The Relationship Between School Size and Student Achievement in Missouri

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Abstract

The purpose of this study was to examine the relationship between school size and student achievement in Missouri elementary, middle, and high schools and identify the optimal school size that maximizes student achievement on the Missouri Assessment Program (MAP) assessments. The study also explored the extent to which the relationship between school size and student achievement was affected by school location, ethnicity, poverty, and special education classifications. The dependent variable in the causal-comparative quantitative study was student achievement as measured by the percentage of students in a school scoring at the proficient or advanced levels on the 2009-2010 MAP assessments. Grade-Level Assessments in Communication Arts and Mathematics were analyzed at grade 5 in elementary schools and grade 8 in middle schools. End-of-Course Assessments in English II, Algebra I, biology, and government were analyzed in high schools. The independent variable was school size. Additional independent variables included school location, ethnicity, poverty, and special education classifications.

Analysis revealed mixed results across the three testing grade levels. Higher levels of student achievement were generally found in larger schools. Location affected the differences in Communication Arts and Mathematics achievement among elementary schools of different sizes. Both poverty and special education affected the differences in English II, Algebra I, biology, and government achievement among high schools of different sizes. In middle schools, special education affected the differences in achievement in both Communication Arts and Mathematics. Recommendations for further research included replicating the current study using data from other states and

longitudinal data. The study could also include additional independent (per pupil expenditure, attendance rate, and GPA) and dependent (ACT, SAT, Advanced Placement) variables.

Dedication

This dissertation is dedicated to my loving family: Annie, Sutton, and baby boy on the way. May the fruits of this journey be a blessing to our family.

Acknowledgments

I cannot take full credit for the completion of this work. Through God's divine power, I have been blessed with a nurturing family and supportive colleagues who have made it possible for me to complete a doctoral degree. This dissertation is evidence that "I can do all things through Christ who gives me strength" (Philippians 4:13).

From the time that I was young boy growing up on a farm in Iowa, my first teachers, Mom and Dad, taught me to value education, work hard, and take pride in my work. To them, I owe a debt of gratitude for their continuous support, wise guidance, and unwavering love.

I am also indebted to my soul mate and wife, Annie and our wonderful son, Sutton. During the pregnancy, birth, and first two years of Sutton's life, Annie allowed me to be an absentee husband and father on Wednesday nights and every available hour in between to complete the work necessary to attend class and write this dissertation. Never did she complain or scoff when I retired to the basement to work after dinner, on the weekends, and throughout the summer. Her support, kind words of encouragement, and unconditional love kept me focused and determined to finish the dissertation.

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Chapter One

Introduction

As early as the late nineteenth century, educational policy makers and researchers engaged in the debate over the appropriate student enrollment size for public schools (National Education Association, 1894). While some advocated for the preservation of the small one-room school house (Kennedy, 1915), others looked to school consolidation as a remedy for improving the quality of education across rural America (Foght, 1917). Examining the condition of rural education at the turn of the century, Joseph Kennedy (1915), Dean of the School of Education at the University of North Dakota wrote, *Rural Life and the Rural School*. While Kennedy acknowledged that much needed to be done to improve rural schools, he stopped short of abandoning the system of autonomous tiny rural schools stating, “If there are twenty or thirty children and an efficient teacher we have the essential factors of a good school” (p. 64). Conversely, Harold Foght, Professor of Rural Education and Sociology at the State Normal School in Kirksville, Missouri, held a disparate view of rural education in his 1917 work, *The American Rural School: Its Characteristics, Its Future and Its Problems*. Believing that the small rural district was “generally unsatisfactory” (p. 17), Foght looked to consolidation as the key to improving the quality of rural education.

Conceptual Framework and Background

While nearly one hundred years have passed since Foght’s and Kennedy’s critiques and recommendations, educational researchers continue to explore the issue of optimal student enrollment size in public schools due primarily to mixed and contradictory findings (Stevenson, 2009). Fueling the debate are two competing points of view: the school consolidation movement urging the establishment of larger more comprehensive and economically efficient schools, and the small schools reform movement encouraging the creation of smaller, more responsive and nurturing schools (Raywid, 1997). According to Berry (2004), beginning in the 1920s, the move to consolidate schools gained momentum through much of the 20th century and tapered off by the late 1980s resulting in the reduction of about 188,000 schools and pushed the average student enrollment in American schools from 83 to more than 450.

However, in the last twenty years, a desire to return to schools with smaller student enrollments has counteracted the consolidation movement. Spurred on by millions of dollars in funding from government and private sources for school districts willing to create smaller schools (Cotton, 2001), the small schools movement gained substantial momentum as the "next big thing in education" (Berry, 2004, p. 56). Yet, as state and local governments currently look for ways to operate more efficiently, consolidation of schools is once again emerging as a viable school restructuring initiative (National School Boards Association, 2009).

Statement of the Problem

It is worth noting again that educators, communities, and policy makers have struggled to determine the appropriate size of schools since the birth of public education (Cubberley, 1922). In its infancy, formalized public education started out as an unorganized collection of township-based schoolhouses (Strang, 1987). During the last century, schools morphed into an amalgamation of sizes ranging from tiny rural schools struggling to continue operating in the face of declining enrollments, scarce resources, and pressures to consolidate (Howley & Howley, 2006), to massive urban mega-schools challenged with overcrowding, the depersonalization of largeness, and the more recent urge to conform with the small schools reform movement (Allen, 2002).

According to Williams (1990), such differences in school sizes across the nation have led some researchers to question both the effectiveness of various school sizes, as well as the equity between large and small schools. This disparity is evident in the state of Missouri where high school sizes ranging from an enrollment of 17 to nearly 3000 students (Missouri State High School Activities Association, 2010a) represent a massive discrepancy in school size. In fact, the smallest 57 high schools in Missouri could fit into the state's largest high school located in St. Louis (Missouri State High School Activities Association, 2010a).

While the schools in Missouri represent a wide variance in size, creating inequities in student enrollments, the federal No Child Left Behind Act (NCLB) has required that all schools be held to the same standard of student achievement (Center on Education Policy, 2008). This compounds the issue of school size, as today's schools are confronted with the NCLB mandate to continually improve student achievement despite discrepancies in resources and funding (Mathis, 2003). Therefore, school funding, which is directly tied to school size based on per-pupil appropriation and student enrollment, may impact student achievement (Mathis, 2003).

Because of the disparity in school sizes across the state of Missouri, the demand to increase student achievement, and the conflicting pressures to both increase and decrease school size, the relationship between school size and student achievement among a diverse student population in various school settings within the state warrants investigation. While extensive research exists regarding the relationship between school size and student achievement, most studies concentrate on only a single school level. Elementary studies by Borland and Howsen (2003), Eberts, Schwartz, and Stone (1990), Huang and Howley (1993), Lamdin (1995), and Lee and Loeb (2000) are examined in depth in chapter two. Additionally, middle school studies by Chamberlin (2007), Howley and Howley (2004), and Lee and Smith (1993) are reviewed in chapter two along with high school studies by Brackett (2008); Gardner, Ritblatt, and Beatty (2000); Lee and Smith (1995); Schneider, Wyse, and Keesler (2007); Slate and Jones (2006); Stewart (2009); and Werblow and Duesbery (2009). Very few studies have been found that control for the location of the school or special education classification. Due to a lack of convergence regarding the findings of studies relating to the relationship between school size and student achievement, the issue warrants further investigation (Stevenson, 2009).

Significance of the Study

Considering the popularity of the small schools movement and the reemerging consideration of school consolidation as a viable cost-saving initiative, this study provides important information concerning variables that may impact student outcomes based on school size and the extent to which school size is a factor in student performance at the elementary, middle, and high school levels in Missouri. The study also expands the body of knowledge regarding variables not previously linked with school size and student achievement by exploring the extent to which the relationship between school size and student achievement may fluctuate based on school location, ethnicity, poverty, or special education classifications. Such information could prove beneficial to education policy makers, school boards, school district personnel, and community stakeholders as they consider school restructuring and plan for future facility construction.

Purpose Statement

This study was designed to explore the relationship between student achievement and school size in Missouri elementary, middle, and high schools. Additionally, the study explored the extent to which the relationship between student achievement and school size was affected by school location, ethnicity, poverty, and special education classifications.

Delimitations

Lunenburg and Irby (2008) define delimitations as “self-imposed boundaries set by the researcher on the purpose and scope of the study” (p. 134). Definitions of terms specific to delimiters, assumptions, and research questions contained in the study are referenced in the *Definition of Terms* section on page 9. The following delimiters were imposed on this study:

1. Data from the 2009-2010 school year were utilized in the study.
2. Public schools in Missouri that administered Missouri Assessment Program (MAP) Grade-Level Assessments for elementary and middle schools and End-of-Course (EOC) Assessments for high schools and reported ex post facto data for location, ethnicity, poverty, and special education were included.
3. Public schools in Missouri with grade configurations that met the National Center for Educational Statistics (NCES) Common Core of Data Glossary definition of elementary, middle, and high school were included.

4. Elementary schools that included grade 5 were considered for inclusion in the study.
5. Middle schools that included grade 8 were considered for inclusion in the study.
6. Public, non-charter schools in the state of Missouri were considered for inclusion in the study
7. Schools with enrollments comprised solely of special education students were excluded from consideration in the study.
8. All alternative educational schools were excluded from consideration in the study.

Assumptions

Assumptions are referred to as the "postulates, premises, and propositions that are accepted as operational for purposes of the research" (Lunenburg & Irby, 2008, p. 135). The following assumptions were made in the study:

1. All MAP Grade-Level and EOC Assessment data retrieved from the Missouri Department of Elementary and Secondary Education (DESE) were complete and accurate.
2. All school and student demographic data reported to DESE by individual school districts were complete and accurate.
3. All data obtained from the National Center for Education Statistics Common Core of Data Public Elementary/Secondary School Locale Code files accurately reflected the location of each school in the study.

4. All data were accurate following the mergers of multiple data sets and subsequent data cleaning.

Research Questions

Creswell (2009) stated research questions (RQ) “shape and specifically focus the purpose of the study” (p. 132). The following research questions were addressed:

RQ 1: To what extent does a relationship exist between elementary school size and student achievement as measured by the MAP Grade-Level Assessment in communication arts?

RQ 2: To what extent does a relationship exist between elementary school size and student achievement as measured by the MAP Grade-Level Assessment in mathematics?

RQ 3: To what extent does a relationship exist between middle school size and student achievement as measured by the MAP Grade-Level Assessment in communication arts?

RQ 4: To what extent does a relationship exist between middle school size and student achievement as measured by the MAP Grade-Level Assessment in mathematics?

RQ 5: To what extent does a relationship exist between high school size and student achievement as measured by the MAP EOC Assessment in English II?

RQ 6: To what extent does a relationship exist between high school size and student achievement as measured by the MAP EOC Assessment in Algebra I?

RQ 7: To what extent does a relationship exist between high school size and student achievement as measured by the MAP EOC Assessment in biology?

RQ 8: To what extent does a relationship exist between high school size and student achievement as measured by the MAP EOC Assessment in government?

RQ 9: To what extent is the relationship between elementary school size and student achievement as measured by the MAP Grade-Level Assessment in communication arts impacted by any of the following variables: location, ethnicity, poverty, or special education classifications?

RQ 10: To what extent is the relationship between elementary school size and student achievement as measured by the MAP Grade-Level Assessment in mathematics impacted by any of the following variables: location, ethnicity, poverty, or special education classifications?

RQ 11: To what extent is the relationship between middle school size and student achievement as measured by the MAP Grade-Level Assessment in communication arts impacted by any of the following variables: location, ethnicity, poverty, or special education classifications?

RQ 12: To what extent is the relationship between middle school size and student achievement as measured by the MAP Grade-Level Assessment in mathematics impacted by any of the following variables: location, ethnicity, poverty, or special education classifications?

RQ 13: To what extent is the relationship between high school size and student achievement as measured by the MAP EOC Assessment in English II impacted by any of the following variables: location, ethnicity, poverty, or special education classifications?

RQ 14: To what extent is the relationship between high school size and student achievement as measured by the MAP EOC Assessment in Algebra I impacted by any of the following variables: location, ethnicity, poverty, or special education classifications?

RQ 15: To what extent is the relationship between high school size and student achievement as measured by the MAP EOC Assessment in biology impacted by any of the following variables: location, ethnicity, poverty, or special education classifications?

RQ 16: To what extent is the relationship between high school size and student achievement as measured by the MAP EOC Assessment in government impacted by any of the following variables: location, ethnicity, poverty, or special education classifications?

Definition of Terms

According to Creswell (2009), terms that "individuals outside the field of study may not understand and that go beyond common language" should be defined (p. 39). The following terms are defined to assist in avoiding confusion and adding coherence to the study. For purposes of the study, the following definitions will be used:

Achievement. Achievement is defined as the percentage of students in a school at the proficient and advanced levels on the MAP Grade-Level Assessments (Missouri DESE, 2010c) and EOC Assessments (Missouri DESE, 2010d).

Core Data Collection System. The Core Data Collection System is a "web-based data collection system utilized by the state of Missouri for school districts to report descriptive statistics to the DESE" (Missouri DESE, 2007, p. 5).

