicts that 85 (eighty-five) percent of new entrants to the workforce in the United States will be females and members of minority groups (Clark, 1999; Derlin and McShannon, 1996). Based on this percentage, both groups should be represented in the scientific and technology professions in proportion to their presence in the population as a whole. Several factors contribute to unequal participation of minorities in the physical sciences and mathematics. One significant factor is understaffed schools where access to quality teachers is low. Here, judgments about abilities are made and tracking is likely to occur. Under-equipped schools are most often located in minority communities. The number of quality sciences and mathematics courses offered

are minimal and the curriculum emphasis is inadequate for college preparation. There is a lack of financial resources, as well as inequities in under- equipped schools (Williams and Haynes, 1993).

Barriers to Minority Students Progression in the Physical Sciences and Mathematics

The National Academy of Sciences and the National Research Council (1993) report that at every junction in the pipeline more minorities and females drop out of mathematics and sciences education than do white males. Even though this report is ten years old, it provides insight into the problem that is relevant today. Currently, jobs requiring mathematical skills are growing double the rate of over all employment. Women and minorities must fill these workforce gaps or the United States will be unable to compete with technologically advanced countries in global markets (NAS, NRC, 1993). The report found that the ten (10) largest school districts in the nation were seventy (70) percent African American and Hispanic and that of the twenty-five (25) largest city school districts in the nation, twenty-two (22) were composed of predominately minority students. The minority enrollments in the K-12 classrooms of 33 states were at least 20 percent (NAS, NRC, 1993). This enrollment has likely grown since the time of the report.

The report further cites that only six (6) states have a minority student enrollment greater than fifteen (15) percent in their math and science teacher education schools, and colleges and programs nationally (NAS, NRC, 1993).

Out of every four hundred (400) students enrolled in teacher education programs nationally, there were twenty-two African - American (5.5 percent), seven Hispanics (1.75 percent), and American Indians (0.5 percent). The report found that students were turned off to mathematics and science in elementary school, and that teachers often lacked adequate preparation, support, and delivery mechanisms (NAS, NRC, 1993).

The mathematics achievements of the United States high school students lag behind that of other industrialized countries (Hagedorn, 1997). Despite the University of California system's policy of accepting only students from the upper 12.5% of their graduating class, over half of the entering freshmen were unprepared for college level mathematics (Hagedorn, 1997). Hagedorn's study indicated that less than 20 percent of U.S. high school seniors performed mathematics at an advanced level and less than 3 percent exhibited what can be termed superior mathematics performance. This would explain why over 40 percent of U.S. first year college and university students failed calculus. Poor mathematics performance of students leaves them without skills necessary to function in the workplace, such as problem solving and analytical aptitude causes serious deficit among present and future workers (Hagedorn, 1997).

Participation in science and mathematics courses at the high school level is directly related to educational opportunity. Minority students who take algebra and geometry are more likely to go on to college (Campbell, et al., 1998). Research shows that students who lack access to advanced math and science courses, to teachers qualified to teach those courses, and to laboratory

equipment do less well on measures of achievement and accomplishments than those who have access to these resources (Campbell, et al., 1998). Minority students in urban schools are especially affected by this lack of resources (Campbell, et al., 1998)

The inadequacies in mathematics and science achievement are one of the main barriers to professional and medical careers for minorities (Hagedorn, et al., 1997). Minority students, when they arrive at the university, have been found to have had less exposure to higher order mathematics and science activities than their white peers do (Campbell, et. al. 1998). Other factors cited are inadequate mathematics preparation from high school, ineffective advising, and nonsupportive faculty as reasons many minority students fall short of their goals (Hagedorn, et. al. 1997). If minorities are to succeed they must be mentored and encouraged to form proper study habits, better test-taking skills, and overall improvement of mathematics performance. Additional factors that lead to success for these students are sound financial aid programs, and quality teaching (NSF, NRC, 1993).

Other pre-college student characteristics and experiences lead to the well-documented low participation of minorities in higher education. We do not understand all of the variables that are related to this problem, but those that have been identified were: being a first generation college student, coming from a low income home, attending a segregated public school, having a lack of knowledge about college, possessing low academic self-confidence, and experiencing a disconnect between the attainment of a college degree and

future success (Matthews, 1990).

Remediation of students matriculating to college is a major problem for the university's administration. Remedial math courses are defined as any course below calculus level. About 46 percent of U. S. College students who have earned more than 10 credits have enrolled in at least one remedial course (Hagedorn, et. al., 1997). The failure rate in college remedial courses is highest among female and minority students (Seymour and Hewitt, 1997).

While minority students have been entering our universities in increasing numbers, student retention has become a persistent problem for American higher education (Derlin and McShannon, 1996). Alexander (1997) suggests that minority students are lost in the mathematics and sciences courses freshmen and sophomore years. This is related to students' enrollment into gateway courses such as calculus 1. Many factors may influence a university student's decision to remain or leave a particular field of study. One factor considered relevant to minority students is what they perceive as an openly hostile atmosphere where they encounter racism and discrimination (Derlin and McShannon, 1996). While most professors do not consciously treat students unfairly, differential treatment such as an unconscious pattern of differential interaction among faculty and their students do occur (Matthews, 1990).

The field of science in higher education attempts to reward meritocracy with rights and opportunity (Seymour and Hewitt, 1994). This would mean that the student who excels academically is rewarded with scholarship and research opportunity. The literature suggests that there is a disparity between minorities

and whites in studying the sciences. Minority students are not always provided with mentors and as a result are not provided equal exposure in the sciences. For minority students who want to progress in the sciences, there is not equal access to graduate education, receipt of research funds, access to outstanding research collaborators and mentoring to do publications (Seymour and Hewitt, 1994).

Hagedorn (1997) stated that even though the mathematics performances gap between non-minority students and African-American and Hispanics students have recently narrowed, substantial differences still remain. The low mathematics performance of minority students is due to a lack of opportunity and differential attitude practices by teachers. As Hagedorn (1997) reported, "The effect of the absence of perceived racial prejudice had a significantly larger effect on the math gains of minorities".

The National Science Foundation found that a lack of self-esteem and self-confidence eroded student's interest, and that inadequate early preparation prevented students in high school and college from taking advanced mathematics courses (NAS, NRC, 1993). There is a lack of minority role models, as well as subconscious tracking of students as underachievers, which erodes their mathematics and sciences aspirations. The report recommended that administrators insist upon developmental activities aimed at understanding the factors that influence minority achievement and nurture the expectations that all students can and must be given the opportunities to learn mathematics (NAS, NRC, 1993). Teachers can develop positive and productive school climates that

facilitate students' learning of mathematics and provide opportunities for students to improve their self- esteem (Hartley, 1987).

The National Academy of Science report (1993) recommended that higher education learn to identify and recruit potential mathematics and science majors among minority students in secondary schools and in the workforce to increase the numbers of minority students who graduate with mathematics and science majors. Institutions are encouraged to provide financial incentives to encourage minorities to pursue mathematics-based majors, including teaching. Universities ought to consider establishing appropriate support to attract and retain minority students who want to study mathematics and sciences, especially during the freshman year. They should also recruit minority faculty members and provide opportunities for them to assume leadership role in the faculty. Institutions can also work with local school systems to ensure the institutional barriers to advanced education are eliminated (NAC, NRS, 1993).

The absence of minority academic advisors and minority role models at predominately white institutions contributes to the high attrition rate of minority students (Matthews, 1990). Minority role models help to create a supportive climate and provide academic tutoring that have been shown to ensure high retention and graduation rates among African Americans and Hispanics (Seymour and Hewitt, 1994).

Programs that Promote Retention and Achievements of Minorities in the Physical Sciences and Mathematics

Over the past several years, the National Science Foundation and the National Institutes of Health have spent billions of dollars to increase the numbers of minorities in the mathematics and the physical sciences (Seymour and Hewitt, 1994). In terms of recruitment, the numbers of minorities in mathematics and the sciences have increased. However, the numbers who remain in mathematics and the sciences is discouraging. Over one half of the African American and Hispanic students who begin college with the intention of studying the sciences abandon their science major by the end of sophomore year (Seymour and Hewitt, 1994).

Science and mathematics education in the 1990's has focused on equity for all students and the application of systemic education reform as a national strategy. Since 1991, the National Science Foundation's Statewide Systemic Initiative programs have been the national response to inequities in science, mathematics, engineering, and technology education (Heck, 1998). Systemic education reform addresses the following: (a) ambition – in that it establishes new learning standards for all students; (b) comprehensive – in that it targets many pieces of the educational system for change toward a common goal; and (c) coherent – in that it supports mutually reinforcing practices and policies that send a strong, consistent message to students, educators, and society about what is important in education. Systematic education reform is a proactive approach to seek solutions to problems beyond those that can be addressed through current educational policy, practice, expectations and norms (Heck, 1998). NSF's conception of systemic reform is that it always views equity as a

goal. The two goals of the system reform is increasing knowledge of science and mathematics by all students and assuring that women, minorities, and the disabled have the opportunity to engage in and learn science at all levels of the educational system (Heck, 1998).

Fredericksen (1998) has found success in "cluster experiences" with minority students at the University of Texas at El Paso by instituting a collaborative learning program sponsored by the National Science Foundation. He linked courses in English composition with both science and mathematics or engineering and mathematics. Clusters of 25 students each travel from class to class as a group. All courses use learning communities and collaborative projects. Most clusters include writing across the curriculum. Fredericksen (1998) reports that since the projects' inception, cluster students have done surprisingly well in completing precalculus mathematics courses, which determines if they are able to continue in science or engineering majors. There is now a 75 to 80 percent pass rate and students credit their success to the cluster program and its encouragement of learning communities. Fredericksen found that students developed strong friendships, the desire to use study teams and a high degree of self-confidence. Other findings were that collaborative activity is amenable to minority learners rather than a competitive structure. It also affords minority students the chance to gain confidence and to learn to accept and like each other (Fredricksen, 1998).

A program at Xavier University identifies students as early as junior high and provides various means of support until they gain entry into health-professional

schools. In this program, 59 percent of the pre-medical students gain entry into medical school. The authors emphasize that this portion is greater than the national rate of 24 percent of "high-ability" African-Americans who complete four-year degrees and gain entry into health-profession schools (Carmichael and Sevenair, 1991). Black Issues in Higher Education cites that Xavier was the # 1 university that granted degrees to African American students in the life sciences, during the 1999-2000 academic year (2001). It graduated 60 students in the physical sciences, and according to Xavier administrators, 93 percent of its pre-medical students that entered medical school graduate (Stewart, 2001).

