5-2008

The Association between Socioeconomic Status and High School Mathematics Scores and Enrollment Rates in Virginia Public Schools.

Kathy A. Johnson
East Tennessee State University

The Association Between Socioeconomic Status and High School Mathematics Scores and Enrollment Rates in Virginia Public Schools

---

A dissertation

presented to

the faculty of the Department of Educational Leadership and Policy Analysis

East Tennessee State University

In partial fulfillment

of the requirements for the degree

Doctor of Education

---

by

Kathy A. Johnson

May 2008

Dr. Jasmine Renner, Chair
Dr. James Lampley
Dr. George Poole
Dr. Terrence Tollefson

Keywords: Socioeconomic Status (SES), Mathematics, Economically Disadvantaged, Enrollment Rates, Ethnicity, Poverty

ABSTRACT

The Association Between Socioeconomic Status and High School Mathematics Scores and Enrollment Rates in Virginia Public Schools

by

Kathy A. Johnson

The purpose of this study was to determine if socioeconomic status for the ethnic groups of white, black, Hispanic, and Asian is a significant indicator of mathematical performance and student participation in higher level courses. The SOL test scores of all high school mathematics students in Virginia for the 2005-2006 school year, their ethnic group membership, and their economically disadvantaged classification were as used to determine if such an association exists. Data provided by the Virginia Department of Education consisted of 113,786 Algebra I scores, 95,898 Geometry scores, and 68,944 Algebra II scores. Descriptive statistics, chi-square tests, and a Two-way ANOVA were used to determine the variables that were highly significant indicators of mathematical performance and enrollment ($p<.001$).

DEDICATION

This study is dedicated to:

The memory of my father, Wayland Johnson, whose gentle spirit is still missed;

my brother, Josh Johnson, the child I never had;

and Jeff Cassell, my comforter during the breakdowns, my encourager during the long periods of doubt, my best friend throughout the entire doctoral program, and the love of my life.

CONTENTS

LIST OF TABLES

LIST OF FIGURES

CHAPTER 1

INTRODUCTION

The effects of generations of minimal education are difficult to change(Payne, 2003). There are many emotional, psychological, and even physical ties to maintain the status quo of families. This is especially true of families in poverty (Payne). A common belief is that socioeconomic status is the most, or at least one of the most, prevalent factors in student academic performance (Gershoff, 2003; Pellino, 2005; Rank, 2004; Teachman, 1997). Other factors in student performance include family structure, parental educational level, parental involvement in school related activities, and gender. However, some of these can be directly related to the lower socioeconomic status of families (Barr, 2002; Brown, 1999).

The fight against the negative effects of poverty on education gained national attention in the 2004 presidential election when Powell (2001, p.1) reported Democratic Vice-Presidential candidate John Edwards claim that "poverty is the greatest moral issue of our century. It is this generation's civil-rights movement".

Almost 13 million American children live in families with incomes below the federal poverty level (NCCP, 2006b). Poverty has negative educational, psychological, and physical effects on children (Roeper Review, 2003). Education is the most important element in breaking the bonds that hold America's youth in poverty (Klem & Connell, 2004; Payne, 2003). There is little doubt that teachers affect students' lives; the effects can be either positive or negative (Barr, 2002; Brown, 1999; Payne). A recurring theme in breaking the cycle of poverty for a child is a teacher, coach, counselor, or someone in the educational setting who created and nurtured a meaningful, encouraging relationship with that child (Payne).

High teacher expectations were also found to be an important factor in positively influencing students' attitudes toward education (Klem & Connell, 2004; Payne, 2003; Pellino, 2005; Singham, 2003). With the enactment of the No Child Left Behind Act of 2001 (NCLB), improving the curriculum by increasing course requirements has been shown to have a similar positive effect on traditional underachieving students (Burris, Heubert, & Levin, 2006). Finishing a course beyond the level of Algebra II more than doubles the odds that a child will complete a bachelor's degree (Singham). Increasing academic standards and decreasing inequality between social and economic groups are stated goals of NCLB (Schiller & Miller, 2003). The standards movement has become the source of much debate in the educational community of the United States.

Because of the NCLB legislation, each state was required to develop educational standards. The development of standards precipitated the development of testing. High stakes (standardized) testing has become commonplace in the educational system today. In Virginia, tests are based upon the Standards of Learning (SOL). These standards were developed for every grade level and course taught in Virginia public schools (VDOE, 2003).

Because mathematics education is considered to be an integral part of education in the United States, this study focused upon the association of socioeconomic status and ethnicity with Algebra I, Geometry, and Algebra II End-of-Course Standards of Learning test scores of students in Virginia's public schools based upon their classification of economically disadvantaged or not economically disadvantaged and ethnic classification.

Statement of the Problem

The purpose of this study was to determine if socioeconomic status and ethnicity are significant indicators of high school mathematical performance and student participation in higher level mathematics courses in the Commonwealth of Virginia.

Student achievement in mathematics and reading is the primary focus of NCLB. This study determined the associations between students' socioeconomic status and the scores of students taking the Virginia Standards of Learning assessments in the high school mathematics classes of Algebra I, Geometry, and Algebra II, as well as their participation rates in the upper level mathematics class of Algebra II which is not a required course. Additionally, this study examined the relationship of socioeconomic status and test scores for the ethnic groups of white, black, Hispanic, and Asian. The SOL scores of all high school mathematics students for the 2005-2006 school year as well as their membership in any of the above-mentioned ethnic groups and their classification of economically disadvantaged or not economically disadvantaged were used to determine if such an association exists. The data consisted of 113,786 Algebra I scores, 95,898 Geometry scores, and 68,944 Algebra II scores.

Research Questions

Question 1

To what extent, if any, is there a significant difference between the participation rates of students who are classified as economically disadvantaged and the students who are classified as not economically disadvantaged among ethnic groups (white, black, Hispanic, and Asian) in the required high school mathematics classes of Algebra I and Geometry and the non-required class of Algebra II?

Question 2

To what extent, if any, is there a significant difference between the pass rates of students who are classified as economically disadvantaged and the students who are classified as not economically disadvantaged on the End-of-Course Standards of Learning tests for the required high school mathematics classes of Algebra I and Geometry and the non-required class of Algebra II?

Question 3

To what extent, if any, is there a significant difference between the pass rates of students from differing ethnic groups (white, black, Hispanic, and Asian) on the End-of-Course Standards of Learning tests for the required high school mathematics classes of Algebra I and Geometry and the non-required class of Algebra II?

Question 4

To what extent, if any, is there a significant difference between scores for students who are classified as economically disadvantaged and the students who are classified as not economically disadvantaged as measured by the End-of-Course Standards of Learning test scores in the required high school mathematics classes of Algebra I and Geometry and the non-required class of Algebra II as a function of ethnicity?

Significance of the Study

In the 2013-14 school year, 100% of the students taking the Virginia Standards of Learning assessments must receive a passing score. It is imperative the Virginia Department of Education, local school systems, administrators, guidance counselors, teachers, and students know the reasons that are preventing a 100% pass rate currently. This study will attempt to determine if an association exists between socioeconomic status, ethnicity, or a combination of the two and the test scores and enrollment rates in the high school mathematics courses of Algebra I, Geometry, and Algebra II in Virginia Public Schools. If such an association does exist, it is important that all of the above mentioned parties recognize this association and take the appropriate steps to change the current trend.

Definitions of Terms

Economically Disadvantaged—In Virginia public schools, a student is classified as economically disadvantaged if the student is eligible for Free or Reduced Meals, receives Temporary Assistance for Needy Families (TANF), or is eligible for Medicaid (Virginia Department of Education [VDOE], 2005).

Enrollment Rate—Class enrollment rate is the percentage of students of similar classification who are registered for a particular class in any given year.

Ethnicity—Ethnicity is a term that can be used interchangeably with “race” or “racial groups” in this study. In Virginia, there are several ethnic groups in which students may indicate membership—American Indian, Asian, black, Hispanic, or white. Students also have the option to not indicate ethnicity. For the purposes of NCLB reporting, Virginia reports only results from three ethnic groups—black, Hispanic, and white.

Federal Poverty Level (FPL)—The FPL is the minimum amount of income that a family needs for food, clothing, transportation, shelter, and other necessities. In the United States, this level is determined by the Department of Health and Human Services. FPL varies according to family size and the number is adjusted for inflation and reported annually in the form of poverty guidelines (The Free Dictionary, 2007).

Socioeconomic Status—Socioeconomic status (SES) is a measure of an individual or family's relative economic and social ranking (National Center for Educational Statistics [NCES], 2007). A family's SES is generally determined by the education level of father and mother, the occupation of father and mother, and family income.

Standard Credit—"A standard credit is based on a minimum of 140 clock hours of instruction and successful completion of the requirements of the course" (Career and Technical Education Services [CTE], 2006, p.9-1).

Verified Credit—A verified credit is based on a standard credit plus a passing score on the End-of-Course SOL test (CTE).

Virginia Standards of Learning—Standards of Learning (SOL) for Virginia Public Schools express the Commonwealth's expectations for student learning and achievement in grades K-12 in English, mathematics, science, history and social science, technology, the fine arts, foreign language, health and physical education, and driver education (VDOE, 2007c). SOL tests are criterion-referenced assessments that evaluate individual student performance of these standards.

Delimitations

This study is delimited to the Commonwealth of Virginia. The results may not be generalized to other states.

Limitations

A student is labeled economically disadvantaged if the student is eligible for Free or Reduced Meals, receives Temporary Assistance for Needy Families (TANF), or is eligible for Medicaid (VDOE, 2005). There may be students who are economically disadvantaged but whose families do not apply for Free or Reduced Meals or seek these other social services; therefore, they are not identified by the school system as economically disadvantaged.

Overview of the Study

This study is organized and presented in five chapters. Chapter 1 includes a general introduction, the statement of the problem, the research questions, the significance of the study, definitions of unfamiliar terms, delimitations, and limitations of the study. Chapter 2 contains a review of related literature pertinent to the problem. Chapter 3 presents the methodology and procedures used to obtain data. Chapter 4 contains the analysis of data and Chapter 5 includes conclusions, recommendation for practice, and recommendations for further study.

CHAPTER 2

REVIEW OF LITERATURE

Introduction

Chapter 2 contains a review of current and historical literature and information concerning socioeconomic status, ethnicity, and high school mathematics performance. It is organized into six sections that have specific relationships to the teaching of mathematics, state standards as mandated by No Child Left Behind, and students classified as economically disadvantaged.

Students and Poverty

Children from poverty start out in life at a disadvantage. Children from poor families do not have the same experiences as children of other social classes (Pellino, 2005). The more income a family has the better the children function academically, socially, and physically (Gershoff, 2003). Children who spend 1 to 3 years of their adolescence in a family below the poverty level are about 60% less likely to graduate from high school than children who have never been poor. Children who spend 4 years of their adolescence living in a family below the poverty line are about 75% less likely to receive a high school diploma (Teachman, Paasch, Day, & Carver, 1997).

In the Quality Counts 2007 Report, Olson (2007a) related that there were 73 million children in the United States from birth through age 18. About 40%, 28.4 million, lived in families with annual earnings of $40,000 or less, twice the federal poverty level (FPL) for a family of four. Just over 18% lived in families earning less than $20,000. “A child who comes to school malnourished, from a poor household, having a mother with less than a high school education, or a parent whose primary language is not English is much more likely than a classmate without those factors to have academic and behavioral problems later on" (Olson, 2007a, p.1).

According to the National Center for Children in Poverty [NCCP] (2006b), nearly 13 million American children in the United States lived in families with incomes below FPL, $20,000 a year for a family of four. The number of children living in poverty increased by more than 11% between 2000 and 2005. There were 1.3 million more children living in poverty in 2005 than in 2000, despite indications of economic recovery and growth.

Poverty is detrimental to psychological well-being as well. The National Institute of Mental Health (NIMH) data indicated that low-income individuals were two to five times more likely to suffer from a diagnosable mental disorder than were those of the highest socioeconomic group. Poorer children were at greater risk than higher income children for a variety of problems, including damaging effects on IQ, poor academic achievement, poor socioemotional functioning, developmental delays, and behavior problems (Roeper Review, 2003). In the United States, if one does not have at least a ninth-grade reading level, it is very difficult to move out of poverty (Shaughnessy, 2005).

The probability of dropping out of high school is higher for students from lower-income families. Nine percent of high school students from families with incomes below the FPL dropped out of school during a 1-year period ending in October 1999. Just two percent of students from families with incomes of $40,000 or more left school before graduation (Jamieson, Curry, & Martinez, 2001).

A good education is often the only means of breaking the cycle of poverty for poor children. Conditions that contribute to student success include high standards for academic learning and conduct, meaningful and engaging pedagogy and curriculum, professional learning communities among staff, and personalized learning environments (Klem & Connell, 2004).

The key to achievement for students from poverty is creating relationships with them. The most noteworthy motivator for these students is a positive personal relationship. Teachers have tremendous opportunities to influence some of the non-financial resources that make a difference in students' lives (Payne, 2003). An important factor affecting student learning is the teacher. Relationships between teachers and children in poverty are crucial for those children to succeed. Children will work harder for teachers who they like (Communication Connects, 2002). "When students who have been in poverty (and successfully made it into middle class) are asked how they made the journey, the answer nine times out of 10 has to do with a relationship — a teacher, counselor, or coach who made a suggestion or took an interest in them as individuals" (Payne, 2003, p.110).

Students need to feel teachers are concerned for them; that adults in the school know and care about them (Klem & Connell, 2004). However, about 38% of the students across all racial groups said they did not feel close to any of their teachers. Black and Hispanic students were more likely than white and Asian students to say their teachers did not really know what they were capable of academically (Lewis, 2003).

Poverty should not be an excuse for teachers to expect less from students. Being in poverty is rarely about a lack of intelligence or ability (Payne, 2003). The American Psychological Association (APA) asserted the beliefs about the poor and about families on welfare, by those not in those circumstances, tended to reflect attitudes and stereotypes that attributed poverty to personal failings rather than to socioeconomic structures and systems and ignored the strengths and competencies in those groups (Roeper Review, 2003). Teachers need to focus on the learning of poor students, find ways to help them overcome the challenges that hinder their learning, and help them gain the most they can from their education (Pellino, 2005). According to Payne (2003, p.148), "The role of the educator is not to save the individual, but rather to offer a support system, role models, and opportunities to learn, which will increase the likelihood of the person's success. Ultimately, the choice always belongs to the individual." It is the responsibility of educators who work with children of poverty to teach the skills that will allow the individual to make that choice. Teachers are one of the biggest hopes in their students' lives. When teachers have trouble interacting with students, they have difficulty teaching them (Brown, 1999). A caring school environment may influence student academic performance. For students to take advantage of high expectations and more advanced curricula, they need support from the people with whom they interact in school (Klem & Connell, 2004).

Singham (2003) found the impact of teacher expectations to be three times as great for blacks as for whites. It was also larger for girls and for children from low-income families. Eighty-one percent of black females and 62% of black males wanted to please the teacher more than they did a parent. Consequently, a good teacher can have a markedly positive effect on all students but most especially upon minority students.

Barton's (as cited in Holloway, 2004) research showed minority students as a group experienced a less rigorous curriculum. Lower expectations for those students often denied them from the opportunity to take more rigorous courses because of inadequate prior preparation. Nevertheless, the most widely accepted conception of what and how to teach disadvantaged students emphasizes "the basics". Children of poverty are often taught less than they are capable of learning (Knapp & Shields, 2005).