DESE. The Missouri Department of Elementary and Secondary Education is the "administrative arm of the State Board of Education" (Missouri DESE, 2010a, para. 1) and is charged with carrying out all statutory obligations related to K-12 education in the state.

Elementary School. Also known as *Primary School,* an elementary school is any "school offering a low grade of prekindergarten to 3 and a high grade of 8 or lower" (U.S. Department of Education, 2008b, para. 31).

End-of-Course Assessments. The End-of-Course (EOC) Assessments are statewide, content-specific, criterion-referenced assessments traditionally administered at the high school level, but required "when a student has received instruction on the course-level expectations for an assessment, regardless of grade level" (Missouri DESE, 2009, para. 1).

Enrollment. Also known as *School Size,* enrollment is the total head counts of all resident and nonresident students in a school as compiled in the January Membership Count and reported to DESE during the February reporting cycle in the Core Data Collection System (Missouri DESE, 2007, p. 93).

Grade-Level Assessment. Grade-level assessments are criterion-referenced, grade-span tests required for all Missouri students in grades 3-8 (Missouri DESE, 2009, para. 2).

High School. A high school is defined as "a school offering a low grade of 7 or higher and a high grade of 12" (U.S. Department of Education, 2008b, para. 10).

Junior High School. Also known as *Middle School*, a junior high school is "a school offering a low grade of 4 to 7 and a high grade of 9 or lower" (U.S. Department of Education, 2008b, para. 28).

MAP. The Missouri Assessment Program (MAP) "assesses students' progress toward mastery of the Show-Me Standards which are the educational standards in Missouri" through required, criterion-referenced, grade span assessments of all Missouri students in grades 3-8 known as Grade-Level Assessments and content-specific, criterion referenced assessments at the secondary level known as End-of-Course (EOC) Assessments (Missouri DESE, 2009, para. 1).

Middle School. Also known as *Junior High*, a middle school is "a school offering a low grade of 4 to 7 and a high grade of 9 or lower" (U.S. Department of Education, 2008b, para. 28).

Primary School. Also known as *Elementary School*, a primary school is any "school offering a low grade of prekindergarten to 3 and a high grade of 8 or lower" (U.S. Department of Education, 2008b, para. 31).

Overview of Methodology

This study employed a quantitative research design and examined the relationship between school size and student achievement and the effect of location, ethnicity, poverty, and special education classifications on the relationship. All schools in the state of Missouri, during the 2009-2010 school year, were considered for inclusion in the study and comprised the study's population.

The independent variable, the sizes of the school, was measured by the total student enrollment in the school as reported to DESE as the January Membership Count. Schools were grouped in five size categories according to student enrollment using an application of the formula derived from the enrollment and classifications policy outlined by the Missouri State High School Activities Association (2010b).

MAP Grade-Level Assessment scores were used as the dependent variable of student achievement for elementary and middle schools while EOC Assessment scores were utilized for high schools. The dependent variable of student achievement included the percentage of students scoring proficient and advanced on the MAP Grade-Level Assessments in communication arts and mathematics in grade 5 in elementary schools and grade 8 in middle schools, and EOC Assessments in English II, Algebra I, biology, and government in high schools. All data used in the study were obtained from the DESE. To determine if statistically significant differences in student achievement existed between schools of different sizes, one factor ANOVAs were used to address research questions. To determine the interaction effect between the size of a school and location, ethnicity, poverty, and special education classifications, two factor ANOVAs were used to address research questions. Tukey's Honestly Significant Difference (HSD) was utilized for all follow-up post hoc analysis.

Summary and Organization of the Study

The first chapter of this study provided a brief prologue to the scope and nature of the study including: the statement of the problem, the significance of the study, a rationale for the study, delimitations and assumptions, research questions, and an overview of the methodology used in the study. Chapter two provides a comprehensive examination of relevant literature related to the research questions by presenting a historical overview of issues involving school size and consolidation, optimal school size, and school size related to student achievement. The design and methodology of the study are contained in chapter three. Results of hypotheses testing relating to the research questions are discussed in chapter four. Chapter five of the study concludes with the study summary, findings related to the literature, implications for action, and recommendations for future research.

Chapter Two

Review of Literature

Chapter two provides a rationale for studying the relationship between school size and student achievement with specific attention given to the impact of location, ethnicity, poverty, and special education on the relationship. While the optimal size of American public schools (Conant, 1959; National Education Association, 1948; Leithwood & Jantzi, 2009; Ornstein, 1990; U.S. Department of the Interior, 1939a; U.S. Department of the Interior, 1939b) has plagued researchers and reformers for more than a century, divergent views with relation to the efficiency and quality of schools (Barker & Gump, 1964; Conant, 1959; Cubberley, 1922; Dawson, 1934), the benefits and challenges of school consolidation (American Association of School Administrators, 1958; Bard, Gardener, & Weiland, 2006; Foght, 1917; Howley & Howley, 2006), and the reemergence of smaller schools (Cotton, 2001; Howley & Howley, 2004; Lee & Smith, 1997; Raywid, 1997) have surfaced as prevalent themes in the discussion of school size. Despite the vast body of research, recommendations, and critiques, the definitiveness of appropriate school size remains illusive due to mixed and contradictory findings (Stevenson, 2009). To that end, chapter two presents a critical examination of literature relevant to the study organized into three distinct sections: (a) the historical context of school size, (b) optimal school size, and (c) school size and student achievement.

Historical Context of School Size

Since the inception of the American public education system, the issue of appropriate school size has been controversial. Horace Mann, recognized as the father of public education in the United States, was one of the first educational reformers to question the efficacy of the small district unit of public school organization (Strang, 1987). Following the Massachusetts Act of 1789, common districts, rather than towns, townships, or counties, emerged as the common organizational scheme for schools in New England and eventually the entire United States (Foght, 1917). Mann objected to the legacy of the Act decrying it as "the most unfortunate law on the subject of common schools" (as cited in Foght, 1917, p. 26). Many reformers primarily viewed the common district as too small due to "fiscal inefficiencies, unprofessional leadership, unequally distributed resources, and backward educational practice" (Strang, 1987, p. 355). By 1837, Mann began advocating the adoption of the town as the central organizational scheme for public schools, and by the mid-1850s led the movement to centralize schools (Bryant, 2002). According to Streifel, Holman, and Foldesy (1992) the centralization movement gained momentum in the late 1800s as reformers justified the closing of schools due to the need for increased "professionalism, specialization, and standardization" in public education (p. 35).

Consolidation.

As the United States increasingly industrialized at the turn of the 19th century, the theory of scientific management, prevalent in American factories at the time, seeped into public school management (Berry & West, 2005). According to Berry and West (2010), Ellwood Cubberley emerged as one of the early adopters of a social scientific theory of educational administration. Cubberley identified three main problems with small schools: inadequate funding, inefficient organization, and ineffective supervision (as cited in Berry & West, 2010). Specifically, Cubberley (1912) believed that the small rural school was wholly inadequate to provide an appropriate education. He lamented the lack of proper instruction, poorly trained teachers, and “isolation and lack of enthusiasm which comes only from numbers” found in the “miserable, unsanitary box[es]” (Cubberley, 1912, p.13) referred to as schools. For Cubberley, the remedy was consolidation of small rural schools.

Likewise, as Americans flocked to cities at the turn of the 19th century in search of work in manufacturing centers, the industrialized model of education became increasing prevalent in urban areas as well. Bard, Gardener, and Wieland (2006) reflected that, “larger schools were seen as more economical and efficient…Urban and larger schools were adopted as the ‘one best model’” (p. 40). From 1870 to 1920, the numbers of students enrolled in a public school more than tripled, while the total number of schools in the United States more than doubled (U.S. Federal Security Agency, 1947, p. 26). However, by 1915, the number of public schools peaked at 279,941 signaling the start of a steady decline until the end of the 20th century (U.S. Department of Interior, 1921, p. 54). Moreover, during the same time, public school enrollment and school size continued to climb as seen in Table 1.

Table 1

Public Schoolhouses, Enrollment, and Size 1870 – 2010

Year	Schoolhouses	Enrollment	Average Size
1869 – 1870[a]	116,312	6,871,522	59
1879 – 1880[a]	178,122	9,867,396	53
1889 – 1890[a]	224,526	12,722,631	57
1899 – 1900[a]	248,279	15,503,110	62
1909 – 1910[b]	265,474	17,813,852	67
1919 – 1920[b]	271,319	21,578,316	80
1929 – 1930[b]	247,289	25,678,015	104
1939 – 1940[b]	226,762	25,433,542	112
1949 – 1950[c]	212,419	25,112,000	118
1959 – 1960[d]	137,850	36,087,000	262
1969 – 1970[e]	95,274	45,619,000	479
1979 – 1980[f]	87,000	41,578,000	478
1989 – 1990[g]	84,538	41,141,000	487
1999 – 2000[h]	93,273	47,061,000	505
2009 – 2010[i]	98,817	48,019,000	486

Note. [a] U.S. Department of Interior, Bureau of Education, 1921, p. 54. [b] U.S. Federal Security Agency, U.S. Office of Education, 1947, p. 26. [c] U.S. Bureau of the Census, 1958, p. 15-16. [d] U.S. Bureau of the Census, 1963, p. 113-114. [e] U.S. Bureau of the Census, 1973, p. 104, 106-107. [f] U.S. Bureau of the Census, 1983, p. 132, 134-135. [g] U.S. Bureau of the Census, 1993, p. 158. [h] U.S. Census Bureau, 2003, p. 161-162. [i] U.S. Department of Education, 2011.

Hastening school consolidation, state governments across the nation assumed control of local school district organization as early as the 1920s and 1930s (Bryant, 2002). According to Rosenfeld and Sher (1977), many local districts were reluctant to resist efforts by state governments to consolidate local schools as funding from the state increased and eased the local burden of financially supporting small schools. Starting in 1932, no fewer than 34 states enacted legislation allowing for, and in some cases mandating, consolidation of local schools (American Association of School Administrators, 1958). Additionally, the federal government weighed in on consolidation efforts. As part of a 1935 study of local school unit organization in 32 states, the Department of Interior released a series of suggested standards to support state departments of education. As a result of "analysis of existing conditions, research findings, and expert opinion," the report suggested that elementary schools enroll a minimum of 240 to 280 pupils, 6-year high schools enroll 210 to 300 pupils, junior high schools enroll 245 to 350 pupils, and senior high schools enroll 175 to 350 pupils (U.S. Department of Interior, 1939b, p. 25). Certainly, consolidation had taken root in the United States. According to Foght, "The period of experimentation in school consolidation [had] passed…The movement has now been accepted as good national policy" (as cited in Rosenfeld & Sher, 1977, p. 35).

However, the Great Depression of the 1930s and subsequent World War II of the 1940s diverted much attention away from school reorganization as the nation dealt with more pressing matters (Streifel, Holman, & Foldsey, 1992). Consolidation gained momentum after 1945 as the federal government and national school organizations again encouraged school reorganization. A report of the National Commission on School District Reorganization proclaimed, "No factor is more closely related to problems of school and district organization and needs for reorganization than the size of schools"

(National Education Association, 1948, p. 58). The report decried the small rural school as a relic of pioneer days unable to provide an adequate educational program due to limited financial resources, equipment, and qualified personnel (National Education Association, 1948, p. 16). Again, standards for minimum pupil enrollments suggested the creation of elementary schools with at least 175 students, preferably 300 students for improved quality, and high schools with at least 300 students (National Education Association, 1948, p. 22-23).

While the allure of financial efficiencies drove many consolidations, the availability and likelihood of a quality instructional program available in comprehensive schools encouraged further consolidations. Even the federal government backed consolidation as a catalyst for improved school curricula necessary to produce an advanced scientific and engineering workforce (Smith & DeYoung, 1988, p. 3). Spurred by the Soviet launch of Sputnik in 1957, "the widely held belief at the time was that schools had to be enlarged to offer the kind of math and science students needed to compete technologically with the Soviet Union" (Cutshall, 2003, p. 22).

A year following Sputnik, the American Association of School Administrators (AASA) also weighed in on school district reorganization and consolidation. By means of a national study team, the AASA (1958) authored a comprehensive report, *School District Organization*, providing guidance to local districts on organizational efficiency, finance policies, legislative mandates, and characteristics of satisfactory schools. Chiefly, the report outlined a clear rationale for school consolidation. According to the AASA (1958), school consolidation was necessary due to a litany of limitations of the small school:

1. barren, meager, insipid curriculum, particularly at the secondary level;
2. inability to attract and to hold high-quality teachers and administrators;
3. inability to construct the school plants needed;
4. needless waste of manpower through unjustifiably small classes and low pupil-teacher ratios;
5. unreasonably high per-pupil expenditures for the quality of educational program provided;
6. inefficient use of financial and other educational resources;
7. poor location of buildings;
8. inequality of the burden of school support;
9. cumbersome, complex formulas for distributing state school aid;
10. absence of many needed specialized educational services that add quality to the educational program. (p. 23)

Furthermore, the report urged school consolidation as a national movement in response to growing public school enrollments, population migration from rural to urban areas, a shortage in qualified instructional staff, a lack of adequate school building facilities, increasing educational expenditures, and the need for a technically and scientifically trained workforce (American Association of School Administrators, 1958).