Treisman (1990) investigated why African-American students were failing calculus at a higher rate than Chinese American students were. He found that Chinese American students integrated their social and academic lives by completing homework assignments and studying for exams together. By contrast, he found that most African American students studied in isolation and had little social interaction with their calculus peers outside of the classroom (Treisman, 1990). In response, Treisman founded the Emerging Scholars programs. This program consisted of smaller classrooms and more interactions with the instructor. The process of doing math was student-centered and collaborative. The Emerging Scholars program was unique in that it assist underrepresented minority students and emphasized the student's strengths rather weaknesses. At some universities these programs are known as honors programs (Alexander, et al., 1992)

Identification of Gifted Minority Students

Educators have identified giftedness as the top 1 percent in general intelligence as measured by the Stanford Binet Intelligence Test (Ford and Harris, 1991). This definition of giftedness does not take into account that many capable minority learners do no perform well on standardized norm-referenced instruments. Therefore, some teachers, parents, and minority educators who recognize that students learn differently challenge the definition of giftedness. The literature suggests that the definition of giftedness is ubiquitous and that many minorities are underrepresented in gifted programs because of the reliance on standardized tests as a means of identifying potentially gifted students (Hartley, 1987). This would suggest that standardized intelligence instruments take into consideration the ethnic background of capable minority learners who have different learning styles. Ford (1997) suggests that the problem lies in the fact that some classroom teachers view minority students as a group rather than individuals. The ability of teachers to work effectively with and identify gifted racially and culturally diverse students depends heavily on staff development efforts and teacher education program (Ford, Baytop, and Harmon, 1997).

There is a critical need to identify gifted African Americans students early in the pipeline. Researchers need to know how these students perform at higher levels of education as well. As colleges and universities struggle to retain minority students, who enter with high GPAs and Standardized Test Scores, it is necessary to understand the experiences of these students (Fries-Britt, 1995).

Williams and Haynes (1993) report that the United States has lagged in seeking out and identifying gifted and talented students, finding them early in the academic process, and individualizing their educational experience. They feel that an injustice has been served to minority students by teacher apathy toward certain minorities and economically disadvantaged students and that neglect of the gifted is an increasing universal problem (Williams and Haynes, 1993).

Minority students who manage to be identified as gifted and who fail to reach their academic potential have perplexed educators for years. Being gifted makes these students more sensitive to psychological, social, or academic difficulties (Ford and Harris, 1994). These students are likely to feel alienated, which brings about a sense of impotence, isolation, refusal to accept prevailing norms, and a lack of meaning found in school (Ford and Harris, 1994). This may lead some gifted minority students to display poor attitudes toward school, such as cutting class, hostile behavior, dropping out, and other forms of passive resistance (Ford and Harris, 1994). These factors play a critical role in the development of underachievement in gifted minority students (Ford and Harris 1994; Fries-Britt, 1997).

Because schools and programs fail to identify and serve gifted minority students they are less likely to receive adequate educational and vocational guidance as compared to majority gifted students (Olszewski-Kubilius and Scott 1992). Only 20 percent of students enrolled in gifted programs are minority and there is a lack of services for the gifted minority students, because they are perceived as self-sufficient, not in need of assistance, and able to reach

their full potential (Williams and Haynes, 1993; Ford, Baytops, and Harmon, 1987).

Like the K –12 educational system there is concern about the underrepresentation of culturally diverse students in gifted programs at the college level. Ford, Baytops, and Harmon (1997) recommend that educational agencies should adopt a culturally sensitive definition of giftedness and intelligence. Schools should consider subgroup norms when assessing individual students and then comparing the scores of one group of students with others (Ford, Baytop, and Harmon, 1997). When culturally sensitive definitions are adopted, then possibly culturally sensitive assessments will be adopted. Currently there is much criticism regarding the inability of tests to assess the strengths of culturally and linguistically diverse students (Williams and Haynes, 1993). Multiple types and sources of information need to be gathered. No one piece of information is sufficient in identifying students' strength, weaknesses and educational needs (Hartley, 1987; Rhodes. 1992).

The Needs of Gifted Minority Students in College

Some minority students, from lower social economic backgrounds have limited access to the academic resources than their more privileged counterparts. These disadvantaged students have undeveloped potential that remains neglected. When members of this group attend poorer schools, neglect often leads to low grade point averages and low standardized tests (Welch, Hodges, and Payne, 1996). This group is further disadvantaged by their low socio-

economic status that prohibits them from taking advantage of expensive supplementary programs and materials to improve their skills such as the Sylvan Learning Center (Welch, Hodges, and Payne, 1996). Welch et al., (1996) asserted that "These students are forced into higher institution environments, in which they are constantly expected to achieve but which they experience infrequent success and commonplace assaults on their competence" (p. 2). They agreed that for these students to achieve, they must develop an academic identity that fosters and sustains academic achievement in spite of factors that impede their progress (Welch, Hodges, and Payne, 1996).

Gifted minority students can receive discouragement from their peers about their giftedness. Because they want to be accepted by these peers, their sense of belonging is challenged in school. Some African Americans see school as a symbol of the dominant culture, which communicates to students that to succeed they must become "unblack" (Ford, 1994; Fordham, 1991). In order to become a member of the "black community, some gifted African American may sabotage any chance they have of succeeding outside of the African American community" (Ford, 1994, p.212). Gifted African American students may purposely underachieve, drop out, and otherwise fail to achieve their academic potential in school (Fries-Britt, 1997). This may be especially evident when gifted African American students attend predominately white schools. During this time they may become even more confused about which culture to support (Olzewski-Kubilius and Scott, 1992).

Gifted African American students may find it difficult to seek out other

students who share their interest and level of ambition. For African American men, athletic ability has been reinforced as a positive characteristic, but not academics. Once gifted African American students have formed friendships with students who are not high achievers like themselves they have expressed concerns about leaving their non-gifted friends behind (Fries-Britt, 1997).

Ford (1994) asserts that gifted African American students have unique counseling needs as they confront issues of social and psychological barriers to achievement, including peer pressure to underachieve, perfectionism, test anxiety, fear of failure, and social isolation. The literature also suggested that gifted ethnic minority students were more likely to come from middle income families and that low income ethnic minorities were motivated to go to college but less prepared. They faced issues such as parental pressures, peer pressures, financial difficulties, lack of knowledge about college, lack of role models, lack of confidence, and the assumption that college would be frightening or lonely (Ford, 1994; Tomlinson, 1995). Therefore, African American students expressed a greater need for personal counseling, support services, and special academic programs that would enhance their chances for both success and a rich college experience (Ford, Webb and Sandidge, 1994; Fries-Britt, 1997). Counseling can help them cope with peer pressures, isolation, economic difficulties, poor study habits, test anxiety, underachievement, lack of motivation, as well as competing priorities and interests. In addition, gifted African American college students may need assistance with racial identity development to resolve values that conflict with their home, community, school, and peer pressures to underachieve (Ford,

Webb and Sandidge, 1994). Racial identity for these students will mean a sense of belonging for mental health that represents a cultural symbol of collective identity, ethnic consolidation. And mental interdependence (Ford, et. al., 1993)

Nelson (1994) found that academically talented minority students, who persist, seek out and express a desire for support services that enhances their success. These services include study skills workshops, personal counseling, special academic courses, and financial aid. Minority students who are at risk tend not to use support services.

Gifted Minority Students in the Physical Sciences and Mathematics

Gifted African American college students face unique challenges, which suggest that support programs that provide academic enhancement, connections to other gifted students and the opportunity to explore endeavors are important. Honors programs, in general, on predominately White college campuses have not been attractive to gifted African American students because of the external perception that African Americans are less intelligent. Additionally their minority peers' often have the impression that these programs are activities for Whites- or those acting White (Fries-Britt, 1997). The literature finds that the number of gifted students participating in honors programs at historically black colleges is increasing. The findings show minority students feel comfortable displaying their academic talents in a comfortable environment where minority peers have similar aspirations (Fries-Britt, 1997).

Self-esteem also plays a role in minority student retention. Minority students, particularly African Americans, with a sense of ethnic identity have a strong self-concept and motivation to excel academically. They are best prepared to face the challenge of developing a "collegiate" or "professional" self (Welch, Hodges, and Payne, 1996). Low self-concept is a concern in working with gifted minority students at the college level because many conditions contribute to the low self-concept of these students. As they move beyond their high school environment where they compared themselves with persons of the same background, they find it unrealistic to maintain such a confined self-concept and must function outside their immediate environment, interacting with the dominant culture or White culture in college and /or job situations (Williams and Hayes, 1993). It is here that their self-esteem becomes threatened. The competitive setting of the integrated classroom, with white students, provides an environment in which minority students' self-concepts are likely to become depressed (Williams and Hayes, 1993).

The University of Texas at El Paso (UTEP) described earlier uses a collaborative learning program to help minorities' progression in the sciences. Clusters of 25 students travel from class to class as a group. Since the program beginning in 1995, 75 to 80 percent of these students have passed calculus, and have been successful in all courses attempted. Students credit their success to the cluster program and its encouragement of learning communities; they experience strong friendship bonds, the desire and ability to use study teams and a high degree of self-confidence (Fredericksen, 1998). The literature suggests

that minority students are particularly receptive to collaborative learning, or learning in groups. They favor a more cooperative goal structure than a more competitive one (Frederickson 1998; Hiemenz and Hudspeth, 1993,Tinto 1993).

The Academic Excellence Workshop program at California State Polytechnic University, Pomona, has an academic support program designed for minorities in mathematics based curriculum. The objective of the program is to apply collaborative learning, good study habits and communication skills as well as mastery of foundation courses. The results indicated that workshop participants outperformed their counterparts who did not participate in the workshop and outperformed them as a whole in chemistry and physics. The discipline showing the most success was mathematics (Hiemenz and Hudspeth, 1993).

Conceptual Framework

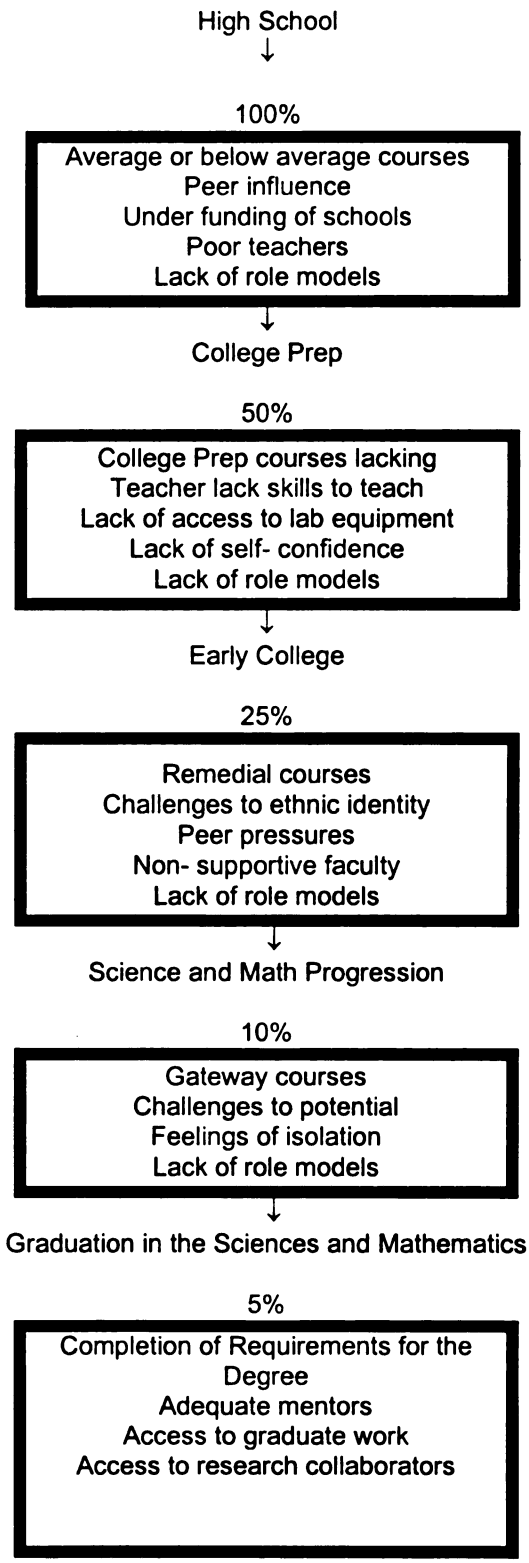
The literature review suggests the concept that the retention and progression of ethnic minority students studying the physical sciences or mathematics at a large research institution has been dismal. Ethnic minority students have the highest rate of attrition than any group of students at universities. Thus, drawing upon intervention programs as the conceptual framework for this study is supported by Seymour and Hewitt (1994). The effectiveness of an intervention program during the freshmen and sophomore years of college for gifted minority students with an intent to study the sciences or mathematics at a large research university will be addressed by assessment and evaluation of an early intervention program.