All students do not arrive at school with the same ways of thinking, speaking, and interacting with others. Teacher expectations for student success are very important. Disadvantaged students often see no purpose in skills-based learning tasks. Therefore, they need help to find meaning in what they do in school (Knapp & Shields, 2005). Likewise, research on dropouts showed that many, while fully appreciating the importance of educational credentials, did not believe that such credentials are of much help in their particular social situations (Madaus & Clarke, 2001). Teachers should provide each student with a rigorous curriculum and have high expectations for all students. Students for whom teachers held low expectations for academic achievement were taught less effectively than those for whom high expectations are held (Brown, 1999). Cooperative learning and shared decision making can help foster a sense of community and promote the development of relationships, both student-teacher and student-student relationships. This can help students of poverty develop a sense of belonging and a sense of connectedness to their school (Pellino, 2005). Learning experiences and problem-solving based on real-life problems can help them cope with some of the issues they may be faced with in their lives (Pellino). Brown pointed out that students who are racially, ethnically, economically, and linguistically different from middle-class white Americans are no less eager to learn. However, they learn for different reasons. The challenge for teachers is to make sure students see some connections between what they are being asked to learn and how they live.

Barr (2002) encouraged teachers to be effective in teaching children of poverty by visiting the home and finding out what kind of conditions the students come from. ”If teachers, with their middle class belief system, could see the conditions that their students exist in, they would be far less critical when students do not have their homework, sleep in class, have negative attitudes, etc.” (Barr, ¶ 8) “Schools can enrich the students’ education by focusing on school work, not homework, providing intense efforts to teach basic skills as soon as possible, reorganizing units of instruction into short modules, and building pride and self-confidence” (Barr, ¶ 10).

Poverty has a variety of detrimental effects on children's education. Poverty is closely tied to hunger and undernutrition, which can affect the overall ability of children to learn (Rank, 2004). Poverty is associated with children's health problems; for example, lead poisoning from their home environment. Elevated lead levels have been shown to significantly impair children's cognitive abilities. Children's education is also impacted by family resources that are unavailable to supplement and enhance their learning. Poor families have access to fewer books, computers, and learning opportunities outside the classroom. Finally, poverty can create a stressful home and neighborhood environment. Crime or violence can make the process of learning more difficult (Rank).

Research has found that participation in intensive, high-quality early-childhood education can improve school readiness. Olson (2007c) contended children who attended such programs were less likely to drop out of school, repeat grades, or need special education services than children who had not had such experiences. As adults, they are less likely to commit crimes, more likely to be employed, and likely to have higher earnings (Olson, 2007c). Within the black population, one out of four men who reaches age 25 will have spent time in prison or on a suspended sentence, while three out of four of their white counterparts will have gone to college (Rank, 2004).

In the wake of NCLB, the achievement of diverse ethnic groups, along with the achievement of the economically disadvantaged, has come to the forefront of the American education system. In the South, the numbers in all subgroups have increased dramatically. The South experienced a 9% increase in the number of children living in poor families, rising from 4.9 million in 2000 to nearly 5.4 million in 2004 (NCCP, 2006b). In the South, children of immigrants experienced a 6% increase in poverty during the same time period, while children living with native-born parents experienced only a 1% poverty increase. Almost one third (1.13 million) of children with immigrant parents in the South are poor (Douglas-Hall & Koball, 2006). Poverty is especially prevalent among black, Latino, and American Indian children. Thirty-five percent of black children, 28% of Latino children, and 29% of American Indian children live in poor families while 11% of Asian children and 10% of white children live in poor families (NCCP, 2006b). However, in a recent study, Sirin (2005) stated that socioeconomic status was a stronger predictor of academic achievement for white students than for minority students.

The National Center for Fair and Open Testing (FairTest), a national assessment reform advocacy organization, has found in several studies that testing was more prevalent in southern states than elsewhere; they tested more and the tests were more likely to have high-stakes consequences (Madaus & Clarke, 2001). Most of the states with high school graduation exams are in the South. In a study that examined the 10 states with the lowest dropout rates and 10 states with the highest dropout rates, the 10 states with the highest dropout rate used minimum competency tests with higher stakes and less flexible standards than did the states with the lowest dropout rates.

The Century Foundation Task Force (2002) discovered that there were approximately 8,600 high-poverty schools that the U.S. Department of Education called underperforming. There were no high-poverty school districts that performed at high levels. The national profile for failing schools indicated that each enrolled a high percentage of racial, ethnic, economic, and linguistic minorities (Brown, 1999). Southern states tended to have a far larger proportion of students at "below basic" in both reading and mathematics than do states in other regions (Madaus & Clarke, 2001).

Because public education is funded largely through local real estate taxes, those who grow up in poor households were likely to be living in lower-income areas. These communities, in turn, were limited in the amount of financial resources they could devote to their school systems (Rank, 2004). Children with the greatest need for a good education were often in schools that were struggling to acquire the bare essentials. Publicity about test scores can create the false impression that teachers are very effective in rich communities and do little of worth in poor schools (Orfield & Kornhaver, 2001).

Rank (2004) purported that leveling the vast financial differences that currently exist across school districts is essential. He stated that pressure should be brought to bear on the federal and state governments to balance the glaring disparities in school financing. Poorer districts would in turn be accountable for spending the additional money wisely, hiring qualified teachers, and building a strong curriculum that can make a significant difference in the education of poorer children. However, in research done by Okpala, Okpala, and Smith (2001) the results showed the percentage of students in free or reduced price lunch programs was statistically significant in explaining difference in mathematics achievement scores while the level of instructional expenditures per student was not.

Consequently, there seems to be no consensus among researchers as to whether the level or distribution of educational funding has an effect on student outcomes. Hanushek (as cited in Toutkoushian & Curtis, 2005) argued that spending had little or no effect on outcomes, while Berliner and Biddle (as cited in Toutkoushian & Curtis, 2005) concluded that spending did affect outcomes. Another financial factor found by McNeil and Valenzuela (as cited in Kornhaver & Orfield, 2001) indicated that funds schools did have previously had been siphoned away from substantive educational resources and poured into test-preparation purchases. "Money has been redirected toward consultants who align curriculum and instruction with the test and toward forms of professional development which emphasized score-raising techniques more than teacher's subject matter knowledge or pedagogy" (McNeil & Valenzuela as cited in Kornhaver & Orfield, p.10).

If children are not educated, they do not have a choice to leave poverty. The skills assessed by minimum competency exams (MCE) have been shown to have large associations with labor market outcomes 10, 20, and 30 years after high school graduation. Students who are motivated by a MCE graduation requirement to learn more in high school will be rewarded by the labor market (Bishop & Mane, 2001). Higher education is one of the most effective ways parents can raise the families' incomes. There is clear evidence that higher educational attainment is related to higher earnings. Nationally, 82% of children whose parents have less than a high school diploma live in low-income families while only 24% of children whose parents have some college education live in low-income families (NCCP, 2006a). In Virginia, 76% of families with parents with no high school diplomas are low-income and 15% of families with education beyond high school were low-income families (NCCP, 2002b).

Brown (1999) contended that many Americans did not accept the belief that we are all diminished when any segment of our population is undereducated. "While we understand that the cost to society for providing services for the undereducated far exceeds the cost of providing adequate education for all segments of the population, the higher cost seems to be one that Americans are willing to pay" (Brown, p. 64).

Teaching Mathematics

In every school across the country, students are taught and expected to learn mathematics. Due to the No Child Left Behind Act of 2001 (NCLB), academic standards have been established for all students. Especially in mathematics, standards are becoming international. Mathematics taught in one country is not vastly different from mathematics taught in another country. Number systems operate in exactly the same way regardless of the race, gender, ethnicity, or religion of the person performing the mathematical operation (Ravitch, 1995). In the United States, mathematics curriculum (or content) standards were developed, in part, by the development of international standards. Yet international studies suggested that by the middle grades, U.S. students know and understand less mathematics than do their peers in many Asian and European countries (Sheldon & Epstein, 2005).

In order to achieve success in helping all students meet the standards, some schools adopted low-track classes with a slower paced curriculum for low achievers and high-track classes with enriched and accelerated instruction for high achievers (Burris et al., 2006). Educational reformers and most members of the American public have concluded that teachers require too little of their low-income pupils (Bishop & Mane, 2001). This seems to be substantiated by a prominent study by Columbia University and neighboring South Side High School in Rockville Center, NY that indicated school's accelerated and enriched "best curriculum", traditionally reserved for their highest achievers, was the best curriculum for all students (Burris et al.). To support this claim, analyses of international studies such as the Second International Mathematics Study (SIMS) and the Third International Mathematics and Science Study (TIMSS) were used. Data from SIMS and TIMSS indicated a traditional low-track, remedial curriculum actually depressed the mathematics performance of American students rather than improving it (Burris et al.).

Several studies have found that highly competent children who lived in lower socioeconomic neighborhoods were sometimes being held back by the academic pace that tended to characterize classrooms with large proportions of children who displayed difficulties in learning (D'Agostino, 2000; Maggi, Hertzman, Kohen, & D'Angiulli, 2004: Nye, Hedges, & Kostantopoulos, 2001). Less stimulating academic climates are created by a high proportion of children who face learning difficulties and by the lack of attention from a teacher who is focused on children who require additional support (Maggi et al.).

In the study conducted by Burris, Heubert, and Levin (2006), no evidence was found that indicated initial high achievers learned less when all students were accelerated in mathematics and studied in untracked classes. This “universal acceleration” produced no evidence that increased numbers of students fell behind grade level or dropped out of mathematics as a result of this reform. In fact African American and Latino students who participated in the study exceeded the national rates for Asian-Pacific Islanders (the student group that exhibited the highest level of participation in advanced mathematics study). The percentage of low socioeconomic status students studying and passing a trigonometry course and the state examination more than doubled, from 32% to 67%.

In a similar study conducted by the U.S. Department of Education, Adelman (as cited in Singham, 2003) found that a measure of academic resources made up of a composite of high school curriculum, test scores, and class rank, has much greater power than socioeconomic status in predicting college completion. Within the high school curriculum, the highest level of mathematics a student has studied has the strongest effect on degree completion. Finishing a course beyond the level of Algebra 2 more than doubles the odds that a student who enters college will complete the requirements for a bachelor’s degree. Improving the curriculum for African American and Latino students is far more positively pronounced than any other measure and consistently overwhelms demographic variables as gender, race, and socioeconomic status. “Improving the high school curriculum has a disproportionately positive effect on students from groups that traditionally underachieve” (Singham, p.587). Murnane (as cited in Levin, 2001) found that one standard deviation difference in test scores has been associated with about 3-4% difference in earnings. “Mathematics test results always demonstrated a statistically significant effect on estimations of earnings while reading test results demonstrated a statistically insignificant or negative effect” (Levin, p.41).

In a study in which university students were questioned about their high school experiences, Thompson and Joshua-Shearer (2002) reported several interesting findings. Forty-three percent of the students surveyed recommended high schools should “provide students with better math preparation”. Unfortunately, high school mathematics teachers appeared to be unsuccessful with many students. More than half of the students surveyed said that mathematics was their most difficult high school subject. A substantial percentage of the college students, especially African American students, said they needed mathematics tutoring once they reached the university level. They also expressed some dissatisfaction regarding the quality of their high school mathematics and science instruction. Mathematics and science teachers were cited as “worst” teachers more frequently than others.

A significant amount of research indicates that attitude toward mathematics is associated with achievement. Researchers have shown that parents’ beliefs and expectations for their children in mathematics predict student achievement in mathematics classes (Sheldon & Epstein, 2005). For students to attain higher achievement, teachers must support and facilitate parental involvement in mathematics. However, compared to other school subjects, home-school partnerships in mathematics are the most difficult to develop. Gal and Stoudt (as cited in Sheldon & Epstein) suggested three reasons why parents may not be involved in their children's mathematical education. First, as mathematics becomes increasingly complex across the school years, parents may not have the content knowledge needed to help their children. Second, changes in the way mathematics is taught may result in parents' hesitance to help their children. Third, teachers are not trained to teach adults how to work on mathematics with their children (Sheldon & Epstein). Parents who were not particularly good mathematics students themselves had a tendency to justify and consequently reinforce their children's negative attitude toward mathematics.

Mathematics anxiety also produces a negative effect on achievement. In McCoy's (2005) study, students had a significantly more negative attitude toward mathematics ***after*** completing Algebra I. Significant differences in algebra achievement along with evidence to attribute these differences to student characteristics and to teachers' pedagogical skill were found. The implications of these findings for educators are to encourage and help all students, particularly poor and minority students, to improve their achievement in mathematics by observing activities inside the classroom. Material should be relevant and accessible to students. In addition, observations of enrollment patterns (course selections by poor and minority) should be monitored.

Singh and Granville (1999) found that the socioeconomic status of minority students significantly influenced whether they enrolled in algebra courses. Many educators believe algebra to be the “gateway to higher mathematics” and many state graduation requirements include at least 1 year of algebra (McCoy, 2005). In the Thompson and Joshua-Shearer (2002) report, the most frequently cited recommendation for Hispanics and African Americans was to “permit all students to take college preparatory classes” (p.7). However, this recommendation was the fourth most frequently cited recommendation for white students.

A student’s decision not to take a rigorous mathematics schedule in high school has long-term consequences. Bishop and Mane (2001) found evidence that guidance counselors, parents, and students too often avoid rigorous courses largely because the rewards for the extra work are small for most students. Employers hardly ever consider the rigor of high school courses when making hiring decisions. While selective colleges evaluate grades based on light course demands, historically most colleges have not factored the rigor of high school courses into their admissions decisions (Bishop & Mane). However, taking advanced mathematics in high school was more strongly associated with successful completion of college than any other factor, including high school grade point average and socioeconomic status (Burris et al., 2006). Rose and Betts’ study (as cited in Burris et al.) shows a positive relationship exists between enrollment in advanced mathematics and higher earning power, even after factors such as occupation, demographic characteristics, and highest degree earned have been controlled.

Bishop and Mane (2001) found that tests measuring basic skills at the end of high school have large effects on wages 10, 15, and 20 years later but only small effects in the years immediately after high school. Effects were small for recent high school graduates because few employers use tests to assess basic literacy as a method of screening job applicants, and most do not ask for information about high school grades. Over time employers learn which employees are the most competent by observing job performance. "Those judged most competent are more likely to get further training, promotions, and good recommendations when they move on. Poor performers are encouraged to leave" (Bishop & Mane, p. 60).

The reoccurring theme in what is considered a good education for all students seems to be a positive relationship with their teachers. Wilkins and Ma (2002) found students' relationship with persons who are aware of their needs (i.e. teachers or parents) may better predict actual learning. In high school, teacher push was related to student growth in algebra, geometry, and statistics. The Eisenhower National Clearinghouse for Mathematics and Science Education (ENC) recommended several curricular changes schools need to make in their offerings to disadvantaged children. In mathematics, teachers should provide in-depth coverage and a broader range of mathematical topics—such as geometry, estimation, probability, and statistics and provide frequent opportunities to apply mathematical ideas and skills to real-life situations (Knapp & Shields, 2002).

A study of the association between part-time work and high school course work completed in mathematics was conducted by Singh and Ozturk (2000). They found working students tended to take easier, less challenging courses. However, the reason for students' working was not financial need as some might assume. In fact, research findings suggested the higher the family income, the greater the probability a teenager will work while in school. For adolescents, consumerism was the dominant drive to earn and spend money. Work intensity was negatively correlated to attention in class, effort in school, and attendance.

Schiller and Muller (2003) found that students in states with more graduation requirements tended to enroll in higher level mathematics as freshmen and tended to take more advanced level courses throughout high school. Between 1980 and 1993 the average number of credits schools required for graduation increased. Over two thirds of those changes were in additional mathematics and science courses. The mathematics courses students take in high school tend to affect scholastic achievement and admission to competitive postsecondary schools more than any other academic area.

Socioeconomic status has been shown to interact with minimum competency exams (MCE) and have an immediate and significant effect on the college enrollment of students of low socioeconomic status (Bishop & Mane, 2001). MCEs raise enrollment rates of student from low socioeconomic backgrounds by 4.4 percentage points, middle class students by 2.4 percentage points, and students of high socioeconomic status not at all.