Accelerating school consolidation in light of Sputnik, Allen (2002) purports that James Conant's *The American High School Today* (1959) forged a lasting argument in favor of comprehensive schools and elimination of small schools. The report chronicled the ills of American education through a survey of over 2,000 public high schools (Conant, 1959). As the former Ambassador to Germany and President of Harvard

University, Dr. Conant articulated a vision for more comprehensive American high schools where rigorous core and elective course offerings were available to all students (Conant, 1959, pp. 46-48) and gifted students were provided a specialized and challenging instructional program (Conant, 1959, pp. 57-63).

According to Conant (1959), small high schools lacked the necessary resources to provide a comprehensive education and advocated for the elimination of small high schools as the nation's top educational priority (p. 37). According to Smith and DeYoung (1988), Conant's recommendation that high schools needed at least 100 students in each graduating class or 400 students in grades 9 through 12 reflected an emphasis on growing schools large enough to provide necessary courses in math and science as part of a comprehensive high school. However, in his follow-up report, *The Comprehensive High School*, Conant (1967) revised his original enrollment criteria and suggested that "an excellent comprehensive high school can be developed in any school district provided the high school enrolls at least 750 students and sufficient funds are available" (p. 2). In the decade following Conant's initial report, the number of schools in America declined by over 30 percent (see Table 1). Thus, while Conant's reports were not without criticism, they carried substantial influence and provided additional momentum to the school consolidation movement (Hylden, 2006, p. 8).

General acceptance of larger schools went "virtually unchallenged, at least through the mid-1960s" (Howley, 1989, p. 3). According to Rosenfeld and Sher (1977) by the 1960s:

> Consolidation and other urbanizing practices were no longer perceived as *reforms* championed solely by the progressive elements of society. Rather, they had

> become accepted educational *standards* supported not only by the full range of the education profession, but also by the mainstream of American society. (p. 40)

Walberg and Walberg (1994) reported that in 1964, Barker and Gump authored a seminal study on school size, *Big School, Small School,* which rebutted the consolidation movement. Barker and Gump (1964) studied five Kansas high schools with enrollments ranging from 83 to 2,287 and examined student participation in school classes and activities. While more students participated in activities in larger schools, students in smaller schools actually participated more fully in the activities. Instead of seeking further consolidation, they encouraged the creation of new small schools, the expansion of facilities at existing schools, and the development of campus schools "by which students are grouped in semiautonomous units for most studies but are usually provided a school-wide extracurricular program" (Barker & Gump, 1964, p. 201).

By the 1970s, faith in consolidation as a legitimate strategy to improve instructional quality and operational efficiency began to fade (Hampel, 2002). While much of the research from the 1920s through the 1970s focused on input factors related to school size, the 1980s brought about a shift in emphasis as many researchers began to examine output factors such as student achievement through the lens of school size (Berry & West, 2010). Moreover, studies of school size from the 1980s and 1990s questioned both the reliability and validity of earlier claims regarding the superiority of large schools (Hylden, 2006). According to Berry (2004), such studies have generally been less supportive of large schools. In fact, much of the research conducted in the 1980s and 1990s "established that small schools are more productive and effective than large ones" (Raywid, 1999, p. 2).

Regardless of the contradictory research, many rural areas voluntarily continued to consolidate schools throughout the 1980s in response to adverse economic conditions brought on by the farm crisis and declining enrollments due to shifts in population from rural to urban areas (Bard, Gardener, & Weiland, 2006). Such consolidations contrasted the general trend in the nation. From 1990 to 2008, some 14,000 schools were added across the U.S., while states such as Iowa, Kansas, South Dakota, West Virginia, and Wyoming reduced the number of schools statewide in response to both academic and economic pressures (Bard et al., 2006; Kinnaman, 2008). More recently, cash strapped state governments and local school districts have again looked to consolidation as a viable option to improve operational efficiency in educational funding (Hoppa, 2010; Slate & Jones, 2005).

Consolidation in Missouri.

The historical evolution of public school size and consolidation efforts in the state of Missouri represents a microcosm of the nationwide consolidation movement at the state level. Much like the national movement, Missouri struggled to define the appropriate organizational unit for public schools, passing multiple legislative mandates from 1839 to 1900 requiring the township, congressional, and common local district unit as the governance structures for local school districts (American Association of School Administrators, 1958). By 1900, the state had 10,499 school districts serving 719,817 students (U.S. Bureau of the Census, 1903). The growing number of small, inefficient schools in the state caused many education reformers to call for consolidation (University of Minnesota, 1968). In 1901, the General Assembly passed the state's first significant consolidation law allowing for "three or more common districts or together with a small village district to form a consolidated district to operate elementary and high schools" (University of Minnesota, 1968, p. 8). Under this legislation, the first consolidated school in Missouri, known as Ruskin High School in Jackson County emerged in 1902 from four districts in Hickman Mills (Emberson, 1913).

Throughout the first three decades of the 20th century, most educational reformers, governors, and state superintendents of education within the state supported consolidation (Scantlin, 1945). Publications sponsored by the State and University of Missouri encouraged school reorganization and provided likeminded citizens with information laden with the benefits of consolidation. In one such bulletin, Kunkel and Charters (1911), argued that consolidated schools, unlike their one-room schoolhouse counterparts, decreased cost and improved service, made children like school more, and improved instruction and educational equipment.

While subsequent reauthorizations of consolidation legislation in 1913, 1919, and 1921 strengthened the original 1901 Act and provided financial incentives for consolidated districts, public opposition rendered wide-scale consolidation a futile proposition (Scantlin, 1945). By 1910, the state boasted only 18 consolidated schools (Kunkel & Charters, 1911) and by 1920 the total number of schools was still over 9,000 (University of Minnesota, 1968). With less than 5% of Missouri schools consolidated, the state passed another reorganization law in 1931 (Dawson, 1934). The provision provided transportation aid for consolidated districts, but by 1940, only reduced the number of districts by 96 (University of Minnesota, 1968). Consolidation in Missouri appeared to lack the support of the citizens. According to Foght (1913), "Missourians are naturally conservative and find it difficult to depart from the long-established small school unit with its hallowed traditions" (p. 16). More bluntly, a citizen of the time remarked, "it takes Missouri a generation to get anything done educationally" (as cited in Scantlin, 1945, p. 28).

Breakthrough seemed eminent in 1945 with Missouri's adoption of a new constitution that provided for a Governor-appointed State Board of Education charged with supervision of the state's schools, and a Board of Education-appointed Commissioner of Education responsible for administering the state's school system. Additionally, two surveys of the state's educational system completed in 1944 and 1947 decried "the shortcomings of Missouri's too numerous and too small school districts" (American Association of School Administrators, 1958, p. 196). Notably, at the time, more than half of all schools in the state had fewer than 100 students, and only 25% enrolled more than 300 students (National Education Association, 1948).

The studies, along with the provisions of the 1945 Constitution, created the conditions for adoption of the 1948 Hawkins Reorganization Act. The act created a local governance structure and timeline for developing consolidation plans, provided funding for buildings and infrastructure, and set minimum standards for assessed valuation and pupil enrollments in newly consolidated districts (American Association of School Administrators, 1958). Existing school districts with fewer than 100 students and assessed valuations of less then $500,000 were closed, essentially eliminating all one-room schoolhouses in the state (Good, 2008). As a result, the number of school districts in the state decreased to just over 4,500 by 1952, signaling a decrease of over 50% since the turn of the century (University of Minnesota, 1968). By 1968, the number dropped to

692 making the 1948 law the "most effective measure treating the problem of the small school districts" (University of Minnesota, 1968, p. 8).

In 1967, the General Assembly established the Missouri School District Reorganization Commission charged with developing a master plan for reorganization of all schools in the state. Following a statewide tour and solicitation of citizen input, the Commission presented its recommendations to the legislature in a comprehensive report produced in conjunction with the University of Minnesota. The report, *School District Organization in Missouri: A Plan to Provide Equal Access to Education Opportunities for all Children* outlined a three-year implementation plan for a series of comprehensive recommendations addressing school size in the state. Among the most controversial, the Commission advocated for the elimination of kindergarten through grade 8 school districts, replacement of all school districts with 20 geographically regional school districts and 133 local school units, and minimum standards for a myriad of curricular and school personnel requirements (University of Minnesota, 1968). The Commission went so far as to create a proposal containing district boundaries for the regional school districts complete with a list of schools to remain open and schools slated for closure.

The radical nature of the Commission's recommendations led to near immediate rejection of the proposal by the general public and legislators alike. Cape Girardeau's daily newspaper, *The Southeast Missourian,* believed the recommendations went too far, too fast and labeled the plan as "not only unwieldy, but unworkable from a practical standpoint" resulting in "nothing but acrimony and bitterness" ("The School Reorganization Plan," 1968, November 12). While the plan generated vigorous discussion throughout the state, the Commission's recommendations failed to gain traction and ignited public resentment of state control of local school board decisions. The General Assembly scrapped the reorganization plan, signaling an end to nearly a century of aggressive school consolidation in Missouri.

Since 1968, the number of consolidations tapered off dramatically. In fact, over the last forty years, only 27 kindergarten through grade 12 school districts consolidated. However, elementary districts serving only grades kindergarten through grade 8 dropped by 144. As of 2010, 522 school districts operated in the state, including 447 kindergarten through grade 12 districts and 74 kindergarten through grade 8 districts comprising 2,305 schools (Missouri DESE, 2010g.) According to Tom Ogle, Director of School Data for the Missouri Department of Elementary and Secondary Education, the decline in consolidations represented a philosophical change during the 1970s and 1980s. Since the public backlash to the Reorganization Commission, the state worked to protect the remaining small schools, left consolidation decisions up to local school boards, and implemented a series of financial incentives designed to keep small rural schools open (Ogle, 2010). Without state funding streams, such as the Small Schools Grants for schools with fewer than 350 students, more than a quarter of Missouri schools would be forced to close (Missouri DESE, 2011, January 20).

Optimal Size

Despite the historical trend toward consolidation of schools, researchers remain divided on the optimal size for public schools and have yet to develop a standardized and quantifiable definition of what constitutes a “small” or “large” school (Stemnock, 1974). Much of the early school size research centered on school inputs such as financial efficiency, facilities, curriculum, and instructional personnel, whereas studies since the

1980s emphasized student outcomes such as graduation rates, attachment to school, and achievement (Berry & West, 2005). Findings that are more recent reveal that mitigating factors such as poverty and ethnicity of students may influence the optimal size of schools based on the demographics of the students (Cotton, 1996; Howley & Bickel, 1999; Lee & Smith, 1997; Leithwood & Jantzi, 2009; Schneider, Wyse & Keesler, 2007).

Early research.

One of Missouri's earliest education reformers, Harold Foght (1913) advocated for schools comprised of at least 200 students. Foght (1913) based his standard on the availability of the property tax base necessary to fund the school and the implications of the geographical area due to transportation limitations. Dawson (1934) concurred with Foght's (1913) minimum school size, but stopped short of recommending an optimum school size. Rather, Dawson based his elementary school recommendation on Covert's (1928) study of school size and student achievement and Manninga's (1929) study of school size and cost.

The early research suggested students in larger elementary schools outperformed students in smaller schools over 76% of the time in reading, arithmetic, and spelling (Covert, 1928). In terms of efficiency, schools enrolling a minimum of 200 students experienced far lower costs per pupil compared to smaller schools (Manninga, 1929). Thus, Dawson (1934) suggested a minimum elementary school size of 240 to 280 students based on "factors as the breadth of the curriculum offering, time allotment to various subjects, the cost per pupil, and probably age-grade and grade-progress status and achievement of pupils" (p. 23).

In terms of high school size, Dawson developed his recommendation based on cost efficiency and curricular offerings. Citing numerous studies from Illinois, Virginia, California, and Minnesota, Dawson (1934) concluded that studies examining “the relationship between the size of the high school and the cost per pupil are unanimous in agreement that the smaller the high school the higher the cost per pupil enrolled” (p. 30). Based on minimum curricular offerings and teaching positions, Dawson (1934) found schools with fewer than three teachers to be inferior to larger schools with more comprehensive programs of study. Thus, Dawson (1934) recommended high school sizes of no fewer than 200 students but also cautioned that schools could be too large. Dawson (1934) concluded:

> There is no conclusive evidence as to the optimum size of high school, but there is evidence that insofar as the curriculum offering and the cost per pupil are concerned there is little if anything gained by having a high school of more than 600 pupils and twenty teachers (pp. 30-31).

Publications distributed by the U.S. Department of Interior Office of Education (1939b) echoed Dawson’s recommendations and suggested that elementary schools enroll 240 to 280 students and high schools enroll 175 to 350 students. Similarly, the National Education Association’s Commission on School District Reorganization (1948) suggested that elementary and high schools enroll no fewer than 300 students due to small classes, poorly trained teachers, inadequate instructional materials, and lack of supervision and noted the “high correlation between small schools and meager educational opportunities” (p. 79).