The conceptual framework for the study centers on the pipeline that carries students from K-12 to a degree in the science. By the time students reach high school, those from urban areas are affected by lack of resources (Campbell, 1998). Minority students arrive on the college campus with less exposure to higher order mathematics and science activities than their white peers (Hagedorn, 1977).

Inadequate mathematics preparation will not allow students to pass the gateway courses of calculus and chemistry. Minority students often fail the mathematics and science freshmen and sophomore years (Alexander, 1991). These correspond to the gateway courses. Gifted minority students oftentimes fail to reach their potential without the appropriate psychological, social, or academic support system (Harris et al.,1994). The students may feel alienated, isolated, and most often refuse to accept prevailing norms. Therefore it is appropriate to investigate the effectiveness of an intervention program during the freshmen and sophomore years for gifted minority students with an intention to major in the physical sciences or mathematics at a large research university.

Figure 1. illustrates what the pipeline is like for ethnic minority students who chose to study the sciences. The percentages are hypothetical proportions for explanatory purposes. The figure illustrates the progression of ethnic minority students' progression in the science and mathematics from high school to college. It must be noted that many minority students are lost in the pipeline before they enter high school. The figure suggests that 100% of the minority students in high school are enrolled in below average courses.

Figure 1.Conceptual Model of a pipeline of cumulative effects.



These courses would not include AP or advanced courses. These students are often distracted by peers, and their schools lack' of funding. These schools often have inadequate numbers of teachers who may lack training and the students lack scientific role models. Hypothetically, 50 percent of ethnic minorities who are enrolled in college prep courses in high schools are taught by teachers who may lack the skills to teach advanced courses. These students may not have access to advanced lab equipment, may experience a lack of confidence and few role models. Hypothetically, 25 percent of these students will enroll in an institution of higher learning where they may be enrolled in remedial courses. Their co-ethnic peers may challenge their ethnic identity and their non-minority peers may question their academic ability. They may experience the non-supportive faculty who may doubt their ability to succeed. This is likely compounded by the lack of ethnic minority scientific role models. Hypothetically, 10 percent of these students will experience success in the gateway courses of math, chemistry, and biology. Many of them will have their academic potential challenged for the first time. They may begin to experience feelings of isolation. There is still a lack of ethnic minority scientific role models. The 5 percent that will make it to graduation and complete a degree in the sciences will have experienced adequate mentors, who may not be members of an ethnic minority group. They may have access to graduate school, research careers, or profession health careers.

The conceptual framework for this study is directly linked to the goals of the Charles Drew Science Enrichment program. The program is designed to

intervene in the early college years by providing a supportive academic environment of their peers, lessening feelings of isolation, and minimalizing peer pressure for minority students intending to major in the sciences. Through the longitudinal study of students who participated in the program, the following over aching research question can be answered: Does participation in a program like Drew help to keep minority students in the sciences?

Chapter 3

Methodology and Research Design

Introduction

The purpose of this study was to investigate and explore the achievements and graduation rates of gifted ethnic minority students (African American, Native American, Hispanic and Latinos ethnic groups) who had declared intent to study the sciences at a large research university. The program that was evaluated was the Charles Drew Science Enrichment Laboratory, in the College of Natural Sciences at Michigan State University. The study focused on ethnic minority students who entered the university from fall 1993 to fall 1998. To obtain graduation rates, data were collected only from entering classes that had the standard 6 year period to complete an undergraduate degree.

General University Environment

Michigan State University was founded in 1855 as the nation's pioneer land-grant institution. The university is a comprehensive research institution with 4,244 faculty and academic staff, 33,966 undergraduates, 7,732 graduate students, and 1,340 professional students. In 2000, the total enrollment of 43,038 is the largest single campus student body of any Michigan university and among the largest in the country.

Michigan State University places great emphasis on service to the state, the nation, and the world. This is central to its land grant mission. Public service and extension missions are fulfilled by long standing commitments to

international development and education and an extensive lifelong education effort throughout the state. Michigan State University attracts faculty, staff, and students from around the world. The university seeks excellence in all that it does, this creating an atmosphere of challenge for high achievement.

The university has fourteen degree granting colleges. The Office of Admissions admits freshmen to the university. However, students may be admitted into a particular college if they have selected a major. Students who have not selected a major are placed in the undergraduate university division (UUD).

The university offers special programs for minority or disadvantaged students through the Office of Supportive Services. These programs provide services to the students such as counseling, tutoring, study sessions, workshops, and seminars that are designed to increase their retention rate. The university also provides other support services for the retention of ethnic minority students. These programs are administered through the College of Engineering, the College of Business, and the residence halls' minority aids (to assist students in their living and learning concerns).

The College of Natural Science enrolls students who wish to pursue a degree in one of the academic disciplines of biological sciences, physical sciences, or mathematics. The college has pre-professional advisors who provide guidance and assistance to students who wish to pursue plans of study that lead to admission to professional schools. Another option for students enrolling in the college of natural sciences is to pursue enrollment in the Lyman Briggs College,

a residential program, that provides academic courses, advisors, professors, and operates as an independent unit within the college.

The Charles Drew Science Enrichment Laboratory

The Charles Drew Science Enrichment Laboratory is an academic assistance and support program for undergraduate students in the College of Natural Science. The program was created in an effort to provide ethnic minority students the opportunity to perform successfully in the core science and mathematics courses, and to increase the number of ethnic minority students who complete degrees in the biological sciences, physical sciences, and mathematics. The program also promotes the students' preparation for post-graduate work and a future professional career in the sciences.

The program began in 1976 as part of the effort to increase diversity in the College of Natural Science. In the beginning, the program was structured around the precalculus and calculus courses. Today the program has expanded academic support structure to include the core introductory chemistry, biology courses, and a freshman seminar course. There is also a comprehensive counseling and advising component integrated throughout the program. The laboratory is grounded in the premise that working with the "total student" maximizes the program's ability to assist students with the development of a sound academic foundation for success in studying science and mathematics. The following goals have been established in supporting retention through this program:

1) Guide and support students in making a successful transition from high school to college;
2) Assist students with the development of sound student management skills needed for the successful negotiation of the campus environment and overall success within the academic system;
3) Assist students in gaining a solid foundation in the basic core disciplines of mathematics, chemistry, biology, and physics, including the development of critical thinking skills and abilities;
4) Provide a supportive environment for personal growth, including provisions for intervention on behalf of students, if needed;
5) Support students as they matriculate through the university and help them reach their goals in the academic and social environment of the university;
6) Guide and support students in preparing and gaining entry into postgraduate programs, and provide help in identifying appropriate career paths.

The Design of the Study

The purpose of this study, as stated previously, was to investigate and explore the achievements and graduation rates of gifted ethnic minority students (African American, Native American, Hispanic, and Latino ethnic groups) who had declared intent to study the sciences at a large research university. The program that was evaluated was the Charles Drew Science Enrichment Laboratory, in the College of Natural Science at Michigan State University. The research explored institutional data that covered students who entered the

university between the academic years of 1993 to 1998. Information was gathered from this population sample by selecting measurable variables available in the institutional database. The ANOVA by class is included in the index.

Students in the study were identified as Drew students by their enrollment in the problem solving seminar class list (NSC 201), required of all participants in the Drew science program. The study sought to determine if participation in the laboratory had a positive relationship on students graduating from the university with a degree in the natural sciences. The purpose of this research was to study a sample population (ethnic minority students) in comparison to a larger population so that inferences can be made to the larger population in regards to the characteristics, aptitude and behaviors (Astin, 1993).

The Population and Sample

The target population for the study was the ethnic minority student populations who attended a large research university with the intent of pursuing a degree in the sciences. The decision was made to target students who were enrolled in the Charles Drew Science Enrichment laboratory at Michigan State University, because of the sizable number of ethnic minority students enrolled in the sciences who have participated in the Charles Drew Science enrichment Laboratory. Approximately 348 Drew students were included in the study. This sample population was selected because they all participated in a core number of courses, which included mathematics, chemistry, biology, and

freshmen problem solving. In addition, all students participated in structured study sessions during the freshmen and sophomore year. A random sample of minority students who entered the university's College of Natural Science, with intent to study the sciences, from 1993 to 1998, but who did not participate in the Drew program, approximately 1071, served as a control group from which the data collected were compared. In addition, a random sample of majority (White) students, approximately 941, with a major in the sciences was drawn to serve as the second control group. This yielded a total sample population of 2360 students.

Data Collection

In this research project, data were collected from two sources, the university's Student Information System (SIS), and the attendance records of Drew program directors or coordinators in mathematics, chemistry, and biology. Prior to collecting the data, an application was submitted to the University Committee on Research Involving Human Subjects (UCRIHS). Approval was granted in the summer of 2001. The SIS database included the following independent variables: ethnicity; high school grade point average; standardized verbal; mathematics, and science reasoning scores; the standardized comprehensive score; the university's predicted grade point average at the end of the student's first semester; the student's achieved grade point average at the end of first semester, the first semester grades in chemistry, math and biology; the graduation data of science degrees awarded; graduation rates; and final GPA.

The following chart illustrates the variables used in the study.

Table 1.	Table 2.	Table 3.
Input Variables	Intermediate Variables	Output Variables
High school GPA	Semester GPA	Science degree
ACT verbal	Chemistry Grade	Non science degree
ACT math	Math Grade	Graduation rate
ACT science score	Biology grade	Final GPA
ACT comp score		
Predicted GPA		

Data Analysis

Use of institutional data drawn from cohorts of students who had sufficient time to graduate from the university allowed for a longitudinal design. The longitudinal study was determined to be the best way to study this group. The investigator found that it was best to study retention efforts over a number of years from entry point until exit point from the university, as well as type of degree obtained. By virtue of her position at the university the author had access to data and could form a profile of the Drew students over a period of time.