No Child Left Behind Act of 2001

In the last 2 decades of the 20th century, dissatisfaction with the performance of U.S. schools grew strong enough to permit serious consideration of major structural changes in American education (Ravitch, 1995). The most striking initiative was the effort to create a national system of standards and assessments. On January 8, 2002, President George W. Bush signed the ***No Child Left Behind Act of 2001*** (NCLB) into law with overwhelming bipartisan support. However, the principles of NCLB date back to ***Brown v. Board of Education,*** when the U.S. Supreme Court outlawed racial segregation in public schools and determined that the "separate but equal" doctrine was unconstitutional (U.S. Department of Education [USDOE], 2004). In 1965 the ***Elementary and Secondary Education Act*** (ESEA) became law. With this legislation the federal government assumed a larger role in financing public schools, recognizing the universal importance of education for all American citizens. In 2001, the reauthorization of ESEA included NCLB.

The U.S. Department of Education (2004b) asserted that "accountability is a crucial step in addressing the achievement gaps that plague our nation. For too long, the poor achievement of our most vulnerable students has been lost in unrepresentative averages. African American, Hispanic, special education, limited English proficient, and many other students were left behind because schools were not held accountable for their individual progress. Now all students count" (USDOE, p.17).

NCLB set five performance goals for states. First, all students will reach high standards, at a minimum attaining proficiency or better in reading and language arts and mathematics by 2013-2014. Secondly, all limited English proficient students will become proficient in English and reach high academic standards, at a minimum attaining proficiency or better in reading and language arts and mathematics. The third goal is all students would be taught by highly qualified teachers by 2005-2006. Fourth, all students will learn in schools that are safe and drug free. Finally, all students will graduate from high school (VDOE, 2007a).

More specifically, the law requires states to administer mathematics and reading exams based on state curriculum standards to all students in grades 3-12. States must also monitor the progress of students who are economically disadvantaged, from racial or ethnic minority groups, have disabilities, or have limited English proficiency (VDOE, 2007a).

NCLB's goals of increasing academic standards and decreasing inequality between social and economic groups promote the use of standardized testing and accountability. Schiller and Muller (2003) found that increasing school accountability for student test performance was the only strategy that appeared to increase all students' opportunities for learning mathematics, especially for minority students.

Under NCLB, every state is required to set standards for grade-level achievement and develop a system to measure the progress of all students and subgroups of students in meeting those state-determined grade-level standards (USDOE, 2004a). Those "standards" are a topic of much debate in education.

The Standards Movement

Ravitch (1995) defined a standard as both a goal (what should be done) and a measure of progress toward that goal (how well it was done). "Standards tell everyone in the educational system what is expected of them; assessments provide information about how well expectations have been met" (Ravitch, p.27). The objective of the national standards movement was to define high standards for what students learn and then to hold students, educators, and schools accountable for reaching them (Burris et al., 2006). NCLB mandates national testing but the format of the tests is left up to individual states. Standards are not useful or meaningful unless there is some way to measure whether they are reached. Performance standards define degrees of mastery of levels of attainment (Ravitch).

Test advocates make the assumption that tests change the behavior of students and teachers in a positive way and those changes produce more learning (Orfield & Kornhaver, 2001). However, evidence was insufficient to demonstrate that test policies will motivate the unmotivated, solve problems created by inadequately trained teachers or weak administrators, close gaps in achievement among students from different racial, ethnic, and economic backgrounds, lead to better job applicant selection, or alter the national economy.

Each state has the directive to develop content standards goals that require criterion-referenced testing. However, school or student ranking goals demand norm-referenced testing (Sloane & Kelly, 2003).

The National Assessment of Educational Progress (NAEP) is the only measure of student achievement in the United States where comparisons of the performance of students in one state can be made with the performance of students across the nation or in other states. State participation in NEAP assessments is one of the testing requirements of NCLB. NAEP results are based on a representative sample of students in public schools, private schools, Bureau of Indian Affairs schools, and Department of Defense schools (NAEP, 2006). Comparisons of student achievement are made in mathematics, reading, writing, science, and other content areas. The NAEP appears to be the best available measure for evaluating whether students in a state have made significant gains in learning, at least in the tested subject areas. NAEP exams appear to assess more complex knowledge and cognitive processes than do most commercial or state exams (Madaus & Clarke, 2001). In addition, NAEP provides information on the achievement gap among different racial and socioeconomic groups. In Virginia, NAEP tests in reading and mathematics are administered every other year in grades 4 and 8. Only a sample of Virginia schools is selected by NAEP for participation. (VDOE, 2003) Participation is mandatory if a school is chosen for testing.

State Standards and Testing

A plethora of educational literature on the advantages and disadvantages of “high-stakes” or standardized testing exists. Nevertheless, standardized tests appear to be a permanent component of the educational process in the United States today.

According to the latest results from the Third International Mathematics and Science Study (TIMSS), America's fourth- and eighth-grade students "significantly outperformed many of their international peers, scoring well above the international average in both mathematics and science" (USDOE, 2004b). The report also found that in the United States, African American fourth- and eighth-graders and Hispanic eighth-graders improved markedly in both mathematics and science between 1995 and 2003, thus narrowing the gap in achievement between white and black students. Former U.S. Department of Education Secretary Rod Paige credited the standards movement with this result stating "Eighth-grade results from TIMSS confirm what we have seen domestically—that a greater emphasis on higher standards in the classroom leads to improved performance and a smaller achievement gap" (USDOE, 2004b, ¶ 3). However, in another international assessment, the Program for International Student Achievement (PISA) released results that showed America's 15-year-olds performed below the international average in mathematics literacy and problem-solving (USDOE, 2004b).

Well-constructed and appropriately used tests can help to detect problems, but they do not, in themselves, solve problems (Orfield & Kornhaver, 2001). Heller (2005) contended that standardized tests put students and teachers on the same side—working to meet the challenge of an impartial test. Teachers have had great autonomy and flexibility with regard to testing and evaluating students. Unfortunately, too many well-meaning teachers passed along students who had failed or gave high marks for minimal performance. Many teachers, under pressure to help students obtain good examination scores, will be more controlling in their teaching (Madaus & Clarke, 2001). “When controlling events are perceived to determine behavior, students’ need for competence, self-determination, conceptual learning and creativity will not be met, but rather diminished” (Madaus & Clarke, p. 98). In addition, Roderick and Engel (as cited in Sloane & Kelly, 2003) found that frequent testing was more effective than frequent homework for improving retention of information, particularly among low-achieving students. Testing may also be viewed as a mechanism to influence the behavior of teachers and administrators by exposing the results of their performance to public scrutiny in a comparative framework (Natriello & Pallas, 2001).

Rothstein (2004) asserted that the high stakes attached to standardized tests gave teachers incentives to modify the priorities of their instruction, especially for low-income children. However, he contended that teachers had shifted greater time to drill on basic skills and less time to other, equally important (but untested), learning areas. This point leads to one of the most common criticisms of high-stakes testing—the emphasis on minimal competency. This emphasis results in schools teaching directly to these minimal competencies rather than the broader curriculum (Sloane & Kelly, 2003).

According to Madaus and Clarke (2001) high-stakes tests did influence which and how things are taught and learned; consequently, test scores would improve. However, as teaching turned into test preparation, test results no longer reflected what students really know or could do. Therefore, it is wrong to believe we can test our way out of our educational problems. In fact, quite the opposite was true. Our fixation on test results diverts attention from fundamental education problems and thus hinders reform. Their analysis was based on research done at Boston College over the past 30 years. They concluded "high-stakes, high-standards tests do not have a markedly positive effect on teaching and learning in the classroom, high-stakes tests do not motivate the unmotivated, "authentic" forms of high-stakes assessment are not a more equitable way to assess the progress of students who differ by race, culture, native language, or gender, and finally, high-stakes testing programs have been show to increase high dropout rates, particularly among minority student populations" (Madaus & Clarke, p. 86).

If teachers perceive that important decisions are related to the test results, they will teach to the test (Madaus & Clarke, 2001). In a nationwide poll of more than 1000 public school teachers by ***Education Week*** (as cited in Sadker & Zittleman, 2004), two thirds indicated their states had become too focused on state tests. Eighty-five percent of the teachers reported their school gave less attention to subjects that were not on the state tests, and 75% indicated they had spent time instructing students in test-taking skills. Nearly 7 of 10 teachers reported feeling test stress and two of three reported preparing for the test takes time from teaching important, but non-tested, topics (Sadker & Zittleman). McNeil and Valenzuela (as cited in Kornhaver & Orfield, 2001) asserted teaching to the test's form and content can narrow the focus of instruction, study, and learning to the detriment of other skills. For example, they found that some students' ability to comprehend book-length material declined because most tests require students to answer multiple-choice questions pertaining to short reading passages. Consequently, these readings replaced the study of longer works of fiction and nonfiction in the classroom. When test stakes were high, past exams began to define the curriculum. Once a high-stakes testing program had been in place for several years, teachers saw the kind of intellectual activity required by the previous tests and prepared students to meet those demands (Madaus & Clarke).

High test scores do not necessarily indicate high levels of problem-solving skills or ingenuity. Assessment experts have found that most tests measure primarily lower-level thinking skills within the subjects and thus cannot show the learning of higher-level problem-solving (Madaus & Clarke, 2001). Some authors have said "by measuring all students against the same yardstick of literacy and numeracy, individual creativity and differences are lost or denigrated" (Sadker & Zittleman, 2004, p. 744). Natriello and Pallas (2001) concluded that students who were focused on tests and sanctions may have lost fundamental interest, learned only superficially, and failed to develop a desire for learning.

Educational reforms include standards, accountability, and sanctions. Sanctions may raise test scores, but they may at the same time impede progress toward creating a population of lifelong learners who can adapt to changing needs and conditions (Natriello & Pallas, 2001). Standardized tests ignore diversity. Creating identical expectations for all students places the poorer ones at a distinct disadvantage (Sadker & Zittleman, 2004). Sternburg (as cited in Levin, 2001) suggested that standardized tests measure only a portion of the knowledge and analytical skills and almost none of the creative and practical skills that are valued in the workplace.

Schiller and Muller (2003) found that extensive testing had little effect on course taking except to increase differences based on socioeconomic status. However, the differences they found between racial or ethnic groups tended to be smaller in states where test performance was linked to consequences, high school graduation for example. Testing for the sake of testing does little for student achievement. But when students and teachers get ongoing information from testing of where they are in mathematics in terms of either the state standards or some other framework, it invariably enhances performance (Gersten, 2002). However, too many students focus their efforts on mastering strategies to help them achieve proficiency on examinations rather than on developing mastery of subject matter and honing lasting competencies (Madaus & Clarke, 2001).

Hill (2005) asserted that because children learned differently and were at different developmental stages, a one-size-fits-all assessment did not work. "Educators are asked to teach in multiple ways to reach all learners, and then on the big test day, only one format is used" (Hill, p.28). Sloane and Kelly (2003) point out that high-stakes tests are given late in the school year. Consequently they do not provide useful diagnostic information for the student or the teacher.

Lee (2006) used NAEP statistics to confirm the validity of individual state test results. The study compared post-NCLB trends in reading and mathematics achievement with pre-NCLB trends among different racial and socioeconomic groups of fourth graders and eighth graders from across the nation. The key findings of the study were that NCLB did not have a significant impact on improving reading and mathematics achievement nor did NCLB help narrow the racial and socioeconomic achievement gap in reading and mathematics. Based on NAEP results, the national average achievement remains "flat in reading and grows at the same pace in math after NCLB as before" (Lee, p. 56). Neill and Gayler (2001) concluded the effective control over curricula and instruction exerted by the state tests makes it less likely that untested content areas will be taught, particularly to students who historically have not done well on the tests. "Children from low-income families and children of color will be less likely to receive high-level, cognitively rich instruction because of the outcomes of such instruction are not measured and those children are in schools most "under the gun" to show improvement on state tests" (Neill & Gayler, p.121).

Lee (2006) predicted the continuation of the current trend will leave the nation far behind the NCLB target of 100% by 2014; only 24% to 34% of students will meet the NAEP proficiency target in reading and 29% to 64% meeting the mathematics proficiency target by 2014. He also predicted that less than 25% of poor and black students will achieve NAEP proficiency in reading and less than 50% will achieve mathematics proficiency. NCLB requires adequately yearly progress of all groups of students toward state proficiency targets, but Lee's report showed how state assessments results indicate improvements in mathematics and reading; however, students were not showing similar gains on the NAEP. Olson (2007b) reported that near the end of high school, African American and Latino students have reading and mathematics skills that were virtually the same as those of white eighth graders.

"By themselves, tests do not produce improved teaching and learning, any more than a thermometer reduces fever" (Heubert, 2001, p. 180). But when good tests are used properly, the information they provide can contribute to improve teaching and learning. The concept of the power of high-stakes testing is encapsulated by Chief Inspector of Schools, Edmond Holmes (as cited in Madaus & Clarke, 2001). Writing about 19th-century school examinations in Great Britain, he proclaimed, "Whenever the outward standard of reality (examination results) has established itself at the expense of the inward, the ease with which worth (or what passes for such) can be measured is ever tending to become in itself the chief, if not sole, measure of worth. And in proportion, as we tend to value the results of education for their measureableness, so we tend to undervalue and at last ignore those results which are too intrinsically valuable to be measured" (Madaus & Clarke, p. 93).

Virginia Education

"A child born in Virginia is significantly more likely to experience success throughout life than the average child born in the United States" (Education Week, 2007, p.1). This quote is based on analysis of the Chance-for-Success Index by the Editorial Projects in Education Research Center, which tracks state efforts to connect education from pre-school through postsecondary education and training. Virginia earned the highest Chance-for-Success score based on 13 indicators, some of which are family income, parental education, language, public school test scores and graduation rates, and the state's postsecondary education enrollments. "The average child in Virginia starts out ahead of the curve: less likely to live in a low-income family and more likely to have college-educated parents and those advantages are amplified during the elementary-through-postsecondary years, when the typical young person enjoys higher achievement, is more likely to finish high school, and continue on to college than in other states" (Education Week, p.2).

However, not every child in Virginia has these advantages. According to the U.S. Census Bureau, 10% of all Virginians lived in poverty and 11.6% of the school age population lived at or below the poverty level (U.S. Census, 2003). While those numbers may not seem excessive, the gap among localities is. The average household income in Virginia was about $50,000, yet Buchanan County, in the southwest corner of the state, had a median family income of less than $25,000 while Loudoun County, in northern Virginia, had a median household income of over $90,000 (U.S. Census). These discrepancies in income affect the tax base of each locality, which, in turn, affects the local school system's operating budget.

The economically disadvantaged (ED) subgroup of the NCLB classifications is identified as those students receiving free or reduced meals or other social benefits. Using information from the same two counties compared above, 70.33% of Buchanan County's total school population receives free or reduced meals while only 13.79% of the students in Loudoun County would be classified as ED (VDOE, 2007d).

In Virginia, the Standards of Learning (SOL) describe the commonwealth's expectation for student learning and achievement in grades K-12 (VDOE, 2007a). Interestingly, the two divisions' SOL test scores in mathematics are not as disparaging as the income and ED statistics. Overall, 72% of Buchanan County's students received passing scores, with 68% of the ED subgroup passing. In Loudoun County, 81% of all students achieved passing scores but only 60% of the students label ED passed (VDOE, 2006).

Virginia's SOL assessments are given in the four core areas of English, mathematics, science, and history and social science. Student performance on SOL tests is classified as failing (scores below 400), proficient (scores between 400-499), or advanced (scores between 500-600). Passage of certain tests is required in order to obtain a high school diploma.

Virginia offers several diplomas that students may achieve based on certain graduation requirements. To graduate with a Standard Diploma, a student must earn at least 22 standard credits and earn at least six verified credits (VDOE, 2004a). In mathematics, a high school student must obtain at least three standard credits and one verified credit. Courses that satisfy this requirement must be at or above the level of algebra. The courses must include two course selections from among Algebra I, Geometry, Algebra II, or other mathematics course above the level of algebra or geometry (VDOE, 2004a).

An Advanced Studies Diploma requires a student to earn 24 standard credits and at least nine verified credits (VDOE, 2004b). Four credits must be obtained in mathematics, two of which must be verified credits. The mathematics courses must include three course selections from among Algebra I, Geometry, Algebra II, or other course above the level of Algebra II (VDOE, 2004b). There are other diplomas and certificates available for Virginia students; however, these are primarily for students with severe disabilities.