Similarly, among the most influential and most often cited study of optimal school size, Conant (1959) asserted that high schools enroll at least 100 students per grade, or 400 total students. Later, Conant (1967) revised his recommendation to conclude that 750 students comprised the optimal high school size. Basing his justification solely on site visits to American schools and audits of course offerings, Conant's findings generated a renewed interest in larger schools (Cotton, 1996) as well as skepticism from the research community (Clements, 1970). Of Conant's studies, Clements (1970) remarked,

> The standards for a 'good' school were arbitrarily chosen, with little empirical evidence to support them. The appraisals of schools were cursory rather than thorough…The ray of hope for enlightenment concerning ideal high school size as indicated by the Conant studies has faded to a mirage. They have little to offer (pp. 5-6).

In response to Conant's (1959) optimal school size, Barker and Gump (1964) conducted an ecological study of school size among schools of varying enrollments in Kansas. The researchers concluded that smaller schools provided students with greater opportunities for involvement in extracurricular activities (Barker & Gump, 1964). Rather than suggesting an optimal school size, Barker and Gump (1964) concluded, "a school should be sufficiently small that all of its students are needed for its enterprises…that students are not redundant" (p. 202).

However, other studies found merit in Conant's (1959; 1967) suggestions. In a review of 18 studies on school size between 1956 and 1963, Wright (1964) analyzed findings to discover an optimal high school size. Wright (1964) concluded that high school size should be less than 2,000 students but at a minimum, enroll 100 students per grade level mirroring Conant's (1959) minimum size recommendation. While the studies considered factors influencing optimal school size such as extracurricular activities, qualifications of teachers, and curricular offerings, Wright (1964) importantly acknowledged, "other considerations are frequently of equal importance" (p. 3) such as school location and socioeconomic status of students.

Similarly, Cohn's (1968) study of high school size in Iowa based on educational quality and per pupil cost indicated that as school size increased, so too did efficiency and student achievement. Cohn's (1968) parabolic cost function revealed an optimal high school size for the sample of Iowa schools of between 1,200 and 1,600 students signaling concurrence with Wright's (1964) maximum school size. Likewise, Turner and Thrasher (1970) recommended an optimal high school size of 1,000 to 1,200 students based on comprehensiveness, participation, program effectiveness, cost, and communication. Correspondingly, Stemnock's (1974) review of 120 school size studies from 1924 to 1974 primarily based on examination of costs and curricular comprehensiveness suggested analogous, yet wide ranges for optimum school size: elementary schools with 350 to 720 students; middle schools with 750 to 800 students; and high schools with 293 to 2,000 students.

Contemporary research.

Beginning in the 1980s, school size research shifted from an emphasis on school inputs to student outcomes and generally established smaller schools to be superior in maximizing student achievement, especially for economically disadvantaged students (Howley, 1989; Howley & Howley, 2004). Additionally, examination of the impact of student factors such as ethnicity and poverty on the relationship between school size and student outputs hampered the “one size fits all” assumption inherently attached to optimal school size determinations (Lee & Smith, 1997; Stevenson, 2009). However, several important studies on optimal size continued to examine cost relationships to school size. Fox (1981) reviewed 34 studies relating to cost efficiency of high schools and identified a U-shaped relationship existed between pupil costs and school size; an indication of inefficiencies in both very large and very small schools. In line with previous studies, Fox (1981) concluded that high schools enrolling between 1,400 and 1,800 students were most cost effective. Riew (1986) supported Fox’s recommendations and suggested an optimal high school size of 1,500 students.

However, recent studies examining student outcomes (Howley & Howley, 2004; Lee & Smith, 1997; Leithwood & Jantzi, 2009) indicated that for students from diverse backgrounds, even smaller schools maximized student achievement. Lee and Smith (1997) examined the relationship between student achievement in mathematics and reading and a variety of school sizes for 9,812 students in 789 public, parochial, and Catholic high schools to determine the optimal school size for minority and economically disadvantaged students. Regardless of the classification of the student, schools enrolling between 600 and 900 students reported higher levels of student achievement with a very large effect size for mathematics and a moderate effect size for reading (Lee & Smith, 1997). Moreover, Lee and Smith (1997) concluded that high school sizes smaller or larger than 600 to 900 students negatively impacted student achievement.

Twenty years following Fox’s study, Andrews, Duncombe, and Yinger (2002) examined 22 studies of school and school district size relative to production cost, and based on Fox's research methodology while using advances in cost and production modeling, updated the findings. Andrews et al. (2002) found Fox's (1981) optimal school size to be too high, and recommended a high school size not to exceed 1,000 students and elementary school size not to exceed 600 students.

Other contradictory findings based on student outcomes by Borland and Howsen (2003), suggested slightly larger elementary schools maximized student achievement. The researchers noted that a nonlinear relationship existed between school size and student achievement in elementary schools and suggested an optimal elementary school size of 760 students. Based on data from over 31,000 third grade students in 654 Kentucky elementary schools, they observed that as school size increased, student achievement increased in schools with enrollments of up to 760 students. However, in schools with enrollments greater than 760 students, student achievement decreased at statistically significant levels (Borland & Howsen, 2003).

In response to Lee and Smith (1997), Howley and Howley (2004) reexamined the study on the basis that the data set used favored large schools characterized as small schools through schools-within-a-school configurations, and thus, failed to take into consideration the unique characteristics of small rural schools. In stark contrast, Howley and Howley (2004) reported that smaller schools maximized achievement for all students except for those with higher socioeconomic status. Furthermore, they discovered no evidence to suggest that a school could be too small. Based on student demographics, high schools with enrollments as low as 300 and as high as 1,200 students comprised an *appropriate*, rather than optimal, school size (Howley & Howley, 2004). Howley and Howley (2004) rejected the "optimal size" label citing that such a wide range "loses the specificity that seems essential to the concept of ideal or optimal…such notions oversimplify the variability of size effects" (p. 11). Instead, the researchers chose to use the term "appropriate" as a reflection of the relative nature of school size based on the unique characteristics of the students served (Howley & Howley, 2004, p. 11).

Still, Stevenson (2006) remained skeptical of contradictory findings. In a review of eight recent studies on the optimal school size in South Carolina, he found the results to be inconclusive. According to Stevenson (2006), "The only logical conclusion that can be reached is that finding the ideal school size is at least elusive" (p. 7).

Supporting Howley and Howley's (2004) claim that economically disadvantaged students perform better in smaller schools, Leithwood and Jantzi (2009) reviewed 59 studies involving school size and its effect on student achievement. While the empirical studies on school size revealed an inconclusive link to student achievement, Leithwood and Jantzi (2009) justified four optimal size recommendations: (a) schools serving large populations of diverse or economically disadvantaged students should enroll no more than 300 students at the elementary level and, (b) 600 students at the high school level; (c) schools serving largely affluent and homogeneous student populations should enroll no more than 500 students at the elementary level and, (d) 1,000 students at the high school level.

School Size and Student Achievement

According to Howley (1989), the use of student achievement as a metric to determine school effectiveness provides the "most suitable criterion" for analysis and judgment (p. 3). As early as the 1980s, research involving the effects of school size shifted from an emphasis on school input factors such as curricular offerings and cost efficiency to student output factors such as graduation rates and academic achievement (Howley, 1996). Contrary to many earlier studies of cost efficiency finding larger schools superior to smaller schools, research examining the relationship between school size and student achievement has generally been more favorable to smaller schools (Berry & West, 2010). However, Stevenson (2006) notes that contradictory findings, inconsistent results, and conflicting perspectives have resulted in the absence of a definitive conclusion regarding academic performance and school size. The following section provides a review of the empirical evidence addressing student achievement and school size in four parts: multiple grade-level studies, elementary school studies, middle school studies, and high school studies.

Multiple grade-level studies.

Several empirical studies including multiple grade-levels revealed a negative relationship between school size and student achievement; that is, as schools get larger, student achievement declines (Eberts, Kehoe, & Stone 1984; Howley & Bickel, 1999; Johnson, 2004). Others recognized the advantage of small schools, but indicated the substantial influence of poverty on the relationship (Friedkin & Necochea, 1988; Howley, 1996). Still others offered inconclusive or unrelated results regarding the relationship (Caldas, 1993; Edington & Martellaro, 1989; Leithwood & Jantzi, 2009; McMillen, 2004; Tajalli & Opheim, 2004). This section reviews studies reporting on the relationship between school size and academic achievement in multiple grade levels.

Eberts, Kehoe, and Stone (1984) studied the impact of school size on math achievement in 328 U.S. schools using a subsample of the Sustaining Effects Study produced by the Systems Development Corporation. Differences in achievement between small and medium sized schools were not statistically significant. However, comparisons between small and large schools yielded statistically significant differences with students in smaller schools exhibiting higher levels of academic achievement (Eberts, Kehoe, & Stone, 1984). Students in small schools achieved an average gain of 8 percent more on the Comprehensive Test of Basic Skills when compared to students in medium schools. When compared to large schools, students in small schools achieved an average gain of 28 percent more (Eberts et al., 1984).

Friedkin and Necochea (1988) indicated the same to be true in elementary schools, but not in high schools. In their study of school size and student performance, Friedkin and Necochea (1988) examined student scores on the California Assessment Program test. While higher achievement levels were associated with smaller schools in grades 3, 6, and 8, high school students in grade 12 experienced higher levels of achievement in larger schools (Friedkin & Necochea, 1988). More importantly, Friedkin and Necochea (1988) reported that as the poverty of a school decreased, the relationship between school size and achievement changed from negative to positive. However, the negative relationship between school size and achievement for poorer students was much stronger than the positive relationship for more affluent students was (Friedkin & Necochea, 1988). Additionally, Friedkin and Necochea (1988) examined the effect of location and indicated no difference in the relationship between school size and student achievement for metropolitan and non-metropolitan schools.

Studies have also signaled a positive relationship between school size and achievement. Edington and Martellaro (1989) examined the relationship between school size and academic achievement and the impact of poverty on the relationship. Using data from the Comprehensive Test of Basic Skills in grades 5, 8, and 11 for all schools in New Mexico, Edington and Martellaro (1989) found a statistically significant positive relationship between school size and student achievement at both elementary and high school levels indicating higher achievement in larger schools. However, after controlling for poverty, the relationship was not significant (Edington & Martellaro, 1989).

In other studies, the benefit of smaller schools has not been as conclusive. Caldas (1993) examined state assessment data from all 1,301 Louisiana schools at grades 3 through 7 and grades 10 and 11 to determine the effect of input and process factors on student achievement. At the elementary level, Caldas (1993) found small negative effects of school size on student achievement, and at the high school level, mixed results.

Howley (1995) replicated Friedkin and Necochea's (1988) study using student achievement scores from the Comprehensive Test of Basic Skills for students in West Virginia. The study was known as the "Matthew Project" for a reference Howley (1995) made in the West Virginia study to Matthew 13:12 in the Bible: "For whosoever hath, to him shall be given, and he shall have more abundance; but whosoever hath not, from him shall be taken away even that he hath" (as cited in Howley, 1995, p. 2). The verse served as a connection to the effect of poverty in education where affluent schools with greater resources produce higher student achievement results and impoverished schools, despite having a greater need for additional resources, function with fewer resources and produce lower levels of student achievement. According to Howley (1995), "the rich get richer and the poor get poorer" (p. 4). In 7 of 8 analyses, correlations between school size and academic achievement were not statistically significant (Howley, 1995). The interaction of poverty with the relationship yielded results mirroring those of Friedkin and Necochea

(1988) as more affluent students experienced higher achievement in larger schools and more impoverished students experienced higher achievement in smaller schools, especially in elementary schools (Howley, 1995). In an update to the 1995 study, Howley (1996) cautioned, "small size is no magic bullet…[it] does not seem to facilitate the achievement of affluent students, and small size by itself is unlikely to eliminate or reverse the negative effects of poverty" (p. 31).

In a more comprehensive study of the effect of poverty on the relationship between school size and student achievement, Howley and Bickel (1999) continued the "Matthew Project" and examined academic achievement of students in Georgia, Montana, Ohio, and Texas. Again, with similar results, Howley and Bickel (1999) revealed that the lower the socioeconomic status of students, the more they benefitted from smaller schools. In fact, smaller schools decreased the influence of poverty on academic achievement by 24% to 90% and in some cases, eliminated the achievement gap between affluent and poor students (Howley & Bickel, 1999). The "Matthew Project" essentially debunked the myth of an ideal size for schools. According to Howley and Bickel (1999), "a one-best, everywhere 'optimal,' school size is a figment. The appropriate size for a school, when the aim is to maximize aggregate student achievement, depends on community circumstance…For very impoverished communities, large schools would…be expected to produce educational impoverishment" (p. 18).

In a replication of Howley and Bickel (1999), Abbott, Joireman, and Stroh (2002) found inconclusive results linking district size, school size, academic achievement, and poverty. The study examined fourth and seventh grade student scores on the 2001

Washington Assessment of Student Learning in math and reading in 1,035 elementary schools and 417 middle schools in Washington. While the results indicated that smaller schools might have some advantage for students in poverty, none of the findings was statistically significant (Abbott, Joireman, & Stroh, 2002). Abbott et al. (2002) concluded, “size is a more complex matter, and needs to be viewed in the context of other influences in order to determine its contribution to school-level achievement” (p. 16).