Statistical analyses were performed to test the hypotheses of this study using the Statistical Package for the Social Sciences (SPSS) and the Statistical Analysis System (SAS). Cross Tabular analysis was used to generate descriptive data from the 3 comparison groups and variables included in the study. ANOVA (analysis of variances) was used to determine if the statistically

significant differences occurred between the three groups. Pearson coefficients correlation analysis was used to determine strength of relationship between Drew input, intermediate, and outcome variables. For the purposes of correlation analysis, each group was analyzed separately. To gain a sense of the overall strength of the program's relationship to the input variables, all cohort groups for each year were combined into one sample. The cohort analysis by year is included in the appendix.

This type of assessment can be addressed appropriately by using longitudinal data. Astin (1993) asserts that longitudinal assessment can be used to enhance the educational and research functions of colleges and universities by promoting talent development among both students and faculty members. Assessment can contribute to talent development among students through examining the direct effects on the learners and indirectly by enlightening the educator (Astin, p. 14). Most importantly assessment promotes talent development when it informs the educator about the effectiveness of various policies and practices. Astin's conceptual model of assessment is that any educational assessment model is incomplete unless it includes data on student input, student environment, and student outcomes (the I-E-O Model). Astin defined student input as pre- enrollment variables, student environment refers to the students' actual experiences during the educational process, and students' outcomes refers to the types of talents we are trying to develop at our institution. In this study, the input was measured in terms of students' pre- enrollment variables (see table 1). The students' environment was measured by their

participation in the supplemental instruction sessions. The Intermediate outcomes were also recommended by Astin as a means to evaluate intervention programs. The intermediate outcomes were a part of the study (see table 2). The students' output will be measured in terms of their graduation rates and final grades in the science and mathematics courses the first semester (see table 3). The groups will be compared to a controlled group who has not had the supplemental instruction. The comparative judgment is a decision to change something, implying that the new environment is expected to produce a better outcome than the current environment. When the decision is not to change anything, the current environment is judged to be equal to or better than all possible alternative environments (Astin, 1993).

Research Questions and Hypothesis

The overall research question for the study was to explore the effectiveness of the Drew program in retaining minority students in the sciences thereby mediating the effects of input or pre-collegiate variables that have been shown to negatively affect achievement in the sciences.

Research Question 1: Are there differences between Drew, non Drew minority students, and White students on the following input variables: high school GPA; ACT verbal; ACT math; ACT science score; ACT comp score; and predicted GPA?

There will be no differences between the Drew and non Drew input Variables, but the input variables for Whites will be higher than Drew and non Drew.

Research Question 2: Are there differences between Drew, non Drew, and White students on the following intermediate variables: semester GPA; chemistry grade; math grade; and biology grade?

There will be higher grades in chemistry, math, biology, and semester GPA for Drew program participants than non Drew or Whites.

Research Question 3: Are there differences between Drew, non Drew, and White students on the outcome variables; science degree; non science degree; graduation rate; and final GPA?

There will a higher graduation rate in the sciences for Drew program participants than non Drew and Whites, and they will achieve a higher final GPA.

Research Question 4: How strongly correlated are the input measures of high school GPA; ACT verbal; ACT math; ACT science score; ACT comp, and predicted GPA to the intermediate measures of semester GPA?

There will be a lower correlation between predicted GPA and first semester GPA for Drew program participants when compared to the other groups.

Research Question 5: How strongly correlated are the intermediate variables of semester GPA, chemistry grade, math grade, and biology grade to the outcome variables?

There will be a strong correlation between the intermediate variables and outcome variables for Drew program participants than the other groups.

Research Question 6: How strongly correlated are the input variables of high school GPA, ACT verbal, ACT math, ACT science score, ACT comp score and predicted GPA to the output variables of receiving a science degree, receiving a non science degree, graduating, and the final GPA for the Drew program participants?

There will be a less strong correlation between the input variables to the output for the Drew program participants than the other groups.

Advantages and Limitations

A database was constructed in Microsoft Access from queries of MSU's SIS INFO records. The SIS INFO database at the time queries were made (in 2001) contained records for all students who were enrolled at Michigan State University as of summer term 1995. Identification of Drew students was based on in house records of all students enrolled in NSC 201 between 1993 and 1998. Hence, Drew students who enrolled in the fall of 1993 but left the university

before the summer of 1995 were included in this analysis. However, selection of the control cohorts for the classes of 1993 and 1994 are presumably biased towards the better students since SIS INFO, at the time of the initial queries, did not include students who left Michigan State University before the summer of 1995. In addition, data on participation in study sessions is available only for the Drew cohort. It is assumed that students from the control groups did not participate in significant organized study sessions. Multiple regression analyses were not used to compare the three cohorts over the six year period but rather was used for comparisons of the three student groups for each year studied. Although these problems weaken the statistical significance of these findings, the data show a striking impact of the Drew program students' success in the sciences. This study was concerned with one enrichment program at a particular institution and thus the findings can not be generalized to all institutions of higher learning or all ethnic minority students.

Chapter 4

Presentation of Findings and Analysis of Results

Results

The purpose of this research was to investigate and explore the achievements and graduation rate of gifted ethnic minority students who have declared the intent to study the sciences at a large research university. The program evaluated was the Charles Drew Science Enrichment Laboratory, in the College of Natural Sciences, at Michigan State University. The study focused on ethnic minority students who entered the university beginning fall 1993 to fall 1998. The data were derived from 2360 students of which 348 participated in the Drew program. The population under study consisted of 998 African Americans, 332 Hispanic/Latino, 89 Native Americans, and 941 whites; 836 of this group were males and 1524 were females.

As referred to in Chapter 3, Astin's assessment model is ideal for studying the impact of educational intervention on minority students' achievement in mathematics and science (Astin, 1993). Attention can be focused on defining and measuring outcomes that are relevant to the goals of the program. The assessment of the program with this model can be used to improve current educational practices as they relate to minority students enrolled at large institutions who wish to pursue a degree in the sciences or mathematics.

Data between the three cohort groups were compared using analysis included analysis of variances, cross tabulation and correlation. In this chapter,

results of the data analysis are presented, beginning with descriptive findings related to the research hypothesis. The 6 questions and hypothesis stated below were listed in the study.

Study Variables

Results from analysis of variances of each of the variables that were measured in the research study are presented below. A concise description of the measured values of the research is presented in the following tables. The Drew and non Drew students had significantly lower input variables than the White cohort. The Drew cohort input variables were slightly higher than non Drew.

Table 1 compares the combined input variables for Drew and non Drew minority students in the cohort that matriculated at Michigan State University between the fall of 1993 to fall 1998. Analysis of variance showed that there were statistically significant differences ($p < .01$) between Drew students and a random sample of non Drew minority students in their high school GPA, ACT Verbal score, ACT math, ACT combined scores, and predicted GPA. However there was no significant difference between their science scores. This would indicate that students had an equal background in their knowledge of scientific concepts. The Drew students' scores on the input variables were only slightly higher, though statistically significant than the Non Drew cohort, except for the predicted GPA, which was significantly higher.

Table 2 compares the combined input variables for Drew and White students

Table 1.

Drew Versus non Drew Input Variables

Variable	Drew N=348 Mean	Non Drew N=1071 Mean	F	Sig.
High school GPA	3.28	3.08	42.631	.000
ACT verbal	20.90	19.72	14.316	.000
ACT math	20.79	19.88	10.384	.001
ACT science score	21.22	20.69	3.494	.062
ACT comp score	21.34	20.47	10.404	.001
Predicted GPA	2.47	2.35	19.685	.001

Table 2.

Drew Versus Whites Input Variables

Variables	Drew N=348 Mean	White N=941 Mean	F	Sig.
High school GPA	3.28	3.58	187.844	.000
ACT verbal	20.90	24.26	156.088	.000
ACT math	20.79	24.89	250.943	.000
ACT science score	21.22	25.47	334.649	.000
ACT comp score	21.34	25.23	324.514	.000
Predicted GPA	2.47	2.85	156.088	.000

in the cohort that matriculated at Michigan State University in the fall of 1993 to fall 1998. The table illustrates that the White cohort achieved much higher scores on all the input variables, thus leading to a higher predicted GPA than the Drew cohort. The F values observed that the mean scores were equal for high school GPA, ACT verbal, and predicted GPA. Analysis of variances showed that there were significant differences (p<. 01) between Drew students and a random sample of White students in high school GPA, ACT verbal, ACT math, ACT science reasoning score, ACT comp and predicted GPA.

Table 3.

Drew versus Non Drew Intermediate Variables

Variable	Drew N=348 Mean	Non Drew N=1071 Mean	F	Sig.
Semester GPA	2.65	2.20	62.796	.000
Chemistry grade	2.36	2.28	.421	.517
Math grade	2.56	2.01	38.280	.000
Biology grade	2.55	1.89	19.254	.000

Table 3 summarizes the combined intermediate variables for Drew and non Drew minority students in the cohort that matriculated at Michigan State University in the fall of 1993 to fall 1998. Analysis of variance showed that there were statistical significant differences (p<. 01) between Drew students and a random sample of non Drew minority students in the achieved GPA, math grade, and biology grade. However, there were no significant differences between the

chemistry grades. The table illustrates that the means for the Drew cohort were much higher for semester GPA, math grade, and the Biology than the non Drew cohort. The F value 12.285 would indicate that there are equal means for the chemistry but unequal means for the math and biology grades.

Table 4.

Drew versus Whites Intermediate Variables

Variable	Drew N=348 Mean	Whites N=941 Mean	F	Sig.
Semester GPA	2.65	2.97	12.385	.000
Chemistry grade	2.36	2.97	22.028	.000
Math grade	2.56	2.50	.449	.503
Biology Grade	2.55	2.81	4.110	.043

Table 4 summarized the combined intermediate variables for Drew and White students in the cohort that matriculated at Michigan State University in the fall of 1993 to fall 1998. Analysis of variances showed that there were statistical significant differences ($p < .01$) between Drew students and a random sample of White students in their semester GPA, and chemistry grade. However, there were no significant differences between their math grade and their biology grade. The Drew cohort semester GPA was lower than that for the White cohort, but the F value (12.385) indicates that more of the means were unequal. This table illustrates that the Drew cohort outperformed the White cohort on the mean math grade. The biology grade was lower for the Drew cohort when compared to the

Whites students but the F value indicates that there were more matches on the means and the differences were not statistically significant.

Table 5.

Drew Versus Non Drew Output Variables

Variable	Drew N=348 Mean	Non Drew N=1071 Mean	F	Sig.
Science degree	48%	31%	10.145	.002
Graduation rate	40%	42%	28.780	.000
Final GPA	2.91	2.86	.899	.344

Table 5 depicts the combined output variables for the Drew and non Drew minority students in the cohort that matriculated at Michigan State in the fall of 1993 to fall 1998. The data demonstrated that the Drew students received a higher percentage of science degrees as compared to a random sample of non Drew minority students. However, the non Drew students achieved a higher graduation rate than the Drew students. Analysis of variance showed that there was no statistical difference in the final GPAs of the group. ANOVAs were not performed on the non science variable because it is essentially opposite the science degree variable making the ANOVA unnecessary. The final GPA mean was close for the two groups, although the Drew cohort achieved a slightly higher GPA.