Virginia students continue to improve on a variety of educational scales. In 2006, Virginia joined a select handful of states in which 20% or more of high school seniors earned a grade of three or more on an Advanced Placement (AP) examination (VDOE, 2007e). The number of Virginia public high school students who took at least one AP exam increased from 39,660 in 2005 to 44,816 in 2006. The College Board also recognized Virginia for lessening the “equity gap” for African American students. Since 2001, the number of AP exams taken by black Virginia students increased by 85.7%. During the same period, the number of Hispanic students taking at least one AP exam more than doubled. Since 2001, the number of AP exams taken by low-income students in Virginia increased by more than 2,000, reversing a downward trend in the late 1990s (VDOE, 2007e).

Summary

There are a plethora of studies on the association of poverty with learning and social development. One recurring theme is a caring relationship between the student and a teacher, coach, or administrator. This relationship is immensely important for children, especially children of poverty, to be successful. High teacher expectations and increased graduation requirements seem to improve educational performance for those who tend to experience learning difficulties.

Mathematics achievement is considered to be one of the most important factors associated with future educational attainment, the higher the level of mathematics taken, the more pronounced the positive educational effects. There is a great deal of evidence to indicate that low-level tracking, particularly in mathematics classes, has more harmful effects than positive effects on achievement.

Federal reforms in education, the standards movement, and statewide assessments will be permanent elements in the educational process of the United States. Even though a national study showed Virginia students were the most likely of all U.S. students to attain educational and life-long success, there is still room for improvement in the educational process. Despite considerable criticism of the educational system in the United States, leaving no child behind is an admirable concept, worthy of every educator's best efforts.

CHAPTER 3

METHODS AND PROCEDURES

Introduction

This quantitative study was designed to determine if socioeconomic status and ethnicity are significant indicators of student achievement on the Virginia End-of-Course Standards of Learning (SOL) tests in Algebra I, Geometry, and Algebra II. It sought to establish whether a relationship between students' socioeconomic status and their participation rate in the upper level, yet non-required, course of Algebra II exists. The study also examined if the relationship differs among the other ethnic subgroups of white, black, Hispanic, and Asian.

Chapter 3 explains the methodology and procedures used in this study. The chapter is organized into sections that will address research design, population, procedures, research questions, and data analysis. The chapter concludes with a brief summary of all sections.

Research Design

Socioeconomic status has long been regarded as the most prevalent factor affecting student academic performance. This study determined if there was a significant difference in the test scores of individual students in Algebra I, Geometry, and Algebra II classified as economically disadvantaged with those students who are not classified as economically disadvantaged. This analysis was conducted for the ethnic subgroups of white, black, Hispanic, and Asian to determine if the relationship differs among these groups.

Population

The population for this study consisted of all Virginia students who took part in the End-of-Course SOL testing in mathematics during the 2005-2006 school year. There were 113,786 Algebra I, 95,898 Geometry, and 68,944 Algebra II tests given to high school students in Virginia public schools during that school year.

Procedures

Data collection for this study began by requesting a data set of individual student information from the Director of Educational Information Management at the Virginia Department of Education. The request was for End-of-Course SOL scores in Algebra I, Geometry, and Algebra II for the 2005-2006 school year and student membership in any of the subgroups of economically disadvantaged, students with disabilities, limited English proficient, and all ethnic groups. Assurance were made that any information which would identify an individual student was not needed. The director approved the request and indicated the data were available upon request.

Data analysis was conducted using the Statistical Package for Social Sciences (SPSS) Version 15.0 software package. The results of the data analysis will be presented in Chapter 4.

Research Questions

Question 1

To what extent, if any, is there a significant difference between the participation rates of students who are classified as economically disadvantaged and the students who are classified as not economically disadvantaged among ethnic groups (white, black, Hispanic, and Asian) in the required high school mathematics classes of Algebra I and Geometry and the non-required class of Algebra II?

Question 2

To what extent, if any, is there a significant difference between the pass rates of students who are classified as economically disadvantaged and the students who are classified as not economically disadvantaged on the End-of-Course Standards of Learning tests for the required high school mathematics classes of Algebra I and Geometry and the non-required class of Algebra II?

H_o2_1: There is no difference between the pass rates of students who are classified as economically disadvantaged and the students who are classified as not economically disadvantaged on the End-of-Course Standards of Learning tests in Algebra I.

H_o2_2: There is no difference between the pass rates of students who are classified as economically disadvantaged and the students who are classified as not economically disadvantaged on the End-of-Course Standards of Learning tests in Geometry.

H_o2_3: There is no difference between the pass rates of students who are classified as economically disadvantaged and the students who are classified as not economically disadvantaged on the End-of-Course Standards of Learning tests in Algebra II.

Question 3

To what extent, if any, is there a significant difference between the pass rates of students from differing ethnic groups (white, black, Hispanic, and Asian) on the End-of-Course Standards of Learning tests for the required high school mathematics classes of Algebra I and Geometry and the non-required class of Algebra II?

H_o3_1: There is no difference between the pass rates of students from differing ethnic groups (white, black, Hispanic, and Asian) on the End-of-Course Standards of Learning tests in Algebra I.

H_o3_2: There is no difference between the pass rates of students from differing ethnic groups (white, black, Hispanic, and Asian) on the End-of-Course Standards of Learning tests in Geometry.

H_o3_3: There is no difference between the pass rates of students from differing ethnic groups (white, black, Hispanic, and Asian) on the End-of-Course Standards of Learning tests in Algebra II.

Question 4

To what extent, if any, is there a significant difference between scores for students who are classified as economically disadvantaged and the students who are classified as not economically disadvantaged as measured by the End-of-Course Standards of Learning test scores in the required high school mathematics classes of Algebra I and Geometry and the non-required class of Algebra II as a function of ethnicity?

H_o4_1: There is no difference between scores for students who are classified as economically disadvantaged and the students who are classified as not economically disadvantaged as measured by the End-of-Course Standards of Learning test scores for Algebra I as a function of ethnicity.

H_o4_2: There is no difference between scores for students who are classified as economically disadvantaged and the students who are classified as not economically disadvantaged as measured by the End-of-Course Standards of Learning test scores for Geometry as a function of ethnicity.

H_o4_3: There is no difference between scores for students who are classified as economically disadvantaged and the students who are classified as not economically disadvantaged as measured by the End-of-Course Standards of Learning test scores for Algebra II as a function of ethnicity.

Data Analysis

The data were analyzed using SPSS Version 15.0. In Question 1, descriptive statistics were used to analyze participation rates. (As Algebra I and Geometry are mathematics courses required for graduation from all Virginia public high schools, participation is mandatory. However, Algebra II is not required for graduation with a standard diploma.) Because the data in Questions 2 and 3 were nominal, the null hypotheses were tested using Chi-Square. In Question 4, the null hypotheses were tested using a Two-Way ANOVA. As the ANOVA was significant, Tukey's post hoc test was used with appropriate follow-ups.

Summary

Chapter 3 presents the research design, population, and procedures used in the study. Also presented are four research questions, three of which had three null hypotheses. The study used quantitative procedures to determine whether the socioeconomic status of students in the Commonwealth of Virginia is a factor in participation rates, pass rates, and End-of-Course SOL scores of students in Algebra I, Geometry, and Algebra II. The study used

278,628 SOL tests scores of students enrolled in these three classes in Virginia's public schools during the 2005-2006 school year. Data were obtained through the Virginia Department of Education. Chapter 4 provides an analysis of the data and Chapter 5 presents the study findings, conclusions, recommendations for practice, and recommendations for further study.

CHAPTER 4

ANALYSIS OF DATA

The No Child Left Behind Act of 2001 required each state to set standards for grade-level achievement and to develop a system of assessments to measure students’ performance in meeting those standards (USDOE, 2004a). The Standards of Learning (SOL) are the standards developed by the Commonwealth of Virginia; the SOL tests are assessments used to determine student proficiency of those standards (VDOE, 2007a). Previous research presented in Chapter 2 indicated the socioeconomic status of students, particularly minority students, was an indicator of the mathematics courses in which they enrolled (Burris et al., 2006; Singh & Granville, 1999; Singham, 2003). The literature reviewed also suggested that a student’s decision not to take more mathematics courses than required for graduation had long-term negative associations (Bishop & Mane, 2001; Levin, 2001; Sheldon & Epstein, 2005; Thompson & Joshua-Sheaver, 2002).

The purpose of this study was to determine if socioeconomic status and ethnicity were significant indicators of high school mathematics performance and student enrollment in higher level mathematics courses in the Commonwealth of Virginia. This study used End-of-Course SOL test scores for Algebra I, Geometry, and Algebra II from the 2005-2006 school year and student classification of economically disadvantaged to determine whether if a relationship exists between socioeconomic status, student performance, and pass rates. It also examined whether socioeconomic status (SES) was associated with the enrollment rate of students in the non-required course of Algebra II. In addition the study examined these relationships for the ethnic subgroups of white, black, Hispanic, and Asian. The data contained American Indian as an ethnic subgroup. There were also some students who did not indicate membership in any ethnic group. The total number of these students is listed as "Other" in Table 1. The data for these two groups were not considered in the data analysis.

The percentage of students classified as economically disadvantaged in Algebra I was 23.7%, in Geometry, 20.3%, and in Algebra II, 14.6%. The percentage of white and Asian students enrolled in sequential mathematics courses increased, while the percentage of black and Hispanic students decreased. Whites made up 58.4% of all Algebra I students, 59.8% of Geometry students, and 65.7% of the Algebra II students. Asian students accounted for 5.3% of the Algebra I students, 5.7% of Geometry, and 7.2% of the Algebra II students. In Algebra I, 27.5% of the students were black, while in Geometry and Algebra II, 26.7% and 20.3% respectively, were black. Hispanic students accounted for 6.7% of the Algebra I students, 6.1% of the Geometry, and 5.1% of the Algebra II students.

Table 1

Demographic Profile of the Study (2005-2006)

Student Group	Algebra I	Geometry	Algebra II
Economically Disadvantaged	26,924	19,424	10,093
Not Economically Disadvantaged	86,862	76,474	58,851
Total	113,786	95,898	68,944
White	66,460	57,327	45,296
Black	31,286	25,560	14,025
Hispanic	7,602	5,873	3,538
Asian	6,022	5,472	4,930
Other	2,416	1,666	1,155
Total	113,786	95,898	68,944

Four research questions guided the study. Nine hypotheses were tested.

Research Question 1

To what extent, if any, is there a significant difference between the enrollment rates of students who are classified as economically disadvantaged and the students who are classified as not economically disadvantaged among ethnic groups (white, black, Hispanic, and Asian) in the required high school mathematics classes of Algebra I and Geometry and the non-required class of Algebra II?

Table 2 shows the calculation of the percentages of total membership enrollment by ethnic group.

Table 2

Percentages of Students Classified as Economically Disadvantaged Within Each Ethnic Group by Class

	Algebra I	Geometry	Algebra II
White	12.8%	10.4%	7.0%
Black	42.6%	38.2%	32.8%
Hispanic	45.8%	40.3%	36.9%
Asian	21.1%	20.4%	18.0%

Table 3 presents the total enrollment in Algebra I, Geometry, and Algebra II for the 2005-2006 school year and students' SES classification as economically disadvantaged (ED) or not economically disadvantaged (NED).

Table 3

Total Ethnic Enrollment Classified by Socioeconomic Status

	Algebra I		Geometry		Algebra II	
	ED	NED	ED	NED	ED	NED
White	8,526	57,934	5,990	51,337	3,192	42,104
Black	13,321	17,965	9,761	15,799	4,606	9,419
Hispanic	3,479	4,123	2,364	3,509	1,307	2,231
Asian	1,268	4,754	1,116	4,356	889	4,041
Total	26,594	84,776	19,231	75,001	9,994	57,795

Figure 1 illustrates the enrollment (as percentages) for Algebra I for students classified as economically disadvantaged and not economically disadvantaged.

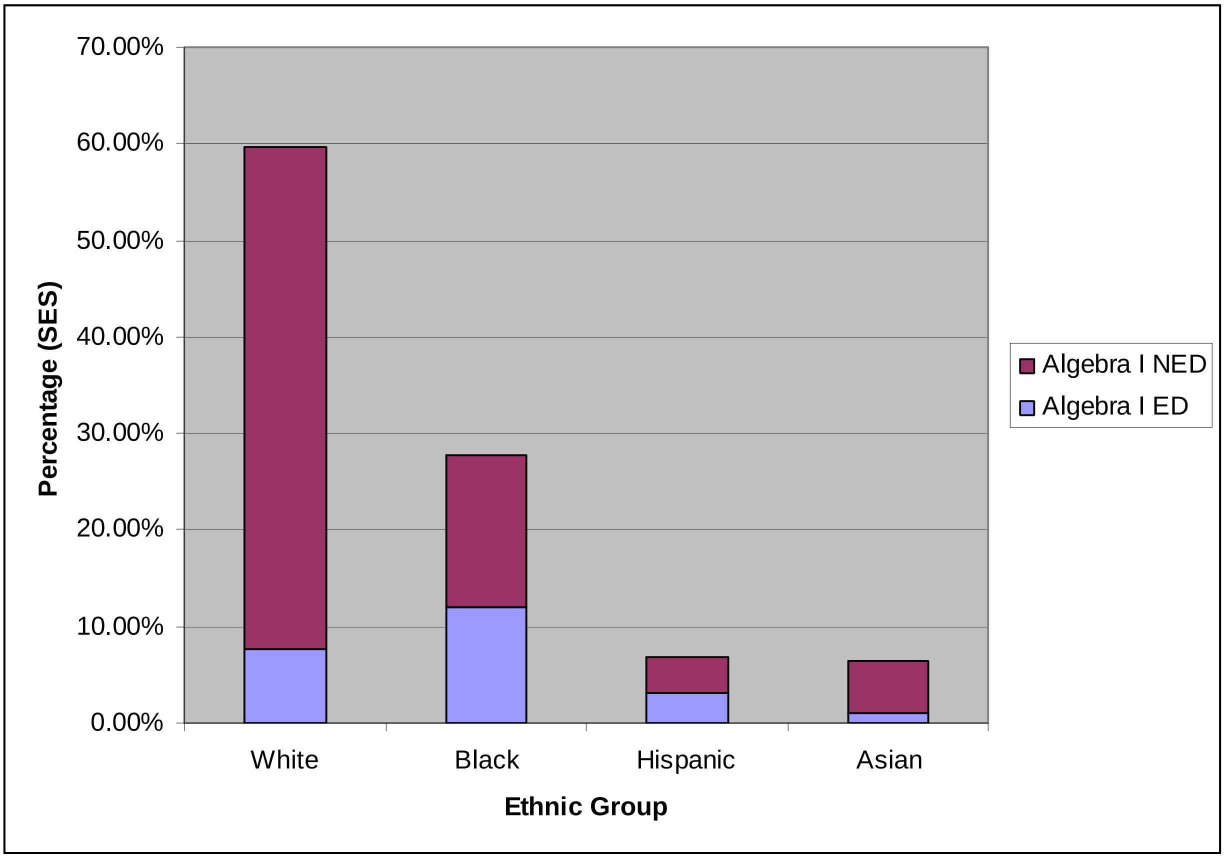

Figure 1. Algebra I enrollment rates by ethnicity and SES

Figure 2 shows the enrollment (as percentages) for Geometry for students classified as economically disadvantaged and not economically disadvantaged.