McMillen (2004) found mixed results in a study of all elementary, middle, and high schools in North Carolina. For students in elementary and middle schools, McMillen (2004) failed to discover a significant relationship between school size and academic achievement after controlling for poverty and ethnicity. However, in high schools, a statistically significant positive relationship existed between school size and achievement in math and reading (McMillen, 2004). For minority, or non-white students in high schools, McMillen (2004) found a curvilinear relationship between school size and achievement in math and a negative relationship in reading.

In Missouri, Johnson (2004) replicated Howley and Bickel (1999) with similar results. Johnson (2004) looked at Missouri Assessment Program achievement results for students in all 523 Missouri school districts. Exploring the relationship between school district size and academic achievement, Johnson (2004) revealed that smaller school districts were associated with higher levels of student achievement regardless of the level of student poverty. Moreover, smaller school districts were able to decrease the effect of poverty on student achievement at every grade-level tested (Johnson, 2004).

In contrast, Tajalli and Opheim (2004) found no relationship existed between school size and student performance. The study included an examination of the relationship between school output and input variables in Texas. Tajalli and Opheim's (2004) sample consisted of fourth, eighth, and 10th grade students in all Texas schools with enrollments containing 50% or more students in poverty. Even in schools with high levels of poverty, the results indicated the absence of an advantage for low socioeconomic status students in smaller schools (Tajalli & Opheim, 2004).

Leithwood and Jantzi (2009) reported mixed results in their meta-analysis of 57 studies conducted between 1990 and 2006 on the effect of school size on student achievement. While all of the studies reviewed contained evidence of higher levels of student achievement for lower socioeconomic status students in smaller schools, six of 10 elementary studies indicated a negative relationship between size and achievement (Leithwood & Jantzi, 2009). Three of the 10 studies revealed a positive, but statistically insignificant, relationship. Of the 18 high school studies reviewed, five indicated a positive relationship and eight a negative relationship between school size and achievement (Leithwood & Jantzi, 2009). The remaining six studies revealed an inverted U-shaped relationship, meaning that achievement increased with school size to an optimal point and then declined as size increased (Leithwood & Jantzi, 2009).

Elementary school studies.

Studies of the relationship between elementary school size and academic achievement tend to favor small schools (Eberts, Schwartz & Stone, 1990; Edington & Gardener, 1985; Huang & Howley, 1994; Lee & Loeb, 2000). Few reveal an advantage for students in larger elementary schools (Zoda, 2009). However, the most recent research indicates an unrelated or inconclusive relationship (Borland & Howsen, 2003; Lubienski, Lubienski, & Crane, 2008; Minolfo, 2010; Odom, 2009). This section reviews studies reporting on the relationship between elementary school size and academic achievement.

Edington and Gardener (1985) investigated the relationship between school size and student achievement in elementary schools in Montana. Their sample consisted of 195 elementary schools in 1981 and 145 high schools in 1982 voluntarily administering a cognitive domain assessment in communication skills, consumer mathematics, critical thinking, lifelong learning, and consumer knowledge and attitudes (Edington & Gardener, 1985). In an analysis of all subtests, the study revealed that students in smaller schools achieved at significantly higher levels than students in larger schools achieved (Edington & Gardner, 1985).

Miller, Ellsworth, and Howell (1986) also indicated a strong negative relationship between elementary school size and student achievement. The researchers examined student achievement and school size in 12 Wichita, Kansas elementary schools with high scores on the Iowa Test of Basic Skills reading comprehension assessment and high levels of poverty. In *t* test comparisons, Miller et al. (1986) discovered students in smaller schools with high levels of poverty achieved higher in reading comprehension than students in larger schools with high levels of poverty.

A study by Eberts et al. (1990) confirmed Edington and Gardener’s (1985) conclusion in a national sample. Among 14,000 students in 287 elementary schools in the U.S., the researchers observed that students in larger schools demonstrated smaller gains in math than students in smaller schools did, signaling an advantage for students attending small elementary schools (Eberts et al., 1990).

Plecki (1991) examined the relationship between school size and student achievement utilizing third grade student scores on the 1986 California Assessment Program test in reading, writing, and math in 4,337 California kindergarten through grade 6 elementary schools. Results indicated a positive linear relationship between school size and student achievement and a negative linear relationship in schools with high levels of poverty (Plecki, 1991). However, analyses were inconclusive in determining the variance in student achievement leaving Plecki (1991) to conclude, “No finite conclusions are drawn from the analyses” (p. 19).

More convincingly, Huang and Howley (1994) found poverty to be a mitigating factor in the relationship between school size and academic achievement. The researchers examined Iowa Basic Skills Test results in reading, writing, and math for 13,533 fourth, sixth, and eighth grade students in Alaska. While most of Alaska’s schools were classified as small, Huang and Howley (1994) indicated that students in smaller schools had lower levels of student achievement. However, after controlling for poverty, small schools diminished the effect of low socioeconomic status on student achievement (Huang & Howley, 1994). Huang and Howley (1994) concluded, “Small schools in Alaska appear to mitigate the effects of disadvantage, whereas larger schools tend to compound those effects” (p. 143).

Lamdin (1995) discovered a much stronger effect of poverty on the relationship between school size and student achievement. Looking at student results on the 1990 California Achievement Test in reading and math in 107 Baltimore, Maryland elementary schools, Lamdin (1995) observed the relationship between school size and academic achievement while controlling for poverty and ethnicity. Results indicated a negative relationship between size and achievement; however, the findings were not statistically significant (Lamdin, 1995). While student ethnicity failed to influence student achievement, poverty significantly impacted student achievement at every grade level (Lamdin, 1995).

Lee and Loeb (2000) observed that poverty influenced the relationship between school size and student achievement. In 264 Chicago elementary schools serving 22,599 students in sixth and eighth grade, the researchers discovered that school size had a moderate effect on academic achievement on the Iowa Test of Basic Skills math assessment (Lee & Loeb, 2000). Students attending schools with fewer than 400 students scored significantly higher than students in medium and larger schools (Lee & Loeb, 2000). Interestingly, when Lee and Loeb (2000) observed the effect of poverty and ethnicity on the relationship, the results were not statistically significantly different.

In Missouri, Alspaugh and Goa (2003) observed fifth grade scores on the Stanford Achievement Test, Ninth Edition, in 39 kindergarten through grade 5 elementary schools in a large urban school district. Analysis indicated that when controlling for poverty, as school size increased, student achievement declined (Alspaugh & Goa, 2003). Students enrolled in schools with fewer than 200 students experienced the highest levels of achievement suggesting that smaller elementary schools increased academic achievement for poorer students.

Borland and Howsen (2003) noted mixed results in their study that examined student achievement data from over 31,000 third grade students in 654 Kentucky elementary schools. Results indicated a nonlinear relationship between academic achievement and school size (Borland & Howsen, 2003). In school sizes of up to 760 students, student achievement increased. However, as enrollments climbed over 760 students, achievement decreased (Borland & Howsen, 2003). Thus, neither small nor large schools represented an advantage for student achievement. Rather, depending on the definition of large or small, mid-sized elementary schools maximized academic achievement (Borland & Howsen, 2003).

However, in a study of the effect of poverty and ethnicity on the relationship between school size and student achievement in North Carolina elementary schools, Cartner (2005) reported conflicting results. Utilizing a sample of all third and fifth grade students in 1,004 North Carolina kindergarten through grade 5 elementary buildings, Cartner (2005) examined student growth on end of grade tests in reading and math. Analysis revealed statistically significant results indicating greater gains in reading and math among third grade students in smaller schools (Cartner, 2005). The relationship was especially strong for minority students and students from disadvantaged backgrounds. However, results for fifth grade students indicated a slight, statistically nonsignificant advantage in math and reading for students attending smaller schools. For minority and low socioeconomic status students, the results were mixed for fifth grade students in both reading and math (Cartner, 2005).

More recently, Archibald's (2006) examination of factors influencing student achievement confirmed the findings of Huang and Howley (1994) and Alspaugh and Goa (2003). Employing a sample of student scores on district-level criterion-referenced tests and TerraNova results in math and reading for students in grades 3 through 6 in 52 Washoe County, Nevada elementary schools, Archibald (2006) discovered that both school size and poverty negatively impacted student achievement in math and reading revealing that as poverty and school size increased, achievement decreased.

Other recent studies failed to identify a relationship between elementary school size and student achievement. In a study of math scores on the 2003 National Assessment of Educational Progress among 157,161 fourth grade students in 6,288 U.S. schools and 119,364 eighth grade students in 4,870 U.S. schools, Lubienski et al. (2008) revealed that the size of school was not a predictor of student achievement at the 4^{th} or 8^{th} grade levels.

In contrast, Zoda (2009) observed the effect of school size on student achievement while controlling for ethnicity and discovered a positive relationship. The researcher examined fourth grade passing rates on the Texas Assessment of Knowledge and Skills in reading, writing, and math for five consecutive years beginning in 2003 for all schools in Texas with fourth grade enrollments. Zoda (2009) classified schools into four categories: very small (fewer than 400 students), small (400-799 students), large (800-1,199 students), and very large (1,200 or more students). In 72 of 81 analyses, statistically significant findings favored students enrolled in large or very large schools when compared to small or very small schools for all students and ethnic groups (Zoda, 2009).

However, Odom (2009) identified mixed results in a study of differences in student achievement with school size as a factor. Three schools were randomly selected from each of Florida's 67 school districts and placed in the following categories: small (fewer than 300 students), medium (301-500 students), and large (more than 600 students). Using student scores on the 2006 Florida Comprehensive Assessment in math and reading for students in third through fifth grade, Odom (2009) found conflicting results. In math, the difference in achievement based on school size was not statistically significant (Odom, 2009). However, in reading, students in large schools scored significantly better than students in medium schools did (Odom, 2009).

Most recently, Minolfo (2010) conducted a study of the relationship between the size of all prekindergarten through grade 5 and kindergarten through grade 5 public elementary schools in South Carolina and student achievement on the 2008 South Carolina Palmetto Achievement test in language arts and math. Findings indicated that school size was not significantly related to academic achievement.

Middle school studies.

In comparison to the number of empirical studies examining the relationship between elementary and high school size and student achievement, relatively fewer studies focusing on middle and junior high schools were discovered. Much like the elementary school studies, results are divided between findings of negative relationships (Lee & Smith, 1993), positive results (Gilmore, 2007), and inconclusive or unrelated results (Chamberlin, 2007; Coldarci, 2006; Roberts, 2002).

Lee and Smith (1993) examined the impact of school restructuring on student achievement using a data set from the 1988 National Education Longitudinal Study. The sample consisted of 8,845 eighth grade students in 377 U.S. schools. The researchers specifically observed the effect of poverty and ethnicity on student achievement and school size. Findings revealed a strong relationship between achievement and poverty and a moderate relationship between achievement and ethnicity (Lee & Smith, 1993).

Lee and Smith (1993) also found students in smaller eighth grade cohorts to be more engaged with a "more equitable distribution of achievement" (p. 19).

In a study of the relationship between school size and achievement and per pupil expenditures while controlling for poverty, Roberts (2002) examined the percent of students scoring at the basic level or higher on the 2001 Palmetto Achievement test in language arts and math in 156 South Carolina middle schools configured with grades 6 through 8. When controlling for poverty, Roberts (2002) discovered a negative relationship between size and achievement and size and per pupil expenditure. Furthermore, results indicated greater cost efficiency in larger schools and lower achievement in schools with higher levels of poverty (Roberts, 2002).

However, Coldarci (2006) indicated an inconclusive relationship existed between school size and achievement primarily due to extreme volatility in student achievement from year to year found in schools with small enrollments. The study employed a sample of all eighth graders in 215 public middle schools in Maine. Analyses indicated a weaker impact of poverty on student achievement in math and reading in small schools compared to large schools (Coldarci, 2006). However, Coldarci (2006) found the math results suspect due to the volatility and unreliability of inconsistent achievement data from small schools and refused to accept the hypothesis that smaller schools decreased the effect of poverty on student achievement.

In contrast, a study by Gilmore (2007) indicated greater achievement in larger middle schools. The study examined the relationship between school size and student achievement as well as the impact of poverty and ethnicity on the relationship. Gilmore (2007) analyzed three years of student scores on the Texas Assessment of Knowledge and Skills in math and reading for students in 1,583 Texas middle schools with configurations of grades 6 though 8. Results indicated statistically significant differences among all ethnic and socioeconomic groups in each of the three years examined (Gilmore, 2007). Regardless of ethnicity or poverty, Gilmore (2007) discovered higher levels of student achievement in very large schools with enrollments exceeding 1,199 students when compared to small schools.

Chamberlin's (2007) study of the effect of poverty and charter designation on the relationship between student achievement and school size in Colorado middle schools yielded an unrelated relationship. Analyses of 2001 and 2004 Colorado Assessment Program test scores of 357 middle schools in the state indicated the absence of a relationship between poverty, size, and charter designation. However, Chamberlin (2007) determined poverty to be a predictor of student achievement.

High school studies.