Table 6 depicts the combined output variables for Drew and White students in the cohort that matriculated at Michigan State University in the fall of 1993 to fall

Table 6.

Drew Versus Whites Output Variable

Variable	Drew N=348 Mean	Whites N=941 Mean	F	Sig.
Science degree	48%	52%	1.517	.219
Graduation rate	40%	51%	.637	.425
Final GPA	2.91	3.28	48.457	.000

1998. The data demonstrated that the Drew students received a lower percentage of science degrees as compared to a random sample of White students, as well as a lower graduation rate. Analysis of variances showed that there were statistical differences ($p < .01$) between the final GPAs, which were higher for the White cohort. The graduation rate of 40 percent is significantly below the white cohort at 51 percent. The percent of science degrees granted for both groups was similar but slightly higher for Whites.

Table 7 depicts the correlation analysis between the semester GPA and the input, intermediate, and output variables for Drew, non Drew and Whites. The ACT verbal input variable had the weaker correlation to the achieved GPA for the Drew cohort (.186). All input variables were weaker correlated to the Drew versus non Drew and White controlled groups. The high school GPA correlation for Drew is .317, for non Drew it is .394, for White it is .495.

The ACT math correlation is .282 for Drew, .365 for non Drew, and, 355 for White. The ACT science is correlated at .220 for Drew, .365 for non Drew, and

Table 7.

Correlation of input Variables and Semester GPA

Variable	Drew N=348	Non Drew N=1071	White N=941	All combined N=2360
	Pearson Product- Moment Coefficients			
High school GPA	.317**	.394**	.495**	.500**
ACT verbal	.186**	.339**	.307**	.407**
ACT math	.282**	.365**	.355**	.448**
ACT science score	.220**	.365**	.260**	.413**
ACT comp score	.268**	.393**	.351**	.460**
Predicted GPA	.423**	.450**	.468**	.531**

** Correlation is significant at p< .01

.260 for Whites. The ACT comp is correlated for Drew at .268, for non Drew at .393, for Whites at .351. The predicted GPA correlation to Drew is .423, for non Drew .450, and for Whites at .468.

Table 8 shows the correlation analysis between science degrees awarded and the input, intermediate, and output variables. The ACT verbal scores have the weaker relation to achieving the science degree for the Drew cohort (.001). Higher correlations were found with the non Drew (.232), and the White cohort (.203). All correlations for the input and intermediate variables were lower for Drew than the other cohorts, with the exception of the biology grade, which is strongly correlated for the Drew than non Drew, but lower than Whites. The high school GPA is correlated at .178 for Drew, .342 for non Drew, and .306 for

Table 8.

Correlation of Variables and Science Degree

Variable	Drew N=348	Non Drew N=1071	White N=941	All combined N=2360
	Pearson Product Moment Coefficients			
High School GPA	.178**	.342**	.306**	.342**
ACT verbal	.001	.232**	.203**	.244**
ACT math	.161	.331**	.297**	.336**
ACT science Score	.209*	.310**	.273**	.319**
ACT comp score	.108	.301**	.298**	.321**
Predicted GPA	.171	.320**	.229**	.309**
Semester GPA	.280**	.296**	.308**	.330**
Chemistry grade	.157	.161	.381**	.278**
Math grade	.254**	.285**	.202**	.265**
Biology grade	.329**	.299**	.550**	.389**

** Correlation is significant at < .01

Whites. The ACT math is correlated for Drew at .161, for non Drew the correlation is .331, for Whites the correlation is.297. The ACT science for Drew is correlated at .209, for non Drew at .310, for Whites at .273. The ACT comp is correlated for Drew at .108, for non Drew .310, and for Whites at .321. The predicted GPA is correlated for Drew at .171, for non Drew at .320, and for

Table 9.

Correlation of Variables and Final GPA

Variable	Drew N=348	Non Drew N=1071	White N=941	All combined N=2360
		Pearson coefficients		
High school GPA	.448**	.463**	.406**	.530**
ACT verbal	.218*	.519**	.326**	.491**
ACT math	.170	.481**	.304**	.472**
ACT science score	.119	.464**	.276**	.458**
ACT comp score	.195*	.530**	.353**	.519**
Predicted GPA	.343**	.556**	.351**	.542**
Semester GPA	.454**	.590**	.526**	.578**
Chemistry grade	.420**	.532**	.436**	.483**
Math grade	.306**	.418**	.395**	.403**
Biology grade	.532**	.572**	.654**	.581**

**Correlation is significant at < .01

Whites at .229. The correlation for semester GPA is .280 for Drew, .296 for non Drew and .308 for Whites. The correlation for the chemistry grade is .157 for Drew, .161 for non Drew and .381 for Whites. The correlation for the math grade is .254 for Drew, .285 for non Drew and .202 for Whites. The correlation for the biology grade is .329 for Drew, .299 for non Drew, and, 550 for Whites.

Table 9 shows the correlation analysis between the final GPAs and the input and intermediate variables. All the variables, with the exception of the high school GPAs were weaker correlated to the final GPAs than the other cohorts. The final GPAs were less strongly correlated for the White cohort, than the Drew

and the non Drew cohorts. The ACT math scores for the Drew cohort, ACT comp scores, and the ACT science scores demonstrated that the correlation is not significant. The ACT comp scores for the non Drew cohort were correlated at .530, the ACT math scores at .481, and the ACT science scores at .464. The ACT math scores for the White cohort correlated at .304, the ACT comps were correlated at .353, and for the ACT science scores at .276. The ACT verbal scores were strongly correlated for the non Drew, than the Drew or White cohort. The predicted GPAs were correlated for Drew at .343, for non Drew at .556,and for the White cohort at .351. The semester GPAs were correlated for Drew at .454, for non Drew at .590, for Whites at .526. The chemistry grades were correlated at .420, for non Drew at .532, and for Whites at .436. The math grades were correlated for Drew at .306, for non Drew at .418, and for Whites at .395. The biology grades correlated for Drew at .532, for non Drew at .572, and for Whites at .654.

Summary of Results

A summary of the analysis concludes the results section and is organized by research question for reinforcement.

Research Question #1: Input variables

> **Are there differences between Drew, non Drew minority students, and White students on the following input variables: high school GPA; ACT verbal; ACT math; ACT science score; ACT comp score; and predicted GPA?**

The statistical analysis showed differences between the input variables of the Drew, non Drew, and the Whites cohorts. Overall, the Drew students had a high school GPA and ACT scores that were significantly below White students, but higher than the non Drew cohort. But their high school grades would indicate that they did experience success in high school. For example, the high school GPA for Drew was a 3.28 compared to 3.58 for Whites and the ACT math scores for Drew were 20.79 compared to 24.89 for Whites. Based on these input variables the White cohort was predicted to have a significantly higher semester GPA than the Drew or non Drew minority students. These input variables are thought to be good predictors of student success in the university curriculum. Furthermore, since the Drew and non Drew cohorts had similar input variables, (although Drew was slightly higher), it would be logical to predict that these two groups will have similar levels of success at the university.

Research Question #2: Intermediate Variables

Are there differences between Drew, non Drew, and White students on the following intermediate variables: semester GPA, chemistry grade; math grade; and biology grade?

The analysis of variances showed significant differences in the intermediate variables between the cohorts. The Drew students outperformed the non Drew students on all the intermediate variables measures, except for the chemistry grades, which showed no significant differences.

For example, the semester GPA of the Drew cohort was significantly higher than the predicted GPA. The non Drew semester GPA was actually lower

than predicted. The differences between these two groups would imply that the experience of the Drew program resulted in higher grades. Obviously, both groups' predicted GPAs indicate that they would need some assistance at the university. When compared to the Whites, Drew outperformed them only in math grades. The intervention of the math component of the program presumably was responsible for higher grades. The Whites cohort, however outperformed the Drew students on the other intermediate variables. The semester GPAs for Whites were almost exactly as the predicted GPA, indicating that the university's predictors of success were accurate for these students. However, the semester GPA for the minority cohort was much lower than predicted for the non Drew cohort. This would suggest that the university's' factors for predicting the semester GPA were not accurate for these students. Considering the disparities in the input variables between the two groups, the Drew students performed well both in relations to the minority students and the majority students.

Research Question #3: Outcome Variables

Are there differences between Drew, non Drew, and White students on the outcome variables: science degree; non science degree; graduation rate; and final GPA?

The analysis of variances showed differences between the three cohorts and the output variables. The Drew students received a higher percentage of degrees in the sciences relative to the non Drew cohort (48 percent of the Drew received a science degree as compared to 31 percent of the non Drew). However, the non

Drew overall graduation rate was slightly higher (42 percent as compared to Drew at 40 percent). The Drew cohort received a slightly higher final GPA upon graduation than the non Drew cohort. The Drew to White comparison on the output variables would indicate that Drew students were closer to Whites in degrees awarded in the sciences. The Drew students had a 48 percent rate of receiving a degree in the sciences, whereas, the White cohort received a science degree at a rate of 51 percent. In addition the White cohort earned slightly higher GPAs than the Drew cohort upon graduation. However, given the disparities between the input variables, one would expect greater differences between the output variables of the White cohort when compared to the two minority cohorts.

Research Question # 4: Input variables, Intermediate variables and Semester GPA

How strongly correlated are the input measures high school GPA; ACT verbal; ACT math; ACT science score; ACT comp score and predicted GPA to the intermediate measures of semester GPA?

The Correlations Pearson Product Moments Coefficients provided quantitative indicators for the relationship between the input measures to the semester GPA. The input variables indicated a weaker relationship to the semester GPA for the Drew cohort than the non Drew or the White cohorts. This supports the hypothesis that the program mediated the input variables for Drew allowing Drew students to achieve a significantly higher GPA than predicted. For example the comparison of the Drew high school GPA to semester GPA was .317, for the non Drew the comparison was .394, and .495 for Whites. Drew had a weak

comparison between the high school GPA and the semester grade, however for the Whites the comparison was strong. The non Drew high school GPA had a weak comparison to the semester GPA than Whites, however on the other input variables, the non Drew has a strong comparison to the semester GPA than Drew or Whites. This finding were significant in that it supports the hypothesis that the input variables compared to the semester GPA can be mediated through intervention.

Research Question #5 Intermediate Variables to Outcome Variables

How strongly correlated are the intermediate variables of semester GPA, chemistry grade, math grade, and biology grade to the outcome variables?

The intermediate variables of semester GPA and chemistry grade were a weaker comparison to the outcome variable of receiving a degree for Drew students than the other cohorts. However, the non Drew and Whites intermediate variables had a strong comparison to receiving the science degree. For example the predicted GPA correlated for Drew was .171, for non Drew the correlation was .320, and for Whites the correlation was .229. These results indicated that non-program participants did not experience success in the introductory courses, however many of them did not remain in the sciences. The comparison of Drew with non Drew students indicates that for minorities, in particular, success in the beginning courses was a factor for them persisting toward the science degree. Success in the math courses was a strong indicator of success for minority students.