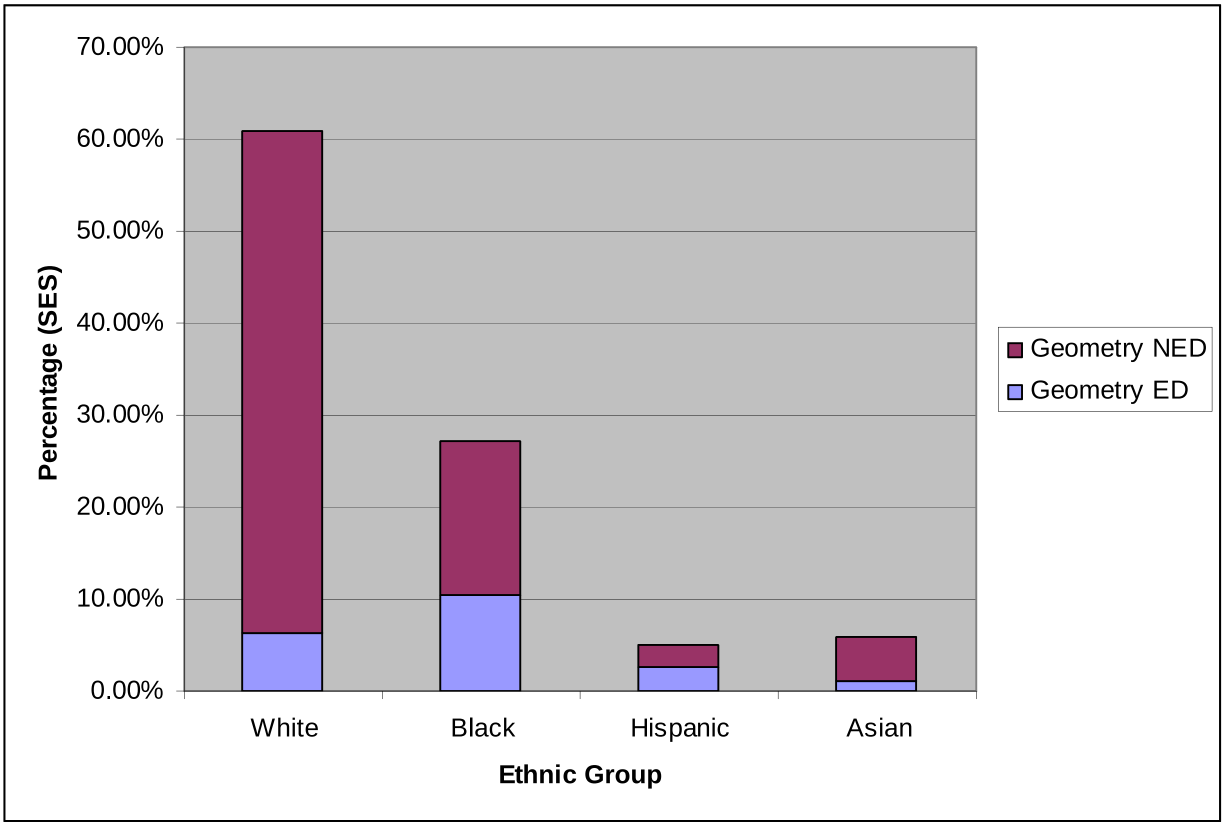

Figure 2. Geometry enrollment rates by ethnicity and SES

Figure 3 shows the enrollment rate for Algebra II for students classified as economically disadvantaged and not economically disadvantaged.

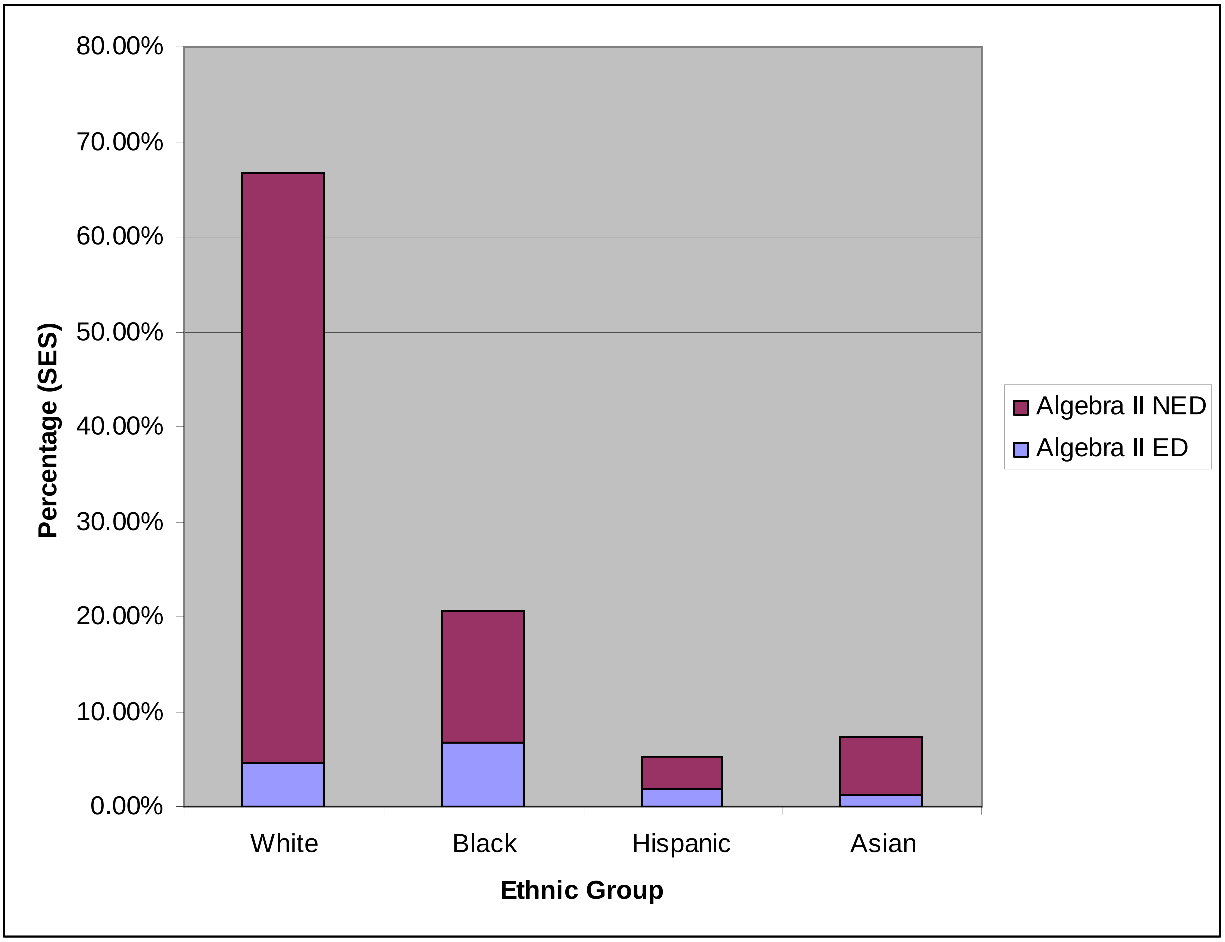

Figure 3. Algebra II enrollment rates by ethnicity and SES

Table 4 presents the total number of white, black, Hispanic, and Asian students classified as economically disadvantaged and their percentage of the total population of students taking Algebra I, Geometry, and Algebra II during the 2005-2006 school year.

Table 4

Enrollment Rates for Economically Disadvantaged Students

	Algebra I		Geometry		Algebra II	
	N	Percentage	*N*	Percentage	*N*	Percentage
White	8,526	7.7	5,990	6.7	3,192	4.7
Black	13,321	12.0	9,761	10.4	4,606	6.8
Hispanic	3,479	3.1	2,364	2.5	1,307	1.9
Asian	1,268	1.1	1,116	1.2	889	1.3
Total	26,594	23.9	19,231	20.8	9,994	14.7

Note: Percentage of total population

A comparison of the number of white, black, Hispanic, and Asian students classified as economically disadvantaged and their relative portion of the total population of students taking Algebra I, Geometry, and Algebra II during the 2005-2006 school year is shown in Figure 4.

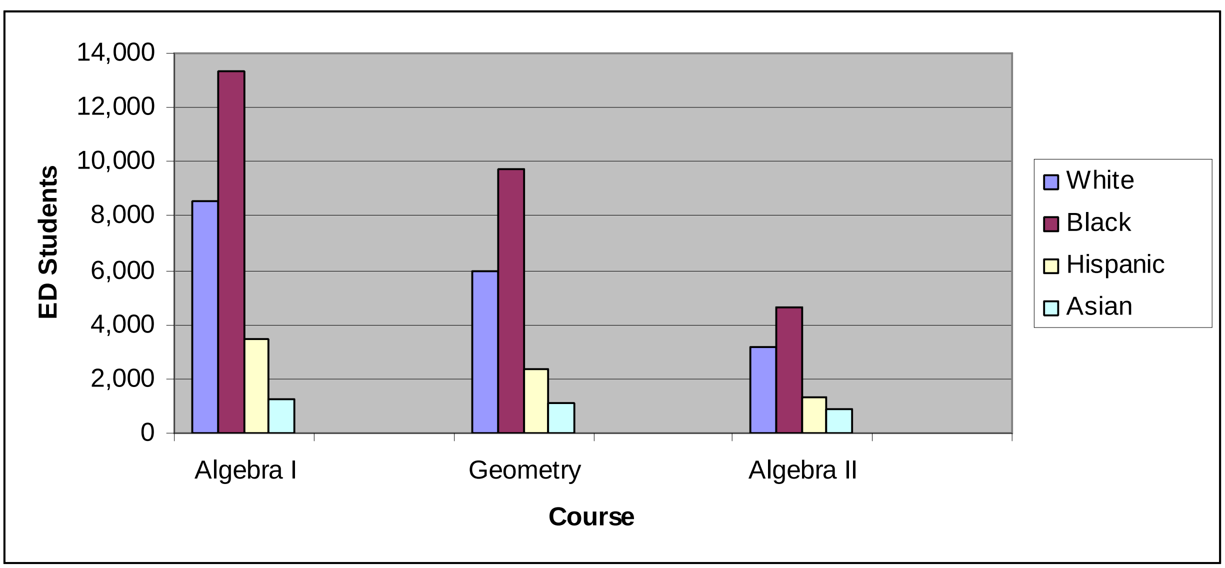

Figure 4. Economically disadvantaged student enrollment among ethnic groups

Research Question 2

To what extent, if any, is there a significant difference between the pass rates of students who are classified as economically disadvantaged and the students who are classified as not economically disadvantaged on the End-of-Course Standards of Learning tests for the required high school mathematics classes of Algebra I and Geometry and the non-required class of Algebra II?

H_o2_1: There is no difference between the pass rates of students who are classified as economically disadvantaged and the students who are classified as not economically disadvantaged on the End-of-Course Standards of Learning tests in Algebra I.

Table 5 presents the pass-fail rate of Algebra I students based on socioeconomic status. A chi-square test analysis was conducted to assess whether students with differing SES have different pass rates in Algebra I. The results of the test were significant, $\chi^2(1, N=113786)=1316.23$, $p<.001$. The null hypothesis was rejected.

Table 5

Pass-Fail Rate of Algebra I Students Based on Socioeconomic Status

	Pass		Fail	
	N	Percentage	*N*	Percentage
Economically Disadvantaged	19,749	73.4	7,175	26.6
Non-Economically Disadvantaged	72,348	83.3	14,514	16.7
Total	92,097	80.9	21,689	19.1

H_o2_2: There is no difference between the pass rates of students who are classified as economically disadvantaged and the students who are classified as not economically disadvantaged on the End-of-Course Standards of Learning tests in Geometry.

Table 6 presents the pass-fail rate of Geometry students based on socioeconomic status. A chi-square test analysis was conducted to assess whether students with differing SES have different pass rates in Geometry. The results of the test were significant, $\chi^2(1, N=95898)=2252.62$, $p<.001$. The null hypothesis was rejected.

Table 6

Pass-Fail Rate of Geometry Students Based on Socioeconomic Status

	Pass		Fail	
	N	Percentage	*N*	Percentage
Economically Disadvantaged	12,212	62.9	7,212	37.1
Non-Economically Disadvantaged	60,556	79.2	15,918	20.8
Total	72,768	75.9	23,130	24.1

H_o2_3: There is no difference between the pass rates of students who are classified as economically disadvantaged and the students who are classified as not economically disadvantaged on the End-of-Course Standards of Learning tests in Algebra II.

Table 7 presents the pass-fail rate of Algebra II students based on socioeconomic status. A chi-square test analysis was conducted to assess whether students with differing SES have different pass rates in Algebra II. The results of the test were significant, $\chi^2(1, N=68845)=335.34$, $p<.001$. The null hypothesis was rejected.

Table 7

Pass-Fail Rate of Algebra II Students Based on Socioeconomic Status

	Pass		Fail	
	N	Percentage	*N*	Percentage
Economically Disadvantaged	7,465	74.7	2,529	25.3
Non-Economically Disadvantaged	48,505	82.4	10,346	17.6
Total	55,970	81.3	12,875	18.7

Research Question 3

To what extent, if any, is there a significant difference between the pass rates of students from differing ethnic groups (white, black, Hispanic, and Asian) on the End-of-Course Standards of Learning tests for the required high school mathematics classes of Algebra I and Geometry and the non-required class of Algebra II?

H_o3_1: There is no difference between the pass rates of students from differing ethnic groups (white, black, Hispanic, and Asian) on the End-of-Course Standards of Learning tests in Algebra I.

Table 8 presents the pass-fail rate of Algebra I students by ethnicity. A chi-square test analysis was conducted to assess whether students from differing ethnic groups have different pass rates in Algebra I. The results of the test were significant, $\chi^2(3, N=111370)=4103.45$, $p<.001$. The null hypothesis was rejected.

Table 8

Pass-Fail Rate of Algebra I Students by Ethnicity

	Pass		Fail	
	N	Percentage	*N*	Percentage
White	57,019	85.8	9,441	14.2
Black	21,882	69.9	9,404	30.1
Hispanic	5,725	75.3	1,877	24.7
Asian	5,539	92.0	483	8.0
Total	90,165	81.0	21,205	19.0

H_o3_2: There is no difference between the pass rates of students from differing ethnic groups (white, black, Hispanic, and Asian) on the End-of-Course Standards of Learning tests in Geometry.

Table 9 presents the pass-fail rate of Geometry students by ethnicity. A chi-square test analysis was conducted to assess whether students from differing ethnic groups have different pass rates in Geometry. The results of the test were significant, $\chi^2(3, N=94232)=7990.16$, $p<.001$. The null hypothesis was rejected.

Table 9

Pass-Fail Rate of Geometry Students by Ethnicity

	Pass		Fail	
	N	Percentage	*N*	Percentage
White	48,364	84.4	8,963	15.6
Black	14,478	56.6	11,082	43.4
Hispanic	3,904	66.5	1,969	33.5
Asian	4,698	85.9	774	14.1
Total	71,444	75.8	22,788	24.2

H_o3_3: There is no difference between the pass rates of students from differing ethnic groups (white, black, Hispanic, and Asian) on the End-of-Course Standards of Learning tests in Algebra II.

Table 10 presents the pass-fail rate of Algebra II students by ethnicity. A chi-square test analysis was conducted to assess whether students from differing ethnic groups have different pass rates in Algebra II. The results of the test were significant, $\chi^2(3, N=67789)=1552.15$, $p<.001$. The null hypothesis was rejected.

Table 10

Pass-Fail Rate of Algebra II Students by Ethnicity

	Pass		Fail	
	N	Percentage	*N*	Percentage
White	38,137	84.2	7,159	15.8
Black	9,951	71.0	4,074	29.0
Hispanic	2,636	74.5	902	25.5
Asian	4,401	89.3	529	10.7
Total	55,125	81.3	12,664	18.7

Research Question 4

To what extent, if any, is there a significant difference between scores for students who are classified as economically disadvantaged and the students who are classified as not economically disadvantaged as measured by the End-of-Course Standards of Learning test scores in the required high school mathematics classes of Algebra I and Geometry and the non-required class of Algebra II as a function of ethnicity?

H_o4_1: There is no difference between scores of students who are classified as economically disadvantaged and the students who are classified as not economically disadvantaged as measured by the End-of-Course Standards of Learning test scores for Algebra I as a function of ethnicity.