A review of empirical studies regarding the relationship between high school size and student achievement yielded a wide research base with consistent findings: a positive relationship favoring larger high schools (Baird, 1969; Brackett, 2008; Chavez, 2002; Crenshaw, 2003; Durbin, 2001; Gardner et al., 2000; Greeney, 2010; Maxey, 2008; Rumberger & Palardy, 2005; Schreiber, 2002; Slate & Jones, 2006, 2008). Fewer studies indicated a negative relationship favoring smaller high schools (Jewell, 1989; Lee & Smith, 1995; Stewart, 2009) or an inconclusive or unrelated relationship (Haller, Monk, & Tien, 1993; Hoagland, 1995; Lee & Smith, 1993; Schneider et al., 2007; Werblow & Duesbery, 2009). This section discusses studies regarding the relationship between high school size and student achievement.

In an early study of the effect of school size on student performance, Baird (1969) looked at student performance on the ACT in schools of different sizes and locations using a national sample. The sample consisted of over 21,000 students in the U.S. taking the ACT between November 1965 and October 1966 (Baird, 1969). Students that attended small schools and schools in large cities scored lower on the ACT than students in larger schools and schools located in suburban areas (Baird, 1969). Baird (1969) determined, "high school size has a considerable effect on achievement" (p. 255).

Jewell (1989) examined the relationship between school size and achievement while controlling for poverty using a national sample of student scores on the 1984 ACT and SAT. Findings revealed a moderately negative relationship between student performance and school size with students in smaller schools performing better than students enrolled in larger schools did. However, Jewell (1989) also noted that the relationship was not statistically significant after controlling for poverty. In fact, Jewell (1989) reported that poverty accounted for 53% to 58% of the variance in test scores.

In contrast, Haller, Monk, and Tien (1993) failed to find any significant relationships between higher order thinking skills and schools size. Utilizing student scores on the 1987 National Assessment of Educational Progress in math and science for 2,829 10th grade students in 51 U.S. high schools, results indicated the absence of a relationship between school size and higher order thinking skills in math or science (Haller et al., 1993). Furthermore, the researchers concluded that a relationship did not exist between school size and poverty (Haller et al., 1993). The study also examined the relationship between higher order thinking skills of students in math and science and location of the school. Haller et al. (1993) noted, "Rural students are at no obvious achievement disadvantage" and failed to find a relationship between higher order thinking skills and rurality (p. 67).

Hoagland (1995) analyzed 1990 California Assessment Program scores in reading, math, and written expression for all 12th graders in 756 California high schools. Results indicated a negative relationship between school size and reading achievement (Hoagland, 1995). However, in math and written expression, the results were inconclusive (Hoagland, 1995). While not statistically significant, Hoagland (1995) noted that students from very large schools performed better than students from smaller schools.

Lee and Smith (1995) supported Jewell (1989) in their study of the impact of school restructuring on academic achievement. The study examined student performance in math and reading taken from the 1988 National Education Longitudinal Study of 11,794 10th grade students in 820 U.S. high schools. Results indicated a statistically significant negative relationship between school size and academic achievement (Lee & Smith, 1995). Furthermore, Lee and Smith (1985) found a positive relationship between school size and poverty, suggesting that school size had an indirect effect on student achievement.

However, a follow-up study by Lee and Smith (1997) failed to indicate a preference for large or small schools and instead found mid-sized schools to maximize student achievement. The researchers examined academic achievement data from the 1988 National Education Longitudinal Study in math and reading for 9,812 students in 789 U.S. high schools. Results indicated that students attending high schools with enrollments between 600 and 900 students had the highest achievement gains in both reading and math for high and low socioeconomic status students (Lee & Smith, 1997). Schools with high and low minority enrollments experienced higher student achievement gains in math with total enrollments of 900 to 1,200 students and 600 to 1,200 students for reading (Lee & Smith, 1997).

Gardner, Ritblatt, and Beatty (2000) conducted a study examining student achievement as a function of school size while controlling for poverty. The researchers randomly selected 57 large high schools and 60 small high schools in California and analyzed 1995 SAT total, math, and verbal scores. Findings indicated that students in larger high schools performed significantly better than did students in small high schools on the SAT verbal test (Gardner et al., 2000). However, when controlling for poverty, the relationship was not statistically significant. In contrast, students in large schools performed significantly better than did students in small schools on the SAT math test and SAT total composite regardless of poverty (Gardner et al., 2000).

Durbin (2001) also discovered larger high schools to benefit academic achievement. Durbin (2001) examined the relationship between school size and student achievement on the 1998 Metropolitan Achievement Test in reading, math, and written expression for 11th grade students in 192 public high schools in South Carolina. After controlling for poverty, analyses indicated a positive relationship between high school size and academic achievement (Durbin, 2001). As a result, Durbin (2001) recommended an optimal high school size of 1,431 to 2,019 students to maximize student achievement.

While several studies indicating a positive relationship between high school size and academic achievement also investigated the effects of poverty on the relationship, Schreiber (2002) only examined student achievement in advanced math in high schools by using student scores from the Third International Mathematics and Science Study for 1,839 12^{th} grade students from 162 U.S. high schools. Results indicated a significant positive relationship between school size and advanced math achievement (Schreiber, 2002). Schreiber (2002) concluded that students attending larger high schools exhibited higher levels of student achievement.

Chavez (2002) examined the relationship between high school size in Texas and student scores on the Texas Assessment of Academic Skills end of course exams, and ACT and SAT scores from 1997 to 1999 while controlling for poverty and ethnicity. On all measures of student achievement, students in larger high schools performed significantly higher than did students in smaller schools regardless of poverty (Chavez, 2002). However, on the Texas Assessment of Academic Skills, Hispanic students experienced higher levels of achievement in smaller schools, while African American students performed at higher levels in larger schools (Chavez, 2002).

Crenshaw (2003) also examined the effect of poverty on the relationship between high school size and achievement. The study employed the 2000 absolute rating, a compilation of multiple measures of student achievement, on the South Carolina School Report Card for 178 high schools in the state. Crenshaw (2003) established that larger high schools had lower levels of poverty, but also experienced higher levels of student achievement.

Rumberger and Palardy's (2005) study of the relationship between student background and student performance variables in high schools of different sizes concurred with the findings of Durbin (2001) regarding optimal school size, but offered an additional caution. Using a national sample from the National Education Longitudinal Study with achievement scores of 14,199 students in U.S. high schools in math, reading, science, and social studies, the researchers identified higher levels of student achievement in high schools with enrollments of more than 1,200 students (Rumberger & Palardy, 2005). However, the larger high schools also had higher dropout rates when compared to students in medium-sized schools (Rumberger & Palardy, 2005). Thus, Rumberger and Palardy concluded, "optimal size for student learning may not be the optimal size for student graduation" (p. 21).

Focusing on the effect of ethnicity on the relationship between school size and student achievement, Slate and Jones (2006) supported Chavez (2002) and indicated that larger high schools benefitted the student achievement of African American students. The researchers examined the relationship between school size and achievement of African American students in all grade 9 through grade 12 Texas high schools. Results indicated higher performance on the ACT and SAT for African American students enrolled in larger schools with enrollments of more than 1,200 students when compared to African American students in mid-sized schools with enrollments of 800 to 1,199 students (Slate & Jones, 2006). On the Texas Assessment of Academic Skills in reading, writing, and math, Slate and Jones (2006) failed to find a statistically significant difference in achievement based on school size. However, on end-of-course exams, African American students in larger schools had a significant advantage over African American students in smaller schools with enrollments of less than 400 students (Slate & Jones, 2006).

Refuting Schreiber (2002), Schneider et al. (2007) reported that school size did not have an effect on student achievement in math. The study observed math achievement data from the 2002 National Education Longitudinal Study for more than 10,000 students in 660 U.S. high schools. Among the notable findings of the study, the researchers found lower levels of student achievement in math in urban schools when compared to math achievement in rural and suburban schools (Schneider et al., 2007). Additionally, Schneider et al. (2007) remained skeptical of smaller schools citing the inconsistency of achievement benefits for students in smaller schools.

Brackett (2008) established that larger schools had more diverse student populations and smaller schools had higher levels of poverty. Brackett's (2008) study examined the relationship between high school size and student achievement while controlling for ethnicity and poverty. Student scores on the 2001 ACT, Arkansas Comprehensive Testing, Assessment, and Accountability System End-of-Course tests, and the Stanford Achievement Test, Ninth Edition, were analyzed for students in 320 public high schools in Arkansas. Brackett (2008) concluded that poverty and ethnicity were both significant factors influencing student achievement regardless of school size. However, after controlling for poverty and ethnicity, larger schools enrolling more than 400 students produced higher levels of student achievement (Brackett, 2008).

Slate and Jones (2008) conducted a similar study regarding student achievement of Hispanic students in Texas high schools. Consistent with their 2006 findings, Slate and Jones (2008) discovered higher levels of student achievement on the ACT and SAT for Hispanic students in larger schools with enrollments of 1,200 students or more. Analyses of the Texas Assessment of Academic Skills revealed contradictory findings with Hispanic students in schools with fewer than 400 students outperforming students in larger high schools (Slate & Jones, 2008). Findings from end-of-course tests indicated mixed results with Hispanic students in smaller schools performing better on biology and English assessments and Hispanic students in larger schools performing better on the U.S. History assessment (Slate & Jones, 2008).

Maxey (2008) conducted a study that supported Gardner, Ritblatt, and Beatty's (2000) work. His study examined the relationship between school size and academic achievement on the 2007 ACT and SAT while controlling for poverty. Mean scores for reading and math for students in 167 South Carolina high schools were examined. Findings indicated a positive relationship between school size and academic achievement (Maxey, 2008). However, when controlled for poverty, size was not significantly related to poverty (Maxey, 2008). Maxey (2008) noted that the power of poverty overshadowed the relationship between school size and achievement.

However, Stewart (2009) found a negative relationship between school size and achievement. The study employed 2005 Texas Assessment of Knowledge and Skills test results for all 11th grade students in traditional grade nine through grade 12 Texas high schools in homogenous groupings based on poverty. Stewart (2009) indicated that more than 25% of all low socioeconomic status students attended larger schools. Additionally, students in smaller high schools performed at higher levels when compared to students in larger schools (Stewart, 2009).

In contrast, Werblow and Duesbery (2009) found both smaller and larger schools to benefit student achievement in math. Their study examined math achievement data from the 2002 and 2004 Educational Longitudinal Study for 10th and 12th grade students in 752 U.S. high schools. While ethnicity, poverty, and location were not significant predictors of student achievement in math, Werblow and Duesbery (2009) discovered a curvilinear relationship between school size and math achievement. Schools with enrollments of fewer than 673 students and more than 2,692 students experienced the highest gains in math achievement (Werblow & Duesbery, 2009).

Most recently, Greeney's (2010) findings and optimal size recommendation further supported the results of Durbin (2001). Greeney (2010) observed the effect of school size on student achievement while controlling for ethnicity. The study employed passing rates on the Texas Assessment of Knowledge and Skills in language arts, math, science, and social studies from 2004 to 2009 among 11th grade students in all Texas high schools housing grades 9 through 12. With 58 of 60 analyses statistically significant, all 58 indicated higher achievement levels for students enrolled in larger high schools regardless of ethnicity (Greeney, 2010). Furthermore, Greeney (2010) indicated that schools with 1,500 students or more produced higher achievement in high schools.

Summary

The studies reviewed in this chapter reveal the convolution of the relationship between school size and student achievement. The divergent and inconsistent findings warrant further research. As state governments and local school boards search for ways to meet the academic achievement demands of NCLB and grapple with tightening budgets, school leaders and policy makers will likely continue evaluating appropriate school size as a measure of school effectiveness and efficiency. Chapter two addressed the historical context of school size in the United States including the effects of school consolidation on the state of Missouri. An examination of research on optimal school size explored arguments based on school inputs and student outcomes. The empirical research regarding the relationship between school size and student achievement at elementary, middle, and high school levels was reviewed. In addition, research concerning the impact of specific variables on the relationship was also reviewed. A review of empirical studies specifically observing the effect of location on the relationship between school size and academic achievement yielded very little literature, while the effect of special education status of students on the relationship failed to yield any relevant literature. The following chapter provides an explanation of the methods used to answer the research questions posed in chapter one.

Chapter Three

Methods

This study was designed to explore the relationship between student achievement and school size at elementary, middle, and high school levels and identify the optimal school size that maximizes student achievement on the MAP Grade-Level and EOC Assessments. Additionally, the study explored the extent to which the relationship between student achievement and school size was affected by school location, ethnicity, poverty, and special education classifications. Chapter three includes the design of the study and the process used to address the research questions posed in chapter one. It begins with an explanation of the research design; followed by a description of the population, sample, and sampling procedures; discussion on instrumentation; enumeration of data collection procedures; an explanation of data analysis and hypothesis testing; and, justification for limitations of the study.

Research Design

This study utilized a causal-comparative quantitative research design. The extent to which school size affected student achievement was examined. Additionally, the study examined the differences in student achievement for schools of different sizes based on the effects of school location, ethnicity, poverty, and special education classification.