Research Question # 6 Input variables to Outcome Variables

How strongly correlated are the input variables of high school GPA, ACT verbal, ACT math, ACT science score, ACT comp score and predicted GPA to the output variables of receiving a science degree, receiving a non science degree, graduating, and the final GPA for the Drew program participants?

The input variables of high school GPA, ACT verbal, ACT math, ACT science score, ACT comp score, and predicted GPA were weakly compared to the outcome variable of receiving a science degree for Drew. The high school GPA was compared weakly for Drew at .178, and strongly for non Drew at .342, and for Whites at .306. For the Drew cohort the program mediated the input variables, suggesting that minority students can progress toward a degree in the sciences, but intervention constitutes a major factor for success. The data also indicate that White students' input variables as well, are strongly compared to their success in receiving a degree in the sciences. This may have implications for the way teaching is managed in the introductory courses on the university campus for all students at the undergraduate level.

Chapter 5

Discussion

This study investigated and explored the achievements and graduation rates of gifted ethnic minority students (African American, Native American, Hispanic and Latino ethnic groups) who have declared intent to study the sciences at a large research university. The study focused on ethnic minority students who entered the university beginning fall 1993 to fall 1998. Using a sample of 2360 students, of which 998 were African Americans, 332 were Hispanic/Latino, 89 were Native Americans, and 941 were White. The sample were comprised of 836 males and 1524 females. There were 348 Drew students used in the study. Six research questions were explored. Data analyses included analysis of variances and correlation analysis. The input variables used in the study were high school GPA, ACT verbal scores, ACT math scores, ACT science reasoning score, comprehensive score, and the predicted GPA of the first semester assigned by the university. The intermediate variables used were the students' achieved GPA from the first semester, chemistry grades, the math grades, and the biology grades. The output variables used were the percent of science degrees received and the final GPA upon graduation. The students who participated in the program (Drew) were compared to a random sample of ethnic minority students who declared a science major and did not participate in the program (non Drew). The students who participated in the program were then compared to a random sample of White students who were enrolled in the

College of Natural Science.

The program evaluated was the Charles Drew Science Enrichment Program, College of Natural Science, at Michigan State University. The program is a student assistance and academic support program that was created in an effort to provide ethnic minority students the opportunity to perform successfully in the core sciences and mathematics courses, and to increase the number of ethnic minority students who complete degrees in the biological sciences, physical sciences and mathematics. The program also promotes student preparation for post-graduate work and professional careers in the sciences.

The program has academic support structure such as supplemental instruction, mandatory concept review and attendance requirements in mathematics courses, chemistry courses, biology courses, and the freshmen seminar course. There is also a comprehensive counseling and advising component integrated throughout the program. The laboratory is grounded in the premise that working with the "total student" maximizes the program's ability to assist the students with development of a sound academic foundation for success in studying sciences and mathematics.

Discussion of Results

The discussion of the results of the study was organized around the six research questions. The results of this study were principally derived with the assistance of data analysis through analysis of variances and correlation.

The conclusions were based on statistical analysis.

The discussion addresses the relationship between degrees granted in the sciences and the student participation in the program. This will be followed by the discussion of the relationship between the predicted GPA at the end of first semester and the student's participation in the program. The relationship of grades in chemistry, math, and biology and student participation in the program will be discussed. The chapter will further explore implications for theory and provide recommendations for practice as it relates to students in higher education and participants in the Drew program.

Relationship between Degrees Granted in Science and Student Participation

The Drew program has been in existence for over twenty years at Michigan State University. The directors of mathematics and biology complete statistical evaluation of the intermediate variables for each semester, however this is the first study that has studied the input, intermediate, and output variables as they relate to the graduation data for five cohorts of students Drew who entered from 1993 to 1997 and graduated by 2001. The study further validates the program's effectiveness by comparing the minority students who participated in the program to minority students who did not participate in the program and to the White students in the College of Natural Science.

The analysis of the data supported the hypothesis that program participation is associated with a higher frequency of degrees granted in the sciences to minority students at a large predominately White research institution.

Review of the data suggests that the program is graduating ethnic minorities students at higher rates than occurs in the minority student science population that did not participate in the Drew program. Forty-eight percent of the Drew participants received a degree in the sciences compared to 31 percent of the non Drew minority cohort. This is a significant finding in that the results indicate that the program is graduating 17 percent more minorities with a science degree. The Drew graduates are closer to the White cohort graduation rate of 52 percent. This suggests that the Drew program participants experienced success in a learning environment that supported them academically.

The comparison of input variables with the science degree further indicates that ACT scores and high school GPA were less of a factor for the Drew participants as it related to them receiving a degree in the sciences. The predicted GPA suggested a weaker relationship to the graduation rate for the Drew cohort than the non Drew cohort. The correlation analysis is the strongest statistical proof that the program works for the participants. The Drew program was able to mediate all of the input variables for these ethnic minority students. For non Drew participants the input variables were strongly related to this group receiving a degree in the sciences, more so than the White cohort. This supports the theory that participation in the Drew program intervened with pre-collegiate measures that are conventionally considered to inhibit achievement in college such as lower ACT scores and high school GPA.

The comparison to the intermediate variables to receiving the science degree indicates that the first semester GPA had a strong relationship for the non

Drew and Whites than for the Drew. The first semester math grade for the White cohort did not have a relationship to these students receiving a degree in the sciences. The math grade was a weaker relationship to receiving a science degree for the Drew (.254), than non Drew (.285), but White cohort (.202) had an even weaker relationship than the Drew cohort. The first semester grades of chemistry and biology had a weaker relationship to the Drew and non Drew receiving a science degree. The chemistry grade had a weaker relationship for Drew (.157) and non Drew (.161), but stronger than Whites (.381). The biology grade was a weaker relationship for non Drew (.299) than the Drew cohort (.329). The White cohort (.550) correlated to the biology grade stronger than the other two cohorts. The stronger relationship for the non Drew (.285) in the math grade to receiving a science degree indicates that for these students math was the course that may have caused these students to change from a science major. One factor that may explain why first semester grades were not a deterrent for ethnic minority students is that Michigan State University has a repeat credit policy that allows students to take a course again if they receive less than a 2.0 in the course. Drew students were advised to repeat the science or math course, if they received less than a 2.0 in the course the preceding semester, particularly, if they wish to receive a degree in the sciences. This study supports Seymour and Hewitt's (1994) findings that students who experience success in the gateway courses will remain in the sciences. The presence of a minority advisor and minority role models in the Drew courses of mathematics, biology, chemistry, and the freshmen seminar contributed to the students remaining in the sciences

(Seymour and Hewitt, 1994). The Drew program created a supportive climate, provided academic tutoring, support, and encouraged all of the students to become involved in campus life.

Relationship between First Semester grades, Predicted Versus Achieved GPA at the End of the First semester and Student Participation

The findings from this study support the hypothesis that the semester GPA will be higher than the predicted GPA for the Drew program participants. The intermediate variables of achieved versus predicted GPA found that Drew students consistently outperformed their predicted GPA. However, for the non Drew cohort, the findings were that they consistently scored lower than their predicted GPA at the end of the first semester at the university. The analysis of variances indicated that there were statistical differences between Drew and non Drew predicted versus achieved GPAs for all the years 93 to 98, but no statistical differences when Drew students are compared to the White students. The test of significance for White students indicated that there were no statistical differences between their predicted and achieved GPA after the end of the first semester at the institution.

The correlation analysis further supported the hypothesis. There were stronger relationships between the non Drew participants and White cohorts' predicted and achieved GPA, although the non Drew cohort achieved a much lower GPA than expected. This finding is important in that it indicates that the lack of intervention for ethnic minority students can lead to poor academic

performance.

The input variables used to predict college performance the first semester for Drew students were weakly related to the Drew students' performance. This supports the theory that intervention by the program mediated the prediction of low performance for the Drew cohort. For a point of comparison, when looking at the non Drew cohort, the students performed even lower than the first semester prediction. This supports the theory that ethnic minority students on large research campuses need intervention to overcome input variables in order to achieve a degree in the sciences.

The higher score for the Drew cohort may be due to the more rigid structure of the program that addresses the "total" student. This rigid structure stresses mandatory and consistent attendance in classes, concept review, study sessions, and the comprehensive advising component that is integrated throughout the program. The program is grounded in the premise that working with the "total" student maximizes the program's ability to assist students with the development of a sound academic foundation for success in studying the sciences and mathematics. Drew students were supported in making the transition from high school to college. Drew students were also assisted with management skills that are needed for successful negotiation of the campus environment and overall success within the academic system. The students were supported as they progressed through the university to help them reach their goals in the academic and social environment of the university. The program provided a supportive environment for personal growth, including intervention on behalf of the student.

Students were further assisted in the development of their critical thinking skills. Therefore, the first semester grades and the input variables for the Drew students were deemed less relevant and had a weak correlation.

Relationship of Grades in Chemistry, Mathematics, and Biology and Student Participation

After a review of the combined cohort data for the intermediate variables for the Drew students, the data analysis supported and contradicted the relationship between participation in the program and obtaining higher grades in mathematics, biology and chemistry for the Drew cohort. The Drew students achieved a higher grade in mathematics, Biology, and Chemistry than non Drew. There were statistical differences between the math and biology grades. However, there were statistical differences between the chemistry grades of the three cohorts of students. Although the Drew cohort did achieve a level of success in passing the course, they were not comparable to the White cohort. The math grade achieved by the Drew students indicated that they outperformed the White cohort, although statistically there was no difference between the grades of the two groups. There was no statistical difference between the Drew and Whites grades in biology as well, although, the biology grades of the Drew students were lower than the White cohort. The Drew students achieved a 2.55 GPA as compared to the White cohort that achieved a GPA of 2.81.

The correlation of the variables further clarified the relationship of the Drew program to grades received in math, chemistry, and biology. The data suggest

that program participants were more likely to receive higher grades in these core science courses, which enabled them to persist toward a degree. The correlation of semester grades and final GPA had a weaker relationship for the Drew students than the other cohorts. This indicates that having a high GPA the first semester was not a good predictor for having a high final GPA.

The data demonstrate consistently higher scores in mathematics and biology for the Drew participants when compared to the non Drew cohort. This is due in large part to the way these courses are structured. The mathematics and biology Drew components have "Directors", whose sole responsibility is to build, develop, and implement the mathematics and biology instruction for students in the program. They have terminal degrees in these disciplines and are involved in their respective disciplines on a professional level. Therefore, they also serve as minority scientific role models. The chemistry Drew component does not have a director. The program is assigned graduate teaching assistants by the chemistry department on a year to year basis. While the chemistry study sessions are mandatory, they do not receive the same attention as the mathematics and biology courses. Although the Drew students performed well, the scores for Drew were lower than non Drew in the years 1993, 1994, and 1996 (see appendix A).