A 2 x 4 ANOVA was used to evaluate the relationship between students' SES classification and their ethnicity on End-of-Course SOL test scores in Algebra I. The means and standard deviation for Algebra I scores as a function of the two factors are presented in Table 11. The ANOVA indicated a significant interaction between SES and ethnicity, $F(3,111369)=185.4$, $p<.001$, partial $\eta^2=.005$, as well as a significant main effect for ethnicity, $F(3,111369)=1711.7$, $p<.001$, partial $\eta^2=.044$ and significant main effect for SES, $F(1,111369)=722.4$, $p<.001$, partial $\eta^2=.006$. The partial η^2 indicates an extremely small effect size. However, Witte and Witte (2004) assert that effect size should be calculated whenever a statistically significant *F* is encountered, especially one based on large sample sizes because a very small effect might be important because of special circumstances". Consequently, the null hypothesis was rejected.

Table 11

Means and Standard Deviations for Algebra I SOL Scores

ED Status	Ethnicity	*N*	*M*	*SD*
ED	White	8,526	439.95	51.97
ED	Black	13,321	424.71	46.95
ED	Hispanic	3,479	432.58	49.69
ED	Asian	1,268	464.68	60.05
Non-ED	White	57,934	463.19	56.99
Non-ED	Black	17,968	428.72	52.56
Non-ED	Hispanic	4,123	439.98	55.34
Non-ED	Asian	4,754	492.31	60.18

Post hoc multiple comparisons were conducted to evaluate the pairwise differences among the means for ethnic groups using Tukey HSD. Significant differences between the means were found among all groups as shown in Table 12 for economically disadvantaged students and in Table 13 for students not classified as economically disadvantaged. These data indicate significance for ethnicity. Scoring from highest to lowest, respectively, is Asian, white, Hispanic, and black.

Table 12

Pairwise Comparisons by Ethnicity for Economically Disadvantaged Students in Algebra I

Ethnic Group	Mean Score	Comparison Group	Mean Score	Mean Difference	*P*
White	439.95	Black	424.71	15.24	<.001
		Hispanic	432.58	7.37	<.001
		Asian	464.68	-24.73	<.001
Black	424.71	Hispanic	432.58	-7.87	<.001
		Asian	464.68	-39.97	<.001
Hispanic	432.58	Asian	464.68	-21.41	<.001

Table 13

Pairwise Comparisons by Ethnicity for Not Economically Disadvantaged Students in Algebra I

Ethnic Group	Mean Score	Comparison Group	Mean Score	Mean Difference	*P*
White	463.19	Black	428.72	34.47	<.001
		Hispanic	439.98	23.21	<.001
		Asian	492.31	-29.12	<.001
Black	428.72	Hispanic	439.98	-11.26	<.001
		Asian	492.31	-63.59	<.001
Hispanic	432.58	Asian	492.31	-59.73	<.001

The final analysis was to determine if an interaction existed between SES and ethnicity. The data indicate higher mean scores for non-economically disadvantaged students on all four levels of ethnicity. The data indicate that differences of 23.24, 4.01, 7.39, and 27.64 are not equal; therefore, there is a significant interaction between SES and ethnicity. These findings are presented in Table 14. Figure 5 shows the mean test scores of ethnic groups with respect to SES.

Table 14

Interaction Between Ethnic Groups and Socioeconomic Status in Algebra I

Ethnic Group	ED Mean Score	Non-ED Mean Score	Mean Differences
White	439.95	463.19	23.24
Black	424.71	428.72	4.01
Hispanic	432.58	439.97	7.39
Asian	464.68	492.32	27.64

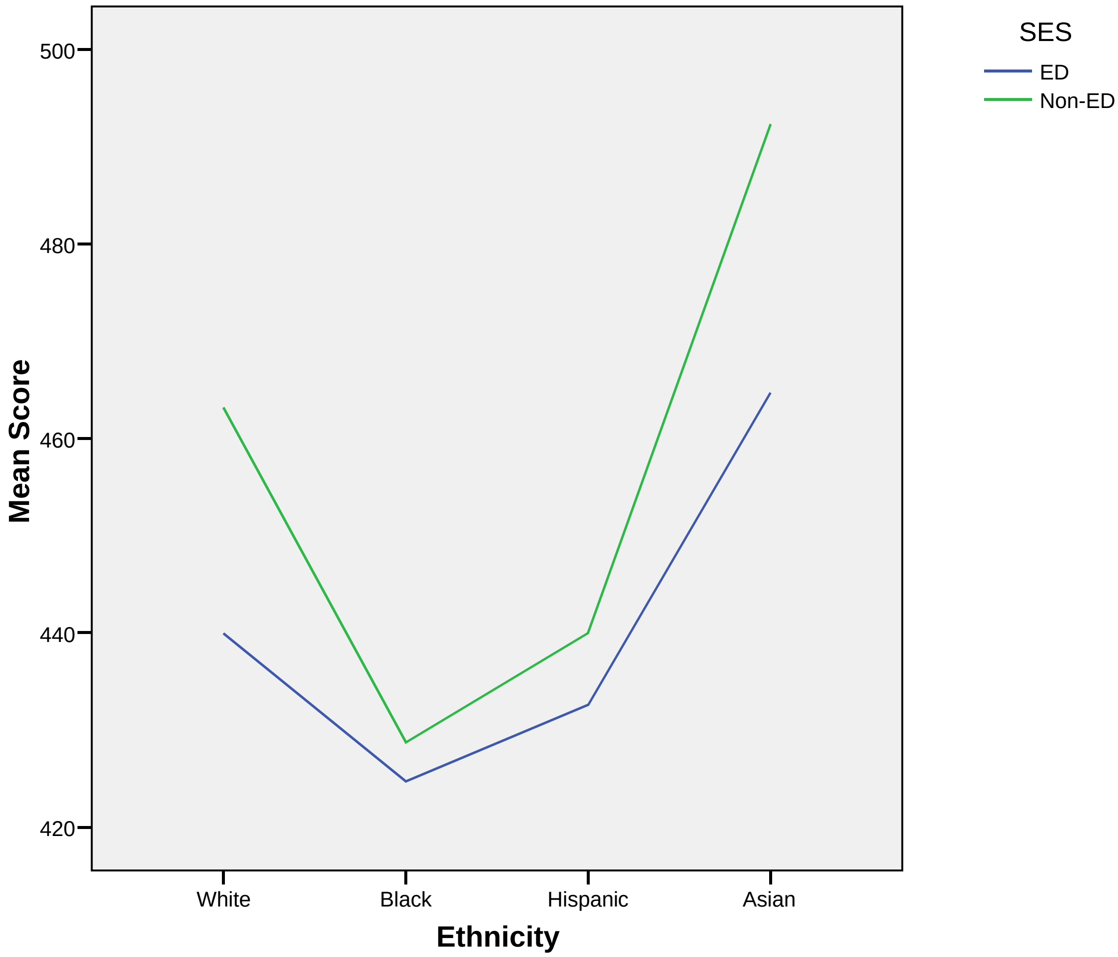

Figure 5. Algebra I mean test scores by ethnicity as compared to SES

H_o4_2: There is no difference between scores of students who are classified as economically disadvantaged and the students who are classified as not economically disadvantaged as measured by the End-of-Course Standards of Learning test scores for Geometry as a function of ethnicity.

A 2 x 4 ANOVA was used to evaluate the relationship between students' SES classification and their ethnicity on End-of-Course SOL test scores in Geometry. The means and standard deviations for Geometry scores as a function of the two factors are presented in

Table 15. The ANOVA indicated a significant interaction between SES and ethnicity, $F(3,94231)=162.46$, $p<.001$, partial $\eta^2=.005$, as well as a significant main effect for ethnicity, $F(3,94231)=2058.89$, $p<.001$, partial $\eta^2=.062$ and significant main effect for SES, $F(1,94231)=725.46$, $p<.001$, partial $\eta^2=.008$. The partial η^2 indicates an extremely small effect size. The null hypothesis was rejected.

Table 15

Means and Standard Deviations for Geometry SOL Scores

ED Status	Ethnicity	*N*	*M*	*SD*
ED	White	5,990	437.48	56.95
ED	Black	9,761	409.78	48.57
ED	Hispanic	2,364	426.63	58.15
ED	Asian	1,116	453.77	64.40
Non-ED	White	51,337	466.26	62.37
Non-ED	Black	15,799	416.71	54.63
Non-ED	Hispanic	3,509	433.17	61.50
Non-ED	Asian	4,356	486.68	68.49

Post hoc multiple comparisons were conducted to evaluate the pairwise differences among the means for ethnic groups using Tukey HSD. Significant differences between the means were found among all groups as seen in Table 16 for economically disadvantaged students and in Table 17 of students not classified as economically disadvantaged. These data indicate a significance for ethnicity. Scoring from highest to lowest, respectively, is Asian, white, Hispanic, and black.

Table 16

Pairwise Comparisons by Ethnicity for Economically Disadvantaged Students in Geometry

Ethnic Group	Mean Score	Comparison Group	Mean Score	Mean Difference	*P*
White	437.48	Black	409.78	27.70	<.001
		Hispanic	426.63	10.85	<.001
		Asian	453.77	-16.29	<.001
Black	409.78	Hispanic	426.63	-16.85	<.001
		Asian	453.77	-43.99	<.001
Hispanic	426.63	Asian	453.77	-27.14	<.001

Table 17

Pairwise Comparisons by Ethnicity for Not Economically Disadvantaged Students in Geometry

Ethnic Group	Mean Score	Comparison Group	Mean Score	Mean Difference	*P*
White	466.26	Black	416.71	49.55	<.001
		Hispanic	433.17	33.09	<.001
		Asian	486.68	-20.42	<.001
Black	416.71	Hispanic	433.17	-16.46	<.001
		Asian	486.68	-69.97	<.001
Hispanic	433.17	Asian	486.68	-53.51	<.001

The final analysis was to determine if an interaction existed between SES and ethnicity. The data indicate higher mean scores for non-economically disadvantaged students on all four levels of ethnicity. The data indicate that differences of 28.78, 6.93, 6.54, and 32.91 are not equal; therefore, there is a significant interaction between SES and ethnicity. These findings are presented in Table 18. Figure 6 shows the mean test scores of ethnic groups with respect to SES.

Table 18

Interaction Between Ethnic Groups and Socioeconomic Status in Geometry

Ethnic Group	ED Mean Score	Non-ED Mean Score	Mean Differences
White	437.48	466.26	28.78
Black	409.78	416.71	6.93
Hispanic	426.63	433.17	6.54
Asian	453.77	486.68	32.91

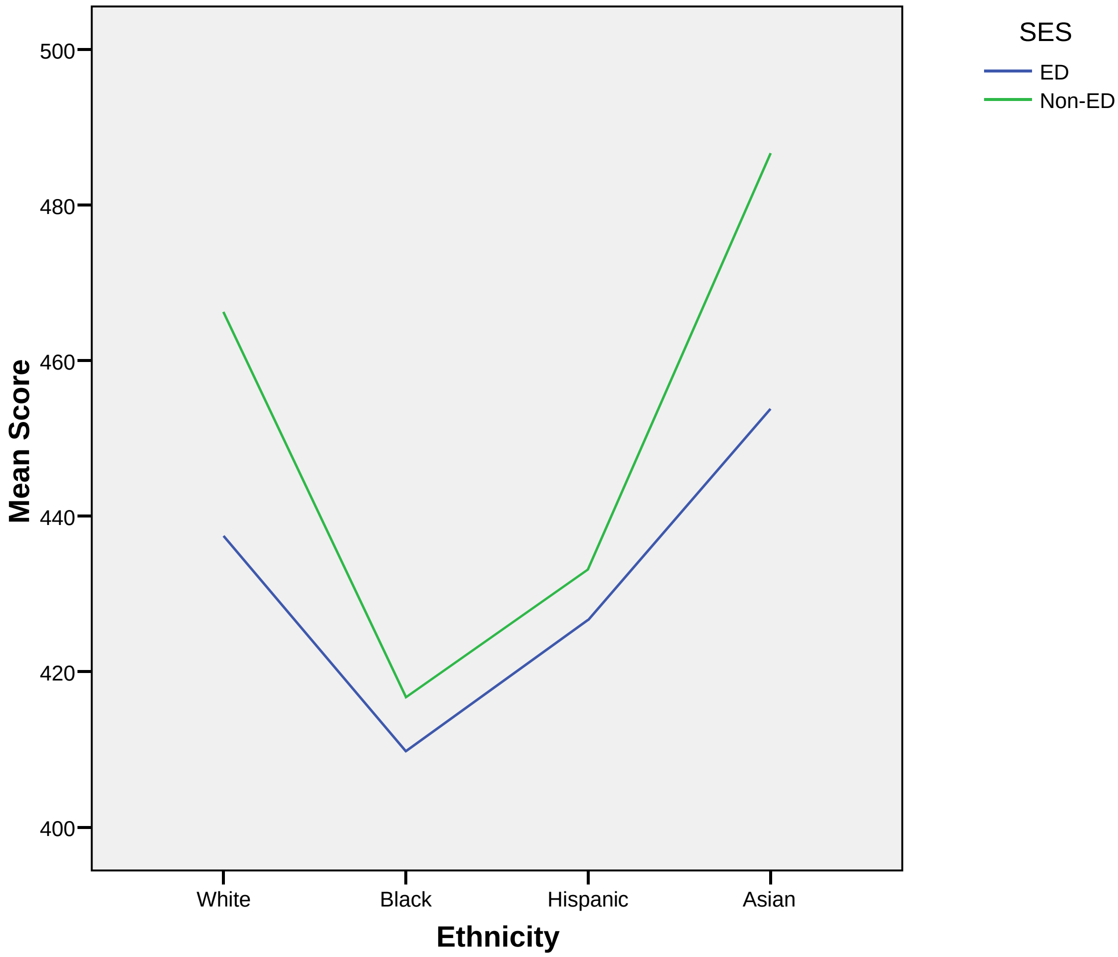

Figure 6. Geometry mean test scores by ethnicity as compared to SES

H_o4_3: There is no difference between scores of students who are classified as economically disadvantaged and the students who are classified as not economically disadvantaged as measured by the End-of-Course Standards of Learning test scores for Algebra II as a function of ethnicity.

A 2 x 4 ANOVA was used to evaluate the relationship between students' SES classification and their ethnicity on End-of-Course SOL test scores in Geometry. The means and standard deviation for Algebra II scores as a function of the two factors are presented in Table 19.

The ANOVA indicated a significant interaction between SES and ethnicity, $F(3,67788)=25.11$, $p<.001$, partial $\eta^2=.001$, as well as a significant main effect for ethnicity, $F(3,67788)=668.31$, $p<.001$, partial $\eta^2=.029$ and significant main effect for SES, $F(1,67788)=192.74$, $p<.001$, partial $\eta^2=.003$. The partial η^2 indicates an extremely small effect size. The null hypothesis was rejected.

Table 19

Means and Standard Deviations for Algebra II SOL Scores

ED Status	Ethnicity	*N*	*M*	*SD*
ED	White	3,192	446.74	58.22
ED	Black	4,606	426.21	52.38
ED	Hispanic	1,307	435.86	60.27
ED	Asian	889	467.76	71.65
Non-ED	White	42,104	462.13	64.43
Non-ED	Black	9,419	431.44	56.84
Non-ED	Hispanic	2,231	441.45	63.82
Non-ED	Asian	4,041	491.16	69.58

Post hoc multiple comparisons were conducted to evaluate the pairwise differences among the means for ethnic groups using Tukey HSD. Significant differences between the means were found among all groups as seen in Table 20 for economically disadvantage students and in Table 21 of students not classified as economically disadvantaged. These data indicate significance for ethnicity. Scoring from highest to lowest, respectively, is Asian, white, Hispanic, and black in both the ED and non-ED subgroups.