The independent variable, school sizes, was defined as the total number of students enrolled in a school and reported to the Missouri Department of Elementary and Secondary Education (DESE) as the January Membership Count as part of the regular February reporting cycle in the Core Data Collection System. School size was classified as very small, small, medium, large, or very large by applying the logic in the formula used by the Missouri High School Activities Association (MSHSAA) in the Board of Directors Policy 13 for enrollment and classification. Such a formula is applied to elementary and middle schools rather than replicated due to the MSHSAA policy only referencing high school size. According to the policy:

> The formula takes into account the total number of MSHSAA member high schools and creates enrollment breaks between five groupings of schools. The formula places the largest 96 schools in the first group and the next largest 96 schools in the second group. Then, starting from the bottom, the formula places the smallest 128 schools in a group, and the next smallest 128 schools in another group. The schools in the middle make up a fifth group. (MSHSAA, 2010b, p. 107)

Using the MSHSAA policy, the percentage of schools in each MSHSAA school size category was determined. Next, for the purpose of creating school size categories for use in the study, the MSHSAA percentages for each category were applied to the total number of schools included in the sample. Table 2 illustrates the application of the formula to the study's sample to determine the number of schools in each category.

Table 2

Application of the MSHSAA Enrollment and Classification Policy to the Study Sample

School Level	Total	Very Small	Small	Medium	Large	Very Large
MSHSAA % [a]		21.62%	21.62%	24.32%	16.21%	16.21%
MSHSAA High Schools	592	128	128	144	96	96
Elementary Schools [b]	924	200	200	224	150	150
Middle Schools [b]	314	68	68	76	51	51
High Schools [b]	492	106	106	122	79	79

Note. [a] MSHSAA Percentages were determined using the Missouri State High School Athletic Association Board of Directors Policy 13 for enrollment and classification of schools by dividing the total number of MSHSAA schools by the number of schools in each size category. [b] For each grade level, the number of schools in each size category for the sample was determined by multiplying the MSHSAA percentage by the total number of schools in the sample at each grade level.

At each grade level, schools in the sample were ordered from smallest to largest. Using the total number of schools in each size category for each grade level as determined in Table 2, enrollment ranges were developed for each size category at each grade level. Table 3 shows the enrollment ranges for each size classification utilized in the study.

Table 3

School Size Classifications by Enrollment

School Size Category	Elementary School	Middle School	High School
Very Small	34 – 180	42 – 231	35 – 153
Small	181 – 289	232 – 362	154 – 265
Medium	290 – 404	363 – 587	266 – 558
Large	405 – 502	588 – 754	559 – 1040
Very Large	503 – 1157	755 – 1564	1041 – 2421

Note. Adapted from the Missouri State High School Athletic Association Board of Directors Policy 13 for enrollment and classification of schools.

Additional independent variables included location, ethnicity, poverty, and special education classifications. School location was identified according to a geographic descriptor determined by utilizing the urban-centric locale code assigned to each school using the 2005 – 2006 National Center for Education Statistics Common Core of Data Public Elementary/Secondary School Locale Code files. The locale code "indicates the location of the school relative to populous areas" (U.S. Department of Education, 2008a, p. 3). For purposes of data analysis, the twelve locale codes were classified into four broader categories: city, suburb, town, and rural. Table 4 provides an explanation of the locale code categories.

Table 4

School Locations From Condensed Locale Codes

Classification	Urban-Centric Locale Codes & Definitions
City	11. City, Large: Territory inside an urbanized area and inside a principal city with population of 250,000 or more.
	12. City, Midsize: Territory inside an urbanized area and inside a principal city with population < 250,000 and ≥ 100,000.
	13. City, Small: Territory inside an urbanized area and inside a principal city with population < 100,000.
Suburb	21. Suburb, Large: Territory outside a principal city and inside an urbanized area with population of ≥ 250,000.
	22. Suburb, Midsize: Territory outside a principal city and inside an urbanized area with population < 250,000 and ≥ 100,000.
	23. Suburb, Small: Territory outside a principal city and inside an urbanized area with population < 100,000.
Town	31. Town, Fringe: Territory inside an urban cluster that is ≤ 10 miles from an urbanized area.
	32. Town, Distant: Territory inside an urban cluster that is > 10 miles and ≤ 35 miles from an urbanized area.
	33. Town, Remote: Territory inside an urban cluster that is > 35 miles of an urbanized area.
Rural	41. Rural, Fringe: Census-defined rural territory that is ≤ 5 miles from an urbanized area, as well as rural territory that is ≤ 2.5 miles from an urban cluster.
	42. Rural, Distant: Census-defined rural territory that is > 5 miles but ≤ 25 miles from an urbanized area, as well as rural territory that is > 2.5 miles but ≤ 10 miles from an urban cluster.
	43. Rural, Remote: Census-defined rural territory that is > 25 miles from an urbanized area and is also > 10 miles from an urban cluster.

Note. Adapted from the definitions of urbanicity as provided in *Documentation to the NCES Common Core of Data Local Education Agency Locale Code File: School Year 2005-06* by the U.S. Department of Education, 2008a, p. 4.

Ethnicity classification for 2009-2010 was measured by the percentage of Hispanic, Black, Asian, and Indian students enrolled in a school as part of the January

Membership Count reported to DESE during the February reporting cycle in the Core Data Collection System (Missouri DESE, 2007, p. 93). For purposes of data analysis, ethnicity was classified into three categories: low minority, moderate minority, and high minority using ranges established by DESE as shown in Table 5 (State of Missouri, 2010, p. 145).

Table 5

Ethnicity Classifications as a Percentage of Non-White Student Enrollment

Ethnicity Classification	Range
Low Minority	0% – 2%
Moderate Minority	3% – 22%
High Minority	23% – 100%

Note. Adapted from the definitions of minority categories developed by the Missouri DESE as utilized in the *Race to the Top Application for Initial Funding* generated by the State of Missouri, 2010.

Poverty classification for 2010-2011 was measured by the percentage of students who were

> eligible for free or reduced lunch documented through the application process using federal eligibility guidelines or through the direct certification process and used by federal programs as reported to DESE as part of the January Membership count during the February reporting cycle in the Core Data Collection System. (Missouri DESE, 2007, p. 86-87)

For purposes of data analysis, poverty was classified into three categories: low poverty, moderate poverty, and high poverty using ranges established by DESE as shown in Table 6 (State of Missouri, 2010, p. 145).

Table 6

Poverty Classifications as a Percentage of Enrollment Receiving Free or Reduced Meals

Poverty Classification	Range
Low Poverty	0% – 30%
Moderate Poverty	31% – 62%
High Poverty	63% – 100%

Note. Adapted from the definitions of poverty levels developed by the Missouri DESE as utilized in the *Race to the Top Application for Initial Funding* generated by the State of Missouri, 2010.

Special education classification was measured as the percent of students having a "disability as prescribed by the Individuals with Disabilities Education Act (IDEA) who by reason thereof received special education services as outlined in an individualized education program (IEP)" (Missouri DESE, 2007, p. 247) in a school and reported to DESE in the December reporting cycle in the Core Data Collection system (p. 58). For the purposes of data analysis, special education was classified into three categories: low special education, moderate special education, and high special education.

Neither the U.S. Department of Education nor DESE offer guidelines to define classifications or maximum special education enrollment as the decision to qualify a student for special education services is made by the student's IEP team. Thus, Table 7 contains category ranges for special education enrollment generated as a result of calculating the mean (13.27%), standard deviation (4.24%), and the minimum (0%) and maximum (34.09%) of the study's special education enrollment sample and utilizing the standard deviation to create three categories. The low special education category was defined as the range from the minimum to one standard deviation below mean. The moderate special education category was defined as the range of one standard deviation above and below the mean. The high special education category was defined as the range of one standard deviation above the mean and the maximum. While the study delimits some schools from the study (see Appendix A), such ranges seem appropriate considering that the mean incidence rate of students with disabilities in all schools in the state of Missouri during the 2009-2010 school year was 11.16% (Missouri DESE, 2010f, p. 3).

Table 7

Special Education Classification Range as a Percentage of Enrollment with an IEP

Classification	Ranges
Low Special Education	0% – 9.02%
Moderate Special Education	9.03% – 17.51%
High Special Education	17.52% – 34.09%

The dependent variable was student achievement as measured by the percent of students scoring in the proficient and advanced categories on the 2009-2010 Missouri Assessment Program (MAP) Grade-level Assessment for grade 5 in communication arts and mathematics for elementary and grade 8 for middle schools. The percent of students scoring in the proficient and advanced categories on the 2009-2010 Missouri Assessment Program (MAP) End-of-Course (EOC) Assessment for grades 9 through 12 in English II, Algebra I, biology, and government were used as the measures of student achievement for high schools.

Population and Sample

The population for the study included all 2,334 public schools in Missouri excluding charter, alternative, special education, career, vocational, and technical schools. The sample comprised 1,730 public schools in the state of Missouri meeting the criteria below for inclusion in the sample: 924 were elementary schools, 314 were middle schools, and 492 were high schools.

Sampling Procedures

The researcher used purposive sampling. Lunenburg and Irby (2008) validate such a sampling method in research when "clear criteria provide a basis for describing and defending" the sample (p. 175). Schools were selected for inclusion in the sample if they met the following criteria:

1. The school must be a public, non-charter school in the state of Missouri.
2. The school must have reported MAP data for the 2009-2010 school year.
3. The school must contain a grade configuration consistent with the definition of an elementary, middle, or high school as specified by the National Center for Educational Statistics (NCES) Common Core of Data Glossary as defined in chapter one.
4. Elementary schools must contain grade 5.
5. Middle schools must contain grade 8.
6. The school must report ex post facto data for location, ethnicity, poverty, and special education.

As a result, preschools, charter, technical, vocational, career, and special education schools, alternative educational facilities, elementary schools without grade 5 and middle schools without grade 8, and schools with grade configurations outside of the NCES Common Core of Data definitions were excluded from the sample. Additionally, schools that failed to report ex post facto data for location, ethnicity, poverty, or special education (see Appendix A) were excluded from the sample for the applicable test.

Instrumentation

MAP Grade-Level Assessments.

The Missouri Department of Elementary and Secondary Education (DESE) administers the Missouri Assessment Program (MAP) Grade-Level Assessments annually during a spring testing window to all students in grades 3 through 8 in communication arts and mathematics. The Grade-Level Assessments evaluate “knowledge, skills, and competencies that Missouri students should acquire by the end of certain grade levels” as well as determine progress toward meeting the state’s broad and specific academic goals: the Show-Me Standards and Grade-Level Expectation (GLE) Strands (Missouri DESE, 2010c, p. 3). Thus, the tests are primarily criterion-referenced to the state’s content and process standards found in the Show-Me Standards and GLEs. However, each grade-level test contains a “subset of selected-response items taken from the Survey edition of TerraNova™, a nationally normed test developed by CTB/McGraw-Hill” (Missouri DESE, 2010c, p. 3).

The criterion-referenced assessment items are generated through a collaborative partnership between local educators, DESE, and the state’s Grade-Level Assessment contractor, CTB/McGraw-Hill. A robust process is used in item development:

> Initial item writing/passage selection workshop; a local pilot study; a content and bias review, item refinements and form construction; a subsequent round of

> formal field testing; the selection of operational forms based on statistical data from the field test; and ultimately, operational testing (Missouri DESE, 2009c, p. 15).

Each Grade-Level Assessment "requires three to five hours of test administration time and may include any of three types of test items: selected-response items, constructed-response items, and performance events including writing prompts" (Missouri DESE, 2010c, p. 1). Selected-response items, also known as multiple-choice items, are questions with a list of possible correct responses given. Constructed-response items are questions where students are expected to write a response. Performance events "require students to work through more complicated items" and "allow for more than one approach to get a correct answer," while the writing prompt is a performance event in the form of an "open-ended item that requires students to demonstrate their writing proficiency" (Missouri DESE, 2010c, p. 1). All selected-response items are scored by CTB/McGraw-Hill using electronic scanners. Human raters score constructed-response, performance event, and writing prompt items after receiving training from CTB/McGraw-Hill (Missouri Department of Elementary and Secondary Education, 2009c).

MAP End-of-Course Assessments.

Development and administration of the MAP End-of-Course (EOC) Assessments follows a process very similar to that of the Grade-Level Assessments. EOC Assessments are administered annually during fall, spring, and summer testing windows to high school students following completion of course-level work in Algebra I, Algebra II, Geometry, English I, English II, biology, American History, and government. For the

2009-2010 school year, only Algebra I, English II, and biology were required assessments while the remaining assessments were available only for field testing as operational assessments (Missouri DESE, 2010e). The EOC Assessments are based on the Show-Me Standards and the Content-Level Expectation (CLE) Strands. The CLEs outline the "ideas, concepts, and skills that form the foundation for an assessed EOC subject area, regardless of student grade level" (Missouri DESE, 2010d, p. 1). Thus, the EOC Assessments are criterion-referenced to the state's content and process standards found in the Show-Me Standards and CLEs.

The criterion-referenced assessment items are generated through a collaborative partnership between local educators, DESE, and the state's EOC Assessment contractor, Riverside Publishing. The process for item development mirrors that of the Grade-Level Assessment (Missouri DESE, 2009d). Each EOC Assessment requires up to 180 minutes for administration and "may include two types of test items: selected response items and performance events including writing prompts" (Missouri DESE, 2010d, p. 2). Riverside Publishing scores all selected-response items using digital scanners. The Assessment Resource Center at the University of Missouri is responsible for scoring all performance events and writing prompts using human raters (Missouri DESE, 2009d).

Measurement.

Both the MAP Grade-Level and EOC Assessments utilize correct student responses on assessment items to derive a scale score and achievement level. For the Grade-Level Assessments, the scale score "describes achievement on a continuum that in most cases spans the complete range of Grades 3–8" (Missouri DESE, 2010c, p. 4). In contrast, the scale score on the EOC is only reflective of a student's achievement level in reference to specific standards with no bearing on grade-level (Missouri DESE, 2010d). Four achievement levels (advanced, proficient, basic, and below basic) are determined using scale score ranges. "Each achievement level represents standards of performance for each assessed content area" and describes what students can do related to both the skills and content evaluated through the assessment (Missouri DESE, 2010c, p. 4; 2010d, p. 3). Panels of local teachers, education leaders, postsecondary faculty, business, and community members determine achievement level cut scores and ranges. The relationship between scale scores ranges and achievement levels for the Grade Level and EOC Assessments used in the study are shown in Table 8.

Table 8

MAP Grade-Level and EOC Assessment Scale Score Ranges and Achievement Levels

Assessment	Below Basic	Basic	Proficient	Advanced
Communication Arts Grade 5	485 - 624	625 - 674	675 - 701	702 - 840
Communication Arts Grade 8	530 - 638	639 - 695	696 - 722	723 - 875
Mathematics Grade 5	480 - 604	605 - 667	668 - 705	706 - 830
Mathematics Grade 8	525 - 669	670 - 709	710 - 740	741 - 885
Algebra I	100 - 176	177 - 199	200 - 224	225 - 250
English II	100 - 176	177 - 199	200 - 224	225 - 250
Biology	100 - 176	177 - 199	200 - 224	225 - 250
Government	100 - 178	179 - 199	200 - 224	225 - 250

Note. The MAP Grade-Level Assessment is administered at the elementary and middle school levels. The MAP EOC Assessment is administered at the high school level. Adapted from *Missouri Assessment Program Grade-Level Assessments Guide to Interpreting Results* and *Missouri End-of-Course Assessments Guide to Interpreting Results* produced by the Missouri DESE, 2010.

Student performance at the proficient and advanced achievement levels on both the Grade-Level and EOC Assessments is considered to be at or above grade or course-level proficiency. This is commonly referred to as scoring in the "top two." For purposes of this study, student achievement was measured by the percentage of students in the proficient and advanced achievement levels within a school. Using such a measurement allows for a generalized snapshot of student achievement in individual schools for the specific grade spans and content areas assessed.

Validity and reliability.

Lunenburg and Irby (2008) defined validity as "the degree to which an instrument measures what it purports to measure" (p. 181), and reliability as "the degree to which an instrument consistently measures whatever it is measuring" (p. 182). Reliable research-based evidence of the validity and reliability of the MAP Grade-Level and EOC Assessments has been documented.

CBT/McGraw-Hill, the state's assessment vendor, utilized convergent validity as a subtype of construct validity by implementing Item Response Theory (IRT) models. IRT models were used to "calibrate test items and to report student scores" (Missouri DESE, 2009c, p. 141). Thus, item fit is relevant to construct validity. According to CBT/McGraw Hill, "The extent to which test items function as the IRT model prescribes is relevant to the validation of test scores…only 12 items total [out of 830] were flagged for poor model/data fit across all 14 grade/content area MAPs" (p. 141).

CBT/McGraw-Hill used Cronbach's coefficient alpha with values that can range from 0 to 1 to determine the reliability of raw scores on the Grade-Level Assessments. The closer the reliability coefficient is to 1, the greater the reliability of the instrument.

For the Grade-Level Assessments, “reliability statistics are 0.90 or greater for all tests indicating acceptable reliability” (p. 137).

Riverside Publishing, Missouri’s assessment vendor for the EOC Assessments, utilized content validity to determine the degree to which each EOC Assessment measured the CLEs. Such content validity is evidenced in the “use of a test blueprint and a carefully documented test construction process. CLEs and the Show-Me Standards are taken into consideration in the writing of selected response and Performance Event/Writing Prompt (PE/WP) items and in PE/WP rubric development” (Missouri DESE, 2009d, p. 191). Furthermore, in test development, Riverside chose items to “equitably represent the strands on each assessment by balancing CLE and sub-CLE coverage according to the targets outlined in the test specifications and by matching item format to the requirements of the content and standards descriptions” (Missouri DESE, 2009d, p. 191). Riverside Publishing also studied the relationship between content area CLEs and item types because the EOC Assessments “measure student performance in several content areas using a variety of item types” (Missouri DESE, 2009d, p. 192). To test the relationships, the publisher used Pearson correlation coefficients among test domains and clusters. According to Riverside, “the correlations between clusters within each assessment are in the moderate to moderately high range, suggesting strong relationships between the clusters” and strong content validity (Missouri DESE, 2009d, p. 192).

Riverside Publishing also used Cronbach’s coefficient alpha to determine the reliability of raw scores on the EOC Assessments. Reliability statistics for the raw-scores of the total population and for select student subgroups for all EOC Assessments ranged from .69 to .90 indicating moderate to high reliability (Missouri DESE, 2009d).

Data Collection & Cleaning Procedures

Prior to collecting data, a Proposal for Research (see Appendix B) was submitted on February 8, 2011 to the Baker University Institutional Review Board (IRB) requesting an exempt review due to the use of non-personally identifiable archival data. On February 24, 2011, the IRB granted approval for the study in accordance with Baker University's requirements and policies for conducting research under the exempt category (see Appendix C).

All data included in the sample were obtained from the Missouri Department of Elementary and Secondary Education. Student achievement data in the form of MAP Grade-Level and EOC Assessment building scores are public information and were downloaded from the Annual Reporting of School District Data FTP Downloading site (http://dese.mo.gov/schooldata/ftpdata.html) as a Microsoft Excel spreadsheet. The spreadsheet was sorted according to each school's unique DESE assigned County/District/School code. The grade span of each school was acquired by downloading the School Building List as a Microsoft Excel spreadsheet from the DESE Missouri School Directory Data Download site (http://dese.mo.gov/directory/ download.html). The beginning grade field (BGRADE) and ending grade field (EGRADE) were merged with the MAP Grade-Level and EOC Assessment spreadsheet using the County/District/School code.

The enrollments of each school as well as the poverty and ethnicity enrollments of each building were obtained by downloading the building file for Student Demographics from the Annual Reporting of School District Data FTP Downloading site (http://dese.mo.gov/schooldata/ftpdata.html) as a Microsoft Excel spreadsheet. Fields reflecting school size, and poverty and ethnicity percentages were merged with the MAP Grade-Level and EOC Assessment spreadsheet using County/District/School codes assigned by the DESE. Special education enrollments of each building were obtained by contacting the Core Data Department at DESE. A Data Specialist in the Office of Data System Management at DESE provided a Microsoft Excel spreadsheet via e-mail containing the number and percentage of students enrolled in each Missouri school receiving special education services. The data was retrieved from Screen 11 of the Core Data Reporting System for upload during the December reporting cycle. The special education field from the Excel spreadsheet was merged with the MAP Grade-Level and EOC Assessment spreadsheet using County/District/School codes.

The location of each school building as defined by the urban-centric locale codes assigned by the U.S. Department of Education's National Center for Education Statistics (NCES) was obtained by downloading the 2005-06 Public Elementary/Secondary School Locale Code File from the NCES Common Core of Data website at http://nces.ed.gov/ccd/CCDLocaleCode.asp as a Microsoft Excel spreadsheet. Only records containing "MO" were kept after sorting the spreadsheet by the state (LSTATE05) field. The location field (ULOCALE) was merged with the MAP Grade-Level and EOC Assessment spreadsheet using the school city (SCHCITY) field from the School Building List and merging it with the city (LCITY05) field from the Locale Code File.

The final Microsoft Excel spreadsheet contained data for all variables in the study. Sorting the spreadsheet in ascending order by each variable revealed the absence of data for several records. A Data Specialist in the Office of Data System Management at DESE provided a Microsoft Excel spreadsheet via e-mail containing missing data for all applicable records following a request to DESE for the missing data. Additionally, records for schools in the data set that did not meet the criteria for inclusion in the sample were removed from the spreadsheet. A detailed listing and justification for all schools removed from the sample is included in Appendix A.

Data Analysis and Hypothesis Testing

Each of the research questions RQ 1 through RQ 8 was addressed using a one factor analysis of variance (ANOVA) to determine if statistically significant differences in student achievement existed as measured by the MAP Grade-Level Assessments in communication arts and mathematics and MAP EOC Assessments in English II, Algebra I, biology, and government among schools of different sizes. Statistical significance for the ANOVA was set at $\alpha = .05$. A follow-up post hoc analysis, the Tukey Honestly Significant Difference (HSD), was used to determine which interaction effect means were statistically significantly different with $\alpha = .05$. A single hypothesis was tested to address each research question for RQ 1 through RQ 8.

The impact of other relevant factors (location, poverty, ethnicity, and special education classifications) on the relationship was also explored. To address each of the research questions RQ 9 through RQ 16, a two factor analysis of variance (ANOVA) was conducted to determine the interaction effect between the size of a school (very small, small, medium, large, and very large) and each of the following variables: location, ethnicity, poverty, and special education classifications as independent variables. For each ANOVA, an *F* statistic was calculated to identify differences in student achievement based on each of the interactions. A follow-up post hoc analysis, the Tukey Honestly Significant Difference (HSD), was used to determine which interaction effect means were statistically significantly different with $\alpha = .05$. Statistical tests were conducted using the Statistical Package for the Social Sciences 18.0 program. Four hypotheses were tested to address each research question for RQ 9 through RQ 16.

Limitations

The limitations of a study are the “factors that may have an effect on the interpretation of the findings or on the generalizability of the results” (Lunenburg & Irby, 2008, p. 133). This study has the following limitations:

1. Grade configurations for elementary, middle, and high schools are inconsistent across the state because of local school district decisions.
2. The instruction and preparation of students prior to taking the MAP Assessment is unknown and potentially varies from school to school.
3. The environment in which students completed the MAP Assessment is unknown and potentially varies from school to school.
4. The potential for data entry and maintenance error by schools and DESE is unknown.

Summary

This chapter revisited the purpose of the research study and offered a detailed explanation of the processes used to address the research questions. A purposive sample of all Missouri public schools as well as conditions for inclusion in the sample were discussed. Careful examination of the instrument including implications for validity and reliability were also presented. A thorough explanation of the data collection procedures and methods of data analysis were explored in the chapter. Chapter four presents the results of the data analysis.

Chapter Four

Results

The purpose of this study was to explore differences in achievement among elementary, middle, and high schools of varying sizes with special attention given to identifying the optimal school size that maximizes student achievement on the Missouri Assessment Program (MAP) assessments. The study also examined the extent to which school location, ethnicity, poverty, and special education classifications affected the relationship between school size and student achievement at elementary, middle, and high school levels. While the preceding three chapters addressed the background of the study, a review of relevant literature, and the methodology, research questions, and hypotheses related to the study, this chapter presents the results of quantitative analyses related to each of the research hypotheses. The following section, hypothesis testing, contains results from one factor ANOVAs and post hoc analyses conducted to determine if the size of elementary, middle, or high schools had an effect on student achievement as measured by the MAP test, and results from two factor ANOVAs and post hoc analyses conducted to determine if school location, ethnicity, poverty, and special education classifications had an impact on the relationship between the size of elementary, middle, or high schools and student achievement measured by the MAP assessments.

Hypothesis Testing

RQ 1: To what extent does a relationship exist between elementary school size and student achievement as measured by the MAP Grade-Level Assessment in communication arts?

H 1: There is a statistically significant difference in student achievement as measured by the MAP Grade 5 Communication Arts Assessment among the five categories of elementary school size: very small, small, medium, large, and very large.

A one factor (School Size) ANOVA was used to determine if statistically significant differences in the MAP Grade 5 Communication Arts Assessment existed among very small, small, medium, large, and very large elementary schools. Below, Table 9 includes the sample size, mean achievement level, and standard deviation for each elementary school size.

Table 9

MAP Grade 5 Communication Arts Means Disaggregated by Elementary School Size

Size	*n*	*M*	*SD*
Very Small	190	47.660	18.511
Small	202	43.066	17.569
Medium	226	49.756	16.734
Large	150	52.114	15.425
Very Large	149	58.949	14.052

Table 10 reports the results of the one factor (School Size) ANOVA (F (*4, 912*) = 20.876, $p < .05$) that indicated a statistically significant difference in the student achievement means among elementary schools of different sizes.

Table 10

ANOVA (School Size) Results for Elementary School Grade 5 Communication Arts

Source	Sum of Squares	*df*	*MS*	*F*	*p*
School Size	23302.297	4	5825.574	20.876	.000
Error	254495.464	912	279.052		
Total	277797.761	916			

A Tukey Honestly Significant Difference (HSD) post hoc was used to determine which means were different. Table 11 includes the results of the comparisons between school sizes using the Tukey HSD.

Table 11

Tukey