Summary of Findings

The relationship of the analysis of variances (ANOVA) and correlation analysis of the input and intermediate variables demonstrated that the Drew

program was able to provide intervention that led to higher performance for the participants. It appears that participation in the program led to higher retention rates for the Drew students which led to higher percentages of them receiving degrees in the sciences. The Drew students graduated with a higher grade point average as well. Participation in the Drew program totally eliminates the predictive ability of the ACT scores and high school GPA. The Drew students' successes were not statistically related to the intermediate and input variables.

The results of the current study indicates that the Drew program participants performed much better academically than the non Drew minority cohort, and in the case of math, higher than the White cohort. This supports the hypothesis that the Drew program had a significant impact on science degrees awarded to ethnic minority students in the sciences at a large research university.

This study supports the fact that ethnic minority students who do make it though the pipeline to our universities require intervention programs that can insure that they remain at the university long enough to receive a science degree.

Implications for Theory Development

Tinto (1993) theorized that having students participate in a collaborative group enables them to develop a small supportive community of peers that bind them to a broader social community of the college, as well as engaging them more fully in the academic life of the institution. This is born out by this study.

The collaborative learning environment created by the Drew program supported the students in and out of the classroom. These collaborative learning settings allowed these students to bridge their academic and social lives, which may not always be possible for gifted minority students on a large campus.

Overall, findings from this study strongly support Tinto's (1993) theory. His research found that student involvement was correlated to student attainment. The Drew Program altered the institutional setting for these gifted minority students by focusing on constructing an educational setting where all students were involved and responsible for the education process.

Recommendation for Practice

A significant finding of this study is that minority students came to a large research university with high GPAs from high school and a lot of pride but lower entrance test scores (ACT) than Whites. Universities must recognize this and implement support structures that will equalize these students' experiences. Incoming students and their families need to be made aware, early in the process, what the institution, faculty and staff expects of them. This may take the form of extensive orientation for the parents and the students to inform them of the academic rigors of the university. Parents need to be encouraged to support their students when they experience self-doubt, and to advise them to take advantage of the academic resources available to them. Parents should also discourage extensive and/or too frequent weekend visits from their students. Weekends are critical study times for college students, particularly students

in the sciences.

Students need to learn how to study consistently and form good study habits, as well as time management skills. Many gifted minority students arrive on the university campus with poor study habits. Many of them had good reputations in high school as "smart" students and were given the benefit of the doubt in producing quality work by well meaning teachers. This was a bad habit that was detrimental to their success for some of them. Time management is a challenge for these students as their parents and the school previously had planned their time. Many of these students were at a lost as to how to effectively use the hours in the day when they were not in class. Institutions of higher learning must recognize that gifted minority students need guidance in developing these skills.

Students need to be motivated when the subject matter becomes challenging. This may be the first time they experience doubt about their academic ability. Minority role models and advisors are critical at this point. They can serve as mentors and motivators. Students need to be reminded that this is not the time to give up. They need to be encouraged to seek additional tutoring, if needed and to spend more time with the subject matter, much more than they did in high school. Students must be reminded of their dream to become a scientist, but it will come at a great sacrifice of study time and persistence.

Building the student's self esteem is critical to adjustment to the university's' environment and expectations. A retention program based on a

community of support can provide educationally disadvantaged students with the tools they need in order to be successful in the sciences at a large research institution.

Recommendations for practice are to focused on factors that affect the progress of gifted minority students at a research institution. Continued examination of their perception of the environment is warranted as retention issues are discussed. There needs to be continued evaluation on the quality of assistance given to minority students. Many universities offer support programs to some degree for all students, but these programs' effectiveness for the retention of ethnic minority students needs to be examined.

There are many factors that lead to success for these students that go beyond academics, including the presence of mentors, supportive parents, or academic peer groups. A recommendation for practice is to continue to identify key factors that lead to success in the sciences. Other factors that affect the progression of minority students need to be examined as well.

Socio- economic status can affect a student's progression at a university. The money available through financial support programs for students is at an all time low. Many minority students form lower socio-economics backgrounds are awarded work-study and loans to complete their financial aid packages. Therefore, these students are working more hours a week and this lessens the time that they have to study their science and math courses. How does this impact their grades and retention rate at the university?

The perception of family support is a factor. Many students feel

that they need to continue to be actively involved and take care of the problems at home. This may be in the form of financial assistance or moral support. Research needs to be done to determine how these factors affect the progression of ethnic minority students in higher education. Counseling will become an integral part of the program to help students deal with guilt for "abandoning" the family.

Identifying and clarifying factors associated with the progression of gifted minority students in the sciences at a large research institution is worthwhile to consider for future research. The data herein also illustrate that the progression for White students in the sciences is dismally low. A 50 percent graduation rate warrants a closer look at White students' experiences as well in the sciences at a large research university.

Finally, a recommendation for program directors, deans, and researchers is that on a regular basis a study of longitudinal, cohort analysis, and periodically combine cohort needs to be done to establish the effectiveness of the program, as well as Multiple Regression Analysis. This will speak to what, if any, changes need to be made as it addresses strengthening the academic requirements of the program.

Implications for Practice for the Drew Program

The implication for practice that supports collaborative learning environments, as well as the need for a pre-college level program where minority students are trained to be problem solvers and independent thinkers, who are capable of solving and guiding their academic progress toward graduation. The

analysis of the input variables is evidence of this as it is correlated to science degrees received.

The Drew participants' performance in the introductory chemistry courses should be a matter of concern, because the science curriculum requires two years of chemistry. Many minority students at the university may find the large chemistry lectures a challenge. If students experience success in the first year of chemistry they will progress on to the second year. Another factor for the Drew program is that teaching assistants are assigned on a year-by-year basis. There is no consistency for the students or the program. Training for the teaching assistants is done through the chemistry department. Training needs to be consistence with the training of the teaching assistants in math and biology that have program directors. Improved performance in chemistry may lead to a higher graduation rate in the sciences for program participants. The program might consider having a director in chemistry so that performances in biology and math can be duplicated in chemistry as well.

Provision needs to be made to integrate the Drew students. experience into the mainstream university. The Program directors are isolated from the academic departments and this has lead to students being caught in the middle of disagreements, between Drew directors and university program advisors in the college. Oftentimes students will receive conflicting advice about which course to take and are left confused as to what to do. Many advisors and faculty feel that a support program for minorities separating the minority students from the larger population and gives them preferential treatment and thus have adversarial

feelings toward the program. This can be remedied if the message comes from the Dean's office that this program is an integral part of the college and begin to education chairs and faculty in the College of Natural Science about the benefits of having such a program that will leads to higher numbers of minorities graduating. Further, the program is person dependent, and this can be detrimental to the effectiveness of the program if one of the directors decides to leave.

This study confirms the literature and the theory about minority students' retention in the sciences thus far. This study contributes to the current literature that demonstrates lower entrance scores and performance in high school does not have to inhibit success in college. This study further confirms that ACT scores and predicted GPAs should not be used as criteria for admission if minority students have academic support like the Drew program. The academic support that the Drew Program offers is a learning culture where expectations of academic success are high and every student's career goal is taken seriously. Students in the program have shared experiences of values and behaviors and they hold each other accountable for their academic progress. Students will report the lack of attendance or loss of faith of a fellow Drew peer to the director or advisors. Study sessions are often held on the weekend so that students are discouraged from going home. The advising component of the program consists of mandatory counseling sessions for each student throughout the freshmen year. Intervention is done as needed by the advisor as needed in the from of coaching or mentoring. The freshmen seminar course is taught both fall and

spring semester. This course consists of freshmen survival skills, introduction to university resources and key personnel. But most importantly the course introduces the students to the history of science participation for ethnic minorities and what is means to be a culturally competent scientist. The students are introduced to this concept through reading the book "Bad Blood, The Tuskegee Syphilis Experiment" by James H. Jones. The findings from the non Drew cohort confirm the relationship between the input variables and performances and the lack of support. This has major policy implications for Michigan State University and nationally.

Recommendations for future research of the program should be focused on the cultural component of the program that leads to a sense of community for the program participants. This can also be compared to the minority students who did not participate in the program. Research needs to be done that will address program participants' experiences at the university during the third and fourth year. We may find that intervention in the upper level courses is warranted. This may lead to a higher graduation GPA and entry into medical or professional school for these students. An alumni data base needs to be created to track where the graduates go upon receiving a science degree. Further study is needed to determine why Drew participants leave the university if they do not receive a degree in the sciences.

Summary

A study of this type can be a tool to begin conversations on college and universities campuses on how to address the disparity in the educational process

for minority students. It is evident from this study that the problem exists early in the pipeline. Outreach programs are urgently needed in the public schools that are predominately minority school systems. These schools must better prepare minority students to attend large universities that have rigorous curriculum and high expectations for achievement. Mechanisms must be put in place to address inequities before these students reach the college campus. There needs to be a recognition on the part of the faculty in the sciences and mathematics that some minority students may not have the necessary science and math background required to be successful in their courses, but with mentoring and an academic and moral support structure, they can succeed. It is hoped that this study will initiate discussions and conversations on college campuses on how to implement programs or learning communities that will lead to graduation of more ethnic minority students with degrees in the sciences who are prepared for professional schools or postgraduate programs.

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Appendixes
1993 -TABLES 1a.

Input Variables

Variable	Drew N=50	Non Drew Minorities N=191	F	Sig.
		ANOVAS		
High school GPA	3.32	3.03	11.482	.001
ACT verbal score	22.22	20.05	7.193	.008
ACT math score	21.68	19.99	6.116	.014
ACT science score	21.70	20.64	2.042	.155
ACT comp score	22.38	20.58	6.777	.010
Predicted GPA	2.43	2.31	2.007	.158

Input Variables

Variable	Drew N=50	White N=170	F	Sig.
		ANOVAS		
High School GPA	3.32	3.48	8.747	.003
ACT verbal score	22.22	23.18	2.051	.154
ACT math score	21.68	23.94	12.058	.001
ACT science score	21.70	24.35	18.661	.000
ACT comp score	22.38	24.21	11.876	.001
Predicted GPA	2.42	2.80	48.404	.000

1993 Tables 1b.

Intermediate Variables

Variable	Drew N= 50	Non Drew Minorities N=191	F	Sig.
		ANOVAS		
Semester GPA	2.55	2.16	5.107	.0259
Chemistry grade	2.07	2.26	.009	.923
Math grade	2.42	1.97	5.744	.018
Biology grade	2.05	2.38	.007	.934

Intermediate Variables

Variable	Drew N=50	Whites N=170	F	Sig.
		ANOVAS		
Semester GPA	2.55	2.79	3.306	.070
Chemistry grade	2.07	2.75	2.649	.107
Math Grade	2.42	2.39	.062	.804
Biology grade	2.05	3.03	9.848	.003

1993 –Tables 1c.

Output Variables

Variable	Drew N=50	Non Drew Minorities N=191	F	Sig.
		ANOVAS		
Science degree	31%	40%	1.574	.212
Non Science	68%	60%	NA	NA
Graduation rate	64%	44%	3.914	.049
Final GPA	3.11	2.74	2.662	.115

Output Variables

Variable	Drew N=50	Whites N=170	F	Sig.
Science degree	31%	32%	2.843	.096
Non Science	68%	68%	NA	NA
Graduation rate	64%	82%	4.487	.035
Final GPA	3.11	3.38	1.806	.191

1994- Tables 2a.

Input Variables

Variable	Drew N=54	Non Drew Minorities N=171	F	Sig.
		ANOVAS		
High school GPA	3.31	2.99	20.825	.000
ACT verbal score	20.36	19.05	3.467	.064
ACT math score	20.58	19.01	6.486	.012
ACT science score	21.23	21.28	2.535	.113
ACT comp score	21.06	19.74	4.669	.032
Predicted GPA	2.49	2.28	11.420	.001

Input Variables

Variable	Drew N=54	Whites N-149	F	Sig.
		ANOVAS		
High School GPA	3.31	3.55	21.551	.000
ACT verbal score	20.35	24.27	41.715	.000
ACT math score	20.58	25.07	61.069	.000
ACT science score	21.23	25.71	68.326	.000
ACT comp score	21.06	25.71	77.935	.000
Predicted GPA	2.49	2.83	54.319	.000

1994-Tables 2b.

Intermediate Variables

Variable	Drew N=54	Non Drew Minorities N=171	F	Sig.
		ANOVAS		
Semester GPA	2.81	2.09	31.199	.000
Chemistry grade	2.47	2.84	.341	.565
Math grade	2.61	2.18	3.160	.079
Biology grade	2.75	1.50	10.458	.005

Intermediate Variables

Variable	Drew N=54	Whites N=149	F	Sig.
		ANOVAS		
Semester GPA	2.81	2.89	.552	.458
Chemistry grade	2.47	3.01	4.960	.032
Math Grade	2.61	2.53	.017	.898
Biology grade	2.75	2.41	.011	.916

1994 –Tables 2c.

Output Variables

Variable	Drew N=54	Non Drew Minorities N=149	F	Sig.
		ANOVAS		
Science degree	44%	26%	2.843	.096
Non science	55.2%	74%	NA	NA
Graduation Rate	54%	29%	13.974	.000
Final GPA	2.89	2.69	1.782	.187

Output Variables

Variable	Drew N=54	Whites N=149	F	Sig.
		ANOVAS		
Science degree	44%	61.1%	3.343	.072
Non Science degree	55.2%	31%	NA	NA
Graduation rate	54%	37%	8.579	.004
Final GPA	2.89	3.22	4.577	.036

1995 –Tables 3a.

Input Variables

Variable	Drew N=58	Non Drew Minorities N=146	F	Sig.
		ANOVAS		
High school GPA	3.23	3.06	4.594	.033
ACT verbal score	21.34	19.29	5.537	.020
ACT math	21.02	19.65	4.170	.043
ACT science score	21.96	20.88	2.653	.105
ACT comp score	21.83	20.46	4.043	.046
Predicted GPA	2.45	2.33	3.499	.063

Input Variables

Variable	Drew N=58	Whites N=138	F	Sig.
		ANOVAS		
High school GPA	3.23	3.55	36.003	.000
ACT verbal score	21.34	24.71	21.747	.000
ACT math score	21.02	24.71	35.161	.000
ACT science score	21.96	25.46	41.654	.000
ACT comp score	21.83	25.17	34.592	.000
Predicted GPA	2.45	2.87	53.821	.000

1995 – Tables 3b.

Intermediate Variables

Variable	Drew N=58	Non Drew Minorities N=146	F	Sig.
		ANOVAS		
Semester GPA	2.65	2.20	12.301	.001
Chemistry grade	2.47	2.31	.499	.484
Math grade	2.53	2.03	6.466	.012
Biology grade	2.20	1.79	1.038	.315

Intermediate Variables

Variable	Drew N=58	Whites N=138	F	Sig.
		ANOVAS		
Semester GPA	2.65	2.90	4.635	.033
Chemistry grade	2.47	3.02	3.156	.080
Math grade	2.53	2.51	.009	.925
Biology grade	2.20	2.59	1.354	.249

1995- Tables 3c.

Output Variables

Variable	Drew N=58	Non Drew Minorities N=146	F	Sig.
		ANOVAS		
Science degree	52%	32%	3.883	.052
Non Science degree	48%	68%	NA	NA
Graduation rate	50%	52%	2.150	.144
Final GPA	2.739	2.736	.001	.981

Output Variables

Variable	Drew N=58	Whites N=138	F	Sig.
		ANOVAS		
Science degree	52%	51%	.024	.876
Non Science degree	48%	49%	NA	NA
Graduation Rate	50%	81%	.889	.347
Final GPA	2.74	3.28	29.223	.000

1996 – Tables 4a.

Input Variables

Variable	Drew N=67	Non Drew Minorities N=204	F	Sig.
		ANOVAS		
High school GPA	3.38	3.11	10.179	.002
ACT verbal score	21.78	19.55	7.696	.005
ACT math score	21.60	19.73	6.147	.014
ACT science score	20.98	20.79	.064	.801
ACT comp score	21.73	20.36	3.878	.050
Predicted GPA	2.53	2.36	5.030	.026

Input Variables

Variable	Drew N=67	Whites N=170	F	Sig.
		ANOVAS		
High School GPA	3.38	3.61	17.914	.000
ACT verbal score	21.78	24.59	20.270	.000
ACT math score	21.60	24.58	18.844	.000
ACT science score	20.98	25.81	65.588	.000
ACT comp score	21.73	25.43	46.340	.000
Predicted GPA	2.53	2.83	28.441	.000

1996 –Tables 4b.

Intermediate Variables

Variable	Drew N=58	Non Drew Minorities N=146	F	Sig.
		ANOVAS		
Semester GPA	2.67	2.32	4.053	.045
Chemistry grade	2.70	2.87	.502	.481
Math grade	2.85	2.31	4.660	.032
Biology grade	2.95	1.75	12.028	.001

Intermediate Variables

Variables	Drew N=58	Whites N=138	F	Sig.
		ANOVAS		
Semester GPA	2.67	2.74	.860	.355
Chemistry grade	2.70	2.98	3.645	.059
Math grade	2.85	2.63	.249	.619
Biology grade	2.95	2.87	.027	.871

1996- Tables 4c.

Output Variables

Variable	Drew N=67	Non Drew Minorities N=204	F	Sig.
		ANOVAS		
Science degree	52%	23	8.182	.005
Non science	48%	77%	NA	NA
Graduation rate	37%	46%	2.57	.113
Final GPA	3.04	2.91	1.370	.244

Output Variables

Variable	Drew N=67	Whites N=159	F	Sig.
Science degree	52%	60.7%	.559	.456
Non science	48%	39.3%	NA	NA
Graduation rate	37%	74%	2.059	.153
Final GPA	3.04	3.26	4.644	.033

1997 – Tables 5a.

Input Variables

Variable	Drew N=62	Non Drew Minorities N=187	F	Sig.
		ANOVA		
High school GPA	3.27	3.13	3.740	.054
ACT verbal score	19.93	20.75	1.468	.227
ACT math score	19.71	20.76	2.504	.115
ACT science score	20.86	21.17	.222	.638
ACT comp score	20.52	21.26	1.510	.220
Predicted GPA	2.49	2.41	1.508	.221

Input Variables

Variable	Drew N=62	Whites N=170	F	Sig.
		ANOVAS		
High School GPA	3.27	3.62	57.982	.000
ACT verbal score	19.93	24.51	52.908	.000
ACT math score	19.71	25.12	80.750	.000
ACT science score	20.86	25.71	86.750	.000
ACT comp score	20.52	25.52	106.738	.000
Predicted GPA	2.49	2.88	81.596	.000

1997- Tables 5b.

Intermediate Variables

Variable	Drew N=62	Non Drew Minorities N=187	F	Sig.
		ANOVAS		
Semester GPA	2.65	2.17	12.373	.001
Chemistry grade	3.19	2.90	.002	.969
Math grade	2.58	2.15	6.983	.009
Biology grade	2.44	1.97	3.617	.062

Intermediate Variables

Variable	Drew N=62	White N=170	F	Sig.
		ANOVAS		
Semester GPA	2.65	2.84	2.564	.111
Chemistry grade	3.19	3.19	2.711	.103
Math grade	2.58	2.57	.012	.911
Biology grade	2.44	2.64	1.117	.294

1997 –Tables 5c.

Output Variables

Variable	Drew N=62	Non Drew Minorities N=187	F	Sig.
		ANOVAS		
Science degree	59%	32%	4.613	.036
Non science	41%	68%	NA	NA
Graduation Rate	35%	51%	4.576	.033
Final GPA	2.93	3.16	3.968	.051

Output Variables

Variable	Drew N=62	Whites N=170	F	Sig.
		ANOVAS		
Science degree	59%	55%	.145	.705
Non science	41%	36%	NA	NA
Graduation Rate	35%	51%	3.884	.050
Final GPA	2.93	3.31	13.206	.000

1998 –Tables 6c.

Input Variables

Variable	Drew N=57	Non Drew Minorities N=172	F	Sig.
		ANOVAS		
High school GPA	3.20	3.13	1.044	.308
ACT verbal score	20.55	19.47	1.669	.198
ACT math score	20.74	19.94	1.080	.300
ACT science score	20.63	20.47	.044	.834
ACT comp score	20.97	20.35	.793	.374
Predicted GPA	2.44	2.38	.843	.359

Input Variables

Variables	Drew N=57	Whites N=155	F	Sig.
		ANOVAS		
High School GPA	3.20	3.60	69.629	.000
ACT verbal score	20.55	24.21	33.256	.000
ACT math score	20.74	24.21	65.763	.000
ACT comp score	20.97	25.52	75.468	.000
Predicted GPA	2.44	2.87	85.388	.000

1998-Tables 6b.

Intermediate Variables

Variable	Drew N=57	Non Drew Minorities N=172 ANOVAS	F	Sig.
Semester GPA	2.79	2.26	9.486	.002
Chemistry grade	3.19	2.34	5.585	.020
Math grade	2.77	1.96	13.467	.000
Biology grade	2.71	1.94	4.125	.047

Intermediate Variables

Variable	Drew N=57	Whites N=155 ANOVAS	F	Sig.
Semester GPA	2.79	2.81	2.499	.116
Chemistry grade	3.19	3.15	2.369	.127
Math grade	2.77	2.57	.770	.382
Biology grade	2.71	2.82	.001	.969

VITA

The author was born in Jackson, Alabama to Lonnie (LJ) and Nettie Armstead Stallworth. She was the second of nine daughters born to the couple. She attended public schools in Mobile County and graduated from Citronelle High School in 1974.

She entered Tuskegee Institute (University) in August 1974 and was granted the Bachelor of Science degree in May 1978. She attended Purdue University and completed her Master of Science in 1981. The author entered Michigan State University graduate school while serving as the director of the Charles Drew Science Enrichment Program in the College of Natural Science. She was granted the doctor of philosophy degree in the summer of 2002.

The author is married to Willie M. Reed, DVM, PhD and they have two children, a daughter, Kimberly age 23 (B.A., M.A. Hampton University), and a son, Brandon, age 18 (freshmen at Georgia Institute of Technology).