Table 20

Pairwise Comparisons by Ethnicity for Economically Disadvantaged Students in Algebra II

Ethnic Group	Mean Score	Comparison Group	Mean Score	Mean Difference	*P*
White	446.74	Black	426.21	20.53	<.001
		Hispanic	435.86	10.88	<.001
		Asian	467.76	-21.02	<.001
Black	426.21	Hispanic	435.86	-9.86	<.001
		Asian	467.76	-41.55	<.001
Hispanic	435.86	Asian	467.76	-31.90	<.001

Table 21

Pairwise Comparisons by Ethnicity for Not Economically Disadvantaged Students in Algebra II

Ethnic Group	Mean Score	Comparison Group	Mean Score	Mean Difference	*P*
White	462.13	Black	431.44	30.69	<.001
		Hispanic	441.45	20.68	<.001
		Asian	491.16	-29.03	<.001
Black	431.44	Hispanic	441.45	-10.01	<.001
		Asian	491.16	-59.72	<.001
Hispanic	441.45	Asian	491.16	-49.71	<.001

The final analysis was to determine if an interaction existed between SES and ethnicity. The data indicate higher mean scores for non-economically disadvantaged students on all four levels of ethnicity. The data indicate that differences of 15.39, 5.23, 5.59, and 23.40 are not equal; therefore, there is a significant interaction between SES and ethnicity. These findings are presented in Table 22. Figure 7 shows the mean test scores of ethnic groups with respect to SES.

Table 22

Interaction Between Ethnic Groups and Socioeconomic Status in Algebra II

Ethnic Group	ED Mean Score	Non-ED Mean Score	Mean Differences
White	446.74	462.13	15.39
Black	426.21	431.44	5.23
Hispanic	435.86	441.45	5.59
Asian	467.76	491.16	23.40

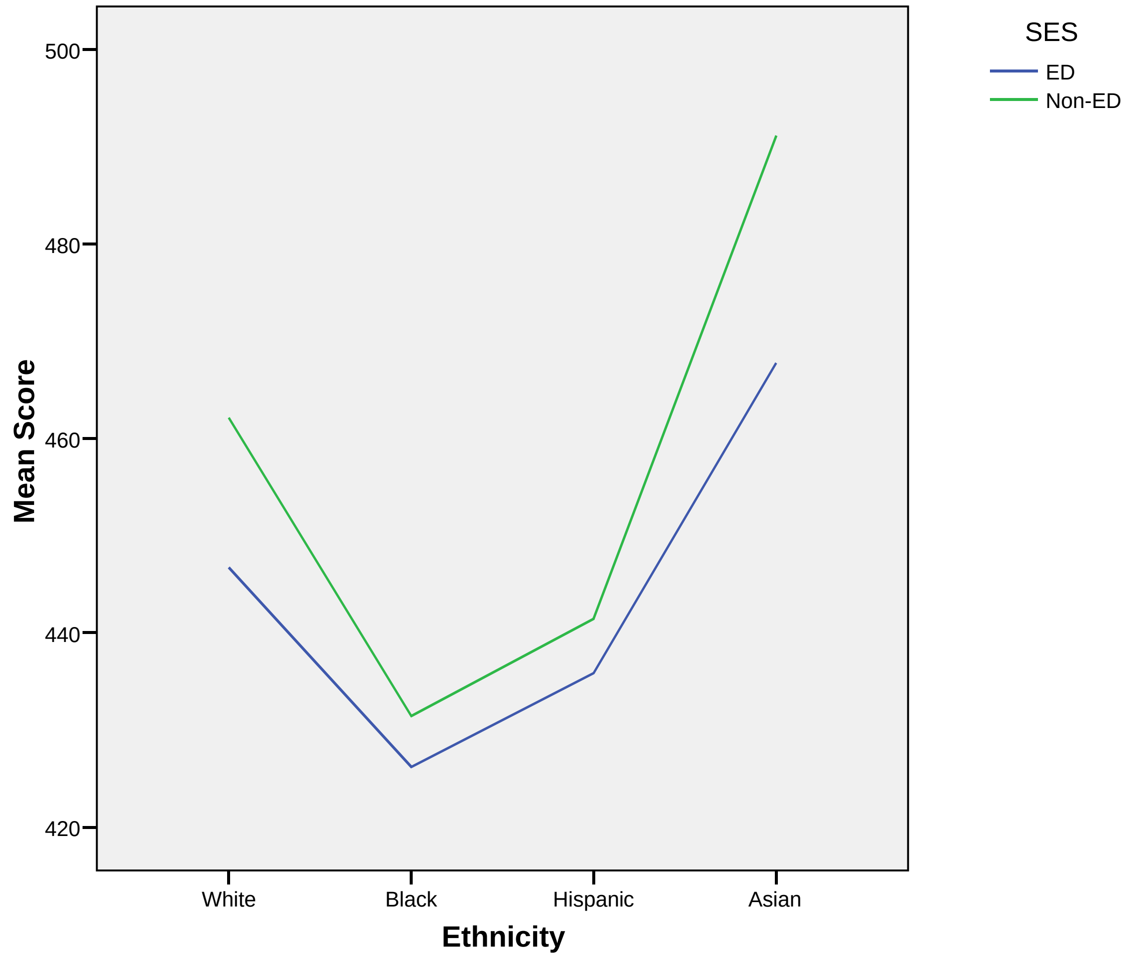

Figure 7. Algebra II mean test scores by ethnicity as compared to SES

CHAPTER 5

FINDINGS, CONCLUSIONS, AND RECOMMENDATIONS

The purpose of this study was to determine if socioeconomic status is a significant indicator of student achievement on the Virginia End-of-Course Standards of Learning tests in Algebra I, Geometry, and Algebra II. In addition, the study attempted to ascertain if a relationship between students' socioeconomic status and their enrollment rate in the upper level, non-required, course of Algebra II existed. The study also examined the relationship of socioeconomic status and test scores for the ethnic groups of white, black, Hispanic, and Asian. The SOL scores of all high school mathematics students for the 2005-2006 school year as well as their membership in any of the above-mentioned ethnic groups and their classification of economically disadvantaged or not economically disadvantaged was used to determine if such a relationship existed. A summary of findings, conclusions, recommendations for practice, and recommendations for further research follow.

Summary of the Study

The purpose of this quantitative study was to determine if socioeconomic status (SES) was a significant indicator of high school mathematics performance. It also examined whether SES was a determining factor in the enrollment rate of students in the non-required course of Algebra II. In addition the study examined these same relationships for the ethnic subgroups of white, black, Hispanic, and Asian. The population of this study consisted of 113,787 Algebra I students, 95,898 Geometry students, and 68,944 Algebra II taking the

End-of-Course SOL assessments in the Commonwealth of Virginia during the 2005-2006 school year. All information was obtained from the Director of Educational Information Management at the Virginia Department of Education.

Classification as economically disadvantaged (ED) or not economically disadvantaged (Non-ED) and ethnic group membership were the independent variables. The dependent variable was the End-of-Course SOL scores in Algebra I, Geometry, and Algebra II. Descriptive statistics, chi-square tests, and an analysis of variance were used to determine the significance between the variables.

The results of this study indicated there were significant differences in enrollment rates, pass rates, and mean scores between economically disadvantaged students and non-economically disadvantaged students and between groups of students of differing ethnicity.

Summary of Findings

The statistical analyses focused on four research questions. The following section reiterates each research question and provides a summary of the findings related to it.

Research Question 1

To what extent, if any, is there a significant difference between the enrollment rates of students who are classified as economically disadvantaged and the students who are classified as not economically disadvantaged among ethnic groups (white, black, Hispanic, and Asian) in the required high school mathematics classes of Algebra I and Geometry and the non-required class of Algebra II?

Descriptive statistics indicated students classified as ED were less likely than non-ED to enroll in Algebra II. The percentage of ED students in the required classes of Algebra I and Geometry were 23.7% and 20.3% of the total population respectively. The percentage of ED students enrolled in Algebra II, a non-required course, was 14.6%. The percentage of white and Asian students increased in sequential mathematics courses while the percentage of black and Hispanic students steadily decreased from Algebra I to Geometry to Algebra II. However, the percentage of ED students, calculated within each ethnic group, decreased in each successive mathematics course.

Research Question 2

To what extent, if any, is there a significant difference between the pass rates of students who are classified as economically disadvantaged and the students who are classified as not economically disadvantaged on the End-of-Course Standards of Learning tests for the required high school mathematics classes of Algebra I and Geometry and the non-required class of Algebra II?

The results of the chi-square test analysis were significant in all secondary mathematics courses indicating ED students have a lower pass rate on the End-of-Course SOL tests in all secondary mathematics courses than students who are not classified as ED. A noteworthy observation was the difference in pass rates of the students in the three mathematics courses. Algebra I had a 9.9% difference in pass rate, Geometry had a 16.3% difference, while Algebra II had a 7.7% difference in the pass rates of economically disadvantaged students as compared to the non-economically disadvantaged students. All null hypotheses relating to this question were rejected.

Research Question 3

To what extent, if any, is there a significant difference between the pass rates of students from differing ethnic groups (white, black, Hispanic, and Asian) on the End-of-Course Standards of Learning tests for the required high school mathematics classes of Algebra I and Geometry and the non-required class of Algebra II?

The results of the chi-square test analyses were significant in Algebra I, Geometry, and Algebra II indicating that ethnicity is significantly associated with pass rates in these courses. Asian students had the highest pass rate on all three End-of-Course SOL tests. Likewise, on each of the three End-of-Course SOL tests, white students had the second highest pass rate, followed by Hispanic students. Black students had the lowest pass rates on all secondary mathematics End-of-Course SOL tests. The three null hypotheses relating to this question were rejected.

Research Question 4

To what extent, if any, is there a significant difference between scores for students who are classified as economically disadvantaged and the students who are classified as not economically disadvantaged as measured by the End-of-Course Standards of Learning test scores in the required high school mathematics classes of Algebra I and Geometry and the non-required class of Algebra II as a function of ethnicity?

The results of the Two-Way ANOVA indicated three significant findings. There were significant differences in the mean scores of students in all secondary End-of-Course SOL mathematics assessments based on SES, ethnicity, and the interaction of SES and ethnicity. Therefore, all three null hypotheses relating to this question were rejected. The results indicated lower mean scores for ED students on the four levels of ethnicity. However, the mean differences were not equal for the four ethnic groups. For ED students, the order, from greatest to least, of the mean scores was Asian, white, Hispanic, and black.

Conclusions

The findings of this study suggest that economically disadvantaged, black, and Hispanic students have lower enrollment rates, pass rates, and test scores than their counterparts who are not classified as economically disadvantaged and are white or Asian. These results are supported by the findings of Douglas-Hall (2006) which indicated poverty is most prevalent among black, Hispanic, and American Indian children. Asian students were the ethnic group with the highest scores on all of the End-of-Course SOL assessments in high school mathematics, which also is consistent with previous research presented in the review of literature by Sheldon and Epstein (2005) and Burris et al. (2006).

In the Commonwealth of Virginia, each student must receive verified credits in Algebra I and Geometry to receive a high school diploma. Algebra II is an elective course and not a requirement for a standard diploma. The results indicate that ED student enrollment rates in Algebra II were significantly lower than enrollment rates in Algebra I and Geometry. The pass rates of ED students were lower than the pass rates of non-ED students. The notable difference in geometry as compared to Algebra I and Algebra II was somewhat perplexing. Geometry had a much larger difference than either of the two Algebra courses. This might be attributed to the visual and spatial nature of the course as compared to Algebra. Another possibility could be the students' inability to understand the terminology related to Geometry and the degree of reading difficulty associated with Geometry.

The results of this study also showed the percentages of Asian and white students taking Algebra II, as compared to Algebra I and Geometry, were significantly higher than the percentages of blacks and Hispanics. This could possibly be attributed to familial, environmental, and socioeconomic background. The ethnic groups with the highest percentages of ED students are black and Hispanic. Poverty can create a stressful, even dangerous, environment. Crime or violence can make the process of learning more difficult (Rank, 2004). Black and Hispanic students were more likely than white and Asian students to say their teachers did not really know what they were capable of academically (Lewis, 2003). Consequently, low teacher expectations could also be a contributing factor in these results.

As school systems strive to meet the demands of ***The No Child Left Behind Act of 2001***, the educational community should be keenly aware of the findings of this study. By the 2013-14 school year, 100% of all students in Virginia's public schools must achieve proficiency on all SOL assessments. Neither poverty nor ethnicity can be a justification for students not performing to a level of proficiency on these tests.

Recommendations for Practice

Based on the findings of this study, there are several recommendations for practice. As previous studies have suggested, taking upper level mathematics classes increases students' future educational attainment and future earnings (Burris et al., 2006; Levin, 2001; Singh & Granville, 1999; Singham, 2003). It is imperative that teachers and guidance counselors encourage ED student to take mathematics courses beyond the requirements for graduation. Individualized educational plans should be developed for all ED students that would include more mathematics courses than are required by the state or school division. These plans should be initiated in middle school and constant encouragement given to keep students focused on attaining a good mathematical education. Guidance counselors should emphasize to ED students the benefits of taking upper level courses, citing sources such as those cited in this study. Intense and individualized career and educational guidance should be on-going throughout the students' middle and high school years.

Secondly, the findings show Asian and white students were more apt to take Algebra II as compared to blacks and Hispanics. A large percentage of the college students, especially black students, said they needed mathematics tutoring once they reached the university level (Thompson & Joshua-Shearer, 2002). Schools should provide tutoring programs to better prepare students for more advanced mathematics courses. All underachieving mathematics students should be targeted for tutoring as early as possible.

The development of mentoring programs should be considered. Placing underachieving students with a mentor throughout their mathematics classes could be beneficial. The consistency of a single person to encourage and tutor them could foster a more positive and constructive attitude toward mathematics. The mentors may be teachers or students who would be willing to participate in an ongoing process. However, schools should develop appropriate screening methods should student mentors be used.

Finally, teachers and curriculum developers within school systems must be vigilant to teach more than is required by minimum competency tests. The tests are just that—minimum competencies. "Universal acceleration" produced no evidence that increased numbers of students fell behind grade level or dropped out of mathematics as a result of this reform (Burris et al., 2006). A curriculum that would prepare students for the rigors of more advanced mathematics classes should be the focus of teachers' efforts, not merely the achievement of passing scores on SOL assessments.

Teacher efficacy is a key element in breaking the cycle of poverty. All members of the educational community must be made aware of their potential influence upon the future of our society by their influence upon the students they come in contact on a daily basis. Teachers must instill a positive belief in all of students that they can learn. They must infuse in their students the belief that education is of the paramount importance in their lives. High expectations for all students are a key factor in breaking the cycle of poverty that many students find themselves entrapped. As one student said, “My teacher thought I was smarter than I was and I was” (Cutlip, 2007).

Recommendations for Further Research

This study could evolve into a longitudinal study in order to ensure the best education is being provided for all students regardless of race or socioeconomic status. This study could also be expanded to all grade levels and all subject areas. Continuation of this research could also be expanded to include gender.

The difference in the pass rates among the three mathematics courses of Algebra I, Geometry, and Algebra II found in this study should be further studied to determine the possible causes of such notable discrepancies.

Teacher attitudes and expectations are crucial factors in student achievement. The impact of these attitudes and expectations could be of significance and should be studied.

The importance of parental involvement is one of the most critical factors affecting student educational beliefs and attainment. Studies of educational attitudes of families in poverty verses families of higher economic status should be conducted.

Research by Madaus and Clarke (2001) indicates the use of minimum competency exams (MCE) may have negative effects on the curriculum. In Virginia, is the curriculum based solely upon SOL tests instead of the tests being driven by the curriculum? An interesting study would be to determine the effects of MCE upon enrollment and achievement in upper level mathematics courses, which are not assessed. For example, do the MCE in Algebra I, Geometry, and Algebra II have any effect upon the curriculum and skills of students proceeding to Math Analysis and Calculus?

Positive relationships between students and teachers appear to be one of the key factors in helping students overcome familial and environmental barriers and move out of poverty. Investigations of these relationships would be an interesting topic on which to conduct research.

Summary

All students must achieve proficiency in Algebra I and Geometry to receive a high school diploma in the Commonwealth of Virginia. Poverty and ethnicity can no longer be a justification for under-achieving students in Virginia public schools. While students may not have a supportive home situation, the members of the educational system must always provide support, encouragement, and the best educational practices for all students regardless of ethnicity or socioeconomic status.

REFERENCES

American Psychological Association. (2000). ***Resolution on poverty and socioeconomic status.*** Washington, DC: Author.

Barr, R. (2002). Revitalizing underachieving student and low-performing schools. ***Educating Kentucky's at-risk kids.*** Eastern Kentucky University. Retrieved June 6, 2005 from www.education.eku.edu/Coop KTIP/help student/Daniel%20How to Effectively Teach Children of Poverty%5B1%5D.ppt

Bishop, J.H., & Mane, F. (2001). The impacts of minimum competency exam graduation requirements on college attendance and early labor market success of disadvantaged students. In G. Orfield & M.L. Kornhaber (Eds.), ***Raising standards or raising barriers? Inequality and high-stakes testing in public education*** (pp. 51-83). New York: The Century Foundation Press.

Brown, T.J. (1999). ***Teaching the poor and children of color.*** Columbia, MD: Brown & Associates.

Burris, C.C., Heubert, J.P., & Levin, H.M. (2006). Accelerating mathematics achievement using heterogeneous grouping. ***American Educational Research Journal, 43***, 105-136.

Career and Technical Education Services [CTE]. (2006). ***CTE administrative planning guide: 2006-2007.*** Richmond, VA: Department of Education.

Century Foundation Task Force. (2002). Divided we fail. Retrieved on January 16, 2007 from http://www.tcf.org/Publications/Education/dividedwefail.pdf

Communication Connects. (2002). Framework of poverty (Workshop Notes). Retrieved June 6, 2005 from www.communicationconnects.com/articles/FrameworkOfPoverty.pdf

Cutlip, B.J. (2007, August). ***Teacher efficacy.*** Workshop presented at a professional development meeting for secondary teachers, Smyth County, VA.

D'Agostino, J.V. (2000). Instructional and school effects on students' longitudinal reading and mathematics achievement. ***School Effectiveness and School Improvement, 11***, 197-235.

Douglas-Hall, A., & Koball, H. (2006). The new poor: Regional trends in child poverty since 2000. ***National Center for Children in Poverty.*** New York: Columbia University.

Education Week. (January 3, 2007). Children's chances for success vary dramatically by state, report warns. ***Quality counts 2007: From cradle to career, connecting American education from birth to***

adulthood (Press packet), 26. Retrieved on January 22, 2007 from http://www.edweek.org/media/ew/qc/2007/qc07_presspacket_full.pdf

Gershoff, E. (2003). Low income and the development of America's kindergartners. ***National Center for Children in Poverty.*** Retrieved June 6, 2005 from www.nccp.org/media/lat03d-text.pdf

Gersten, R. (2002). Math education and achievement. ***U.S. Department of Education.*** Retrieved on January 24, 2007 from http://www.ed.gov/nclb/methods/whatworks/research/page_pg6.html

Heller, B. (2005). Testing is here to stay. ***Phi Delta Kappan, 86***, 641.

Heubert, J.P. (2001 High-stakes testing and civil rights: Standards of appropriate test use and a strategy for enforcing them. In G. Orfield & M.L. Kornhaber (Eds.), ***Raising standards or raising barriers? Inequality and high-stakes testing in public education*** (pp. 179-194). New York: The Century Foundation Press.

Hill, B. (2005). Learning styles and standardized test scores: Is there a connection? ***The Delta Kappa Gamma Bulletin, 71***, 27-30.

Holloway, J.H. (2004). Closing the minority achievement gap in math. ***Educational Leadership, 61***, 84-86.

Jamieson, A., Curry, A., & Martinez, G. (2001). School enrollment in the United States—social and economic characteristics of students. ***Current Population Reports.*** Washington, DC: U.S. Census Bureau.

Klem, A.M., & Connell, J.P. (2004). Relationships matter: Linking teacher support to student engagement and achievement. ***Journal of School Health, 74,*** 262-273.

Knapp, M.S., & Shields, P.M. (2005). Reconceiving academic instruction for the children of poverty. ***Eisenhower National Clearinghouse for Mathematics and Science Education.*** Retrieved June 15, 2005 from www.enc.org/print/topics/equity/articles/document.shtm?input=ACQ-111499-1499

Kornhaver, M.L., & Orfield, G. (2001). High-stakes testing policies: Examining their assumptions and consequences. In G. Orfield & M.L. Kornhaber (Eds.), ***Raising standards or raising barriers? Inequality and high-stakes testing in public education*** (pp. 1-18). New York: The Century Foundation Press.

Lee, J. (2006). Tracking achievement gaps and assessing the impact of NCLB on the gaps: An in-depth look into national and state reading and math outcome trends. ***The Civil Rights Project.*** Cambridge, MA: Harvard University.

Lewis, A.C. (2003). Holes in NCLB. ***The Education Digest, 68,*** 68-69.

Levin, H.M. (2001). The adverse impact of high-stakes tesing on minority students: Evidence from one hundred years of test data. In G. Orfield & M.L. Kornhaber (Eds.), ***Raising standards or raising barriers? Inequality and high-stakes testing in public education*** (pp.85-106). New York: The Century Foundation Press.

Madaus, G., & Clarke, M. (2001). The development and impact of high-stakes testing. In G. Orfield & M.L. Kornhaber (Eds.), ***Raising standards or raising barriers? Inequality and high-stakes testing in public education*** (pp. 19-38). New York: The Century Foundation Press.

Maggi, S., Hertzman, C., Kohen, D., & D'Angiulli, A. (2004). Effects of neighborhood socioeconomic characteristics and class composition on highly competent children. ***The Journal of Educational Research, 98***, 109-114.

McCoy, L.P. (2005). Effects of demographic and personal variables on achievement in eighth-grade algebra. ***The Journal of Educational Research, 98,*** 131-135.

National Assessment of Educational Progress. (2006). National Center for Education Statistics: Washington, DC Retrieved on January 23, 2007 from http://nces.ed.gov/nationsreportcard/faq.asp#ques1

National Center for Children in Poverty. (2002a). ***Basic facts about low-income children in the United States.*** Retrieved June 6, 2005 from www.nccp.org/pub_lic05.html

National Center for Children in Poverty. (2002b). ***Virginia Policy Context.*** Retrieved January 8, 2007 from http://www.nccp.org/printable/printable_state_detail_context_VA.html

National Center for Children in Poverty. (2006a). ***Parents' low education leads to low income, despite full-time employment.*** New York: Columbia University

National Center for Children in Poverty. (2006b). ***Who are America's poor children? The official story.*** New York: Columbia University

Natriello, G., & Pallas, A.M. (2001). The development and impact of high-stakes testing. In G. Orfield & M.L. Kornhaber (Eds.), ***Raising standards or raising barriers? Inequality and high-stakes testing in public education*** (pp. 19-38). New York: The Century Foundation Press.

Neill, M., & Gayler, K. (2001). Do high-stakes graduations tests improve learning outcomes? Using state-level NAEP date to evaluate the effects of mandatory graduation tests. In G. Orfield

& M.L. Kornhaber (Eds.), ***Raising standards or raising barriers? Inequality and high-stakes testing in public education*** (pp. 107-125). New York: The Century Foundation Press.

Nye, B., Hedges, L.V., & Kostantopoulos, S. (2001). Are effects of small classes cumulative? Evidence from a Tennessee experiment. ***The Journal of Educational Research, 94,*** 336-345.

Okpalla, A.O., Okpalla, C.O., & Smith, F.E. (2001). Parental involvement, instructional expenditures, family socioeconomic attributes, and student achievement. ***The Journal of Educational Research, 95,*** 110-115.

Olson, L. (2007a). Breaking the cycle of poverty. ***Quality counts 2007: From cradle to career.*** Education Week. Retrieved on January 22, 2007 from http://edweek.org//ew/articles/2007/01/04/17wellbeing.h23.html?print=1

Olson, L. (2007b). Gauging student learning. ***Quality counts 2007: From cradle to career.*** Education Week. Retrieved on January 22, 2007 from http://edweek.org//ew/articles/2007/01/04/17k-12.h26.html?print=1

Olson, L. (2007c). Paying attention earlier on. ***Quality counts 2007: From cradle to career.*** Education Week. Retrieved on January 22, 2007 from http://edweek.org//ew/articles/2007/01/04/17early.h26.html?print=1

Orfield, G., & Kornhaver, M.L. (2001). Preface. In G. Orfield & M.L. Kornhaber (Eds.), ***Raising standards or raising barriers? Inequality and high-stakes testing in public education*** (pp. ix-xii). New York: The Century Foundation Press.

Payne, R.K. (2003). ***A framework for understanding poverty*** (3rd ed.). Highlands, TX: **aha!**Process.

Payne, R.K. (1998). ***A framework for understanding poverty.*** Baytown, TX: RFT.

Pellino, K.M. (2005). ***The effects of poverty on teaching and learning.*** Retrieved June 14, 2005 from www.teach-nology.com/tutorials/teaching/poverty/print.htm

Powell, B.A. (2005). UC Berkeley Web Feature. Retrieved on January 6, 2007 from http://www.berkeley.edu/news/media/relesases/2005/10/26_edwards.shtml

Rank, M.R. (2004). ***One nation, underprivileged: Why American poverty affects us all.*** New York: Oxford University Press.

Ravitch, D. (1995). ***National standards in American education: A citizen's guide.*** Washington, DC: The Brookings Institution.

Roeper Review. (2003). ***Resolution on poverty and socioeconomic status. (Examining priorities in gifted education).*** Bloomfield Hills, MI: The Roeper School.

Rothstein, R. (2004). ***Class and schools: Using social, economic, and educational reform to close the black-white achievement gap.*** Washington, DC: Economic Policy Institute.

Sadker, D., & Zittleman, K. (2004). Test anxiety: Are students failing tests—or are tests failing students? ***Phi Delta Kappan, 85***, 740-744.

Schiller, K.S., & Muller, C. (2003). Raising the bar and equity? Effects of state high school graduation requirements and accountability policies on students' mathematics course taking. ***Educational Evaluation and Policy Analysis, 25***, 299-318.

Shaughnessy, M.F. (2005). ***An interview with Ruby Payne: About teaching children in poverty***. Eastern New Mexico University. Retrieved June 6, 2005 from www.educationnews.org/an-interview-with-ruby-payne.htm

Sheldon, S.B., & Epstein, J.L. (2005). Involvement counts: Family and community partnerships and mathematics achievement. ***The Journal of Educational Research, 98,*** 196-206.

Singh, K. & Granville, M. (1999). Factors that affect enrollment in eighth grade algebra for African American students. ***Research in Middle Level Education Quarterly, 22***.

Singh, K., & Ozturk, M. (2000). Effect of part-time work on high school mathematics and science course taking. ***The Journal of Educational Research, 94,*** 67-74.

Singham, M. (2003). The achievement gap: Myths and reality. ***Phi Delta Kappan, 84***, 586-591.

Sirin, S.R. (2005). Socioeconomic status and academic achievement: A meta-analytic review of research. ***Review of Educational Research, 75,*** 417-453.

Sloane, F.C., & Kelly, A.E. (2003). Issues in high-stakes testing programs. ***Theory into Practice, 42,*** 12-17.

Teachman, J.D., Paasch, K.M., Day, R.D., & Carver, K.P. (1997). Poverty during adolescence and subsequent educational attainment. ***Consequences of growing up poor.*** New York: Russell Sage Foundation.

The Free Dictionary by Farlex. (2007). Retrieved on November 26, 2007 from http://financial-dictionary.thefreedictionary.com/Federal+Poverty+Level+-+FPL

Thompson, G.L., & Joshua-Shearer, M. (2002). In retrospect: What college undergraduates say about their high school education. *The High School Journal, 85,* 1-10.

Toutkoushian, R.K., & Curtis, T. (2005). Effects of socioeconomic factors on public high school outcomes and rankings. *The Journal of Educational Research, 98,* 259-271.

U.S. Census Bureau. (2003). ***Small area incomes & poverty estimates.*** Retrieved on January 25, 2007 from http://www.census.gov/cgi-bin/saipe/saipe.cgi?year=2003&type=county&table=county&submit=States%20%26%20Counties&areas=all&display_data=Display%20Data&state=51#top

U.S. Department of Education. (2004a). ***Guide to education and No Child Left Behind.*** Retrieved on January 20, 2007 from http://www.ed.gov/nclb/overview/intro/guide/index.html

U.S. Department of Education. (2004b). ***U.S. students show improvement in international mathematics and science assessment.*** Retrieved on January 6, 2007 from http://www.ed.gov/print/news/pressreleases/2004/12/12142004.html

Virginia Department of Education. (2003). ***Virginia's NCLB assessment and accountability plan.*** Retrieved on February 1, 2007 from http://www.pen.k12.va.us/VDOE/nclb/nclbassesment.ppt

Virginia Department of Education. (2004a). ***Virginia graduation requirements: Standard diploma.*** Retrieved on January 31, 2006 from http://www.pen.k12.va.us/2plus4in2004/dip-standard.shtml

Virginia Department of Education. (2004b). ***Virginia graduation requirements: Advanced studies diploma.*** Retrieved on January 31, 2006 from http://www.pen.k12.va.us/2plus4in2004/dip-advanced.shtml

Virginia Department of Education. (2005). ***Data definitions.*** Retrieved January 20, 2007, from http://www.pen.k12.va.us/VDOE/Publications/student-coll/data_definitions.html

Virginia Department of Education. (2006). ***School, school divisions, and state report cards.*** Retrieved on February 1, 2007 from https://p1pe.doe.virginia.gov/reportcard/

Virginia Department of Education. (2007a). ***Standards of Learning currently in effect for Virginia public schools.*** Retrieved on January 6, 2007 from http://www.pen.k12.va.us/VDOE/Superintendent/Sols/home.shtml

Virginia Department of Education. (2007b). ***Virginia implements No Child Left Behind.*** Retrieved on January 21, 2007 from http://www.pen.k12.va.us/VDOE/nclb/#top

Virginia Department of Education. (2007c). ***Virginia school report card: Accountability terminology.*** Retrieved on January 6, 2007 from http://www.pen.k12.va.us/VDOE/src/terminology.shtml

Virginia Department of Education. (2007d). ***2005-2006 Free and reduced lunch program eligibility report.*** Retrieved on February 1, 2007 from http://www.pen.k12.va.us/VDOE/Finance/Nutrition/DivisionLevel-Free&ReducedEligibilityOCT2006.xls

Virginia Department of Education. (2007e). ***Virginia Advanced placement performance even stronger in 2006: African-American students narrow "equity gap".*** Retrieved on February 14, 2007 from http://www.pen.k12.va.us/VDOE/NewHome/pressreleases/2007/feb6.html

Wilkins, J.L.M., & Ma, X. (2002). Predicting student growth in mathematical content knowledge. *The Journal of Educational Research, 5,* 288-298.

Witte, R.S., & Witte, J.S. (2004). ***Statistics*** (7th ed.). Hoboken, NJ: John Wiley & Sons.

VITA

KATHY JOHNSON

Personal Data:	Date of Birth: 08-17-1958 Place of Birth: Abingdon, Virginia
Education:	Clinch Valley College (now University of Virginia’s College at Wise), Wise, Virginia; Bachelor of Arts in Mathematics and History; 1980 Virginia Tech, Blacksburg, Virginia; Master of Arts in Curriculum and Instruction; 1998 East Tennessee State University, Johnson City, Tennessee; Doctor of Education in Educational Leadership and Policy Analysis; 2008
Professional Experience:	Lebanon High School Mathematics Teacher, Russell County Public Schools, Lebanon, Virginia 1980-2004 Mathematics Coordinator Russell County Public Schools, Lebanon, Virginia 2001-2004 Chilhowie High School Mathematics Teacher, Smyth County Public Schools, Marion, Virginia 2004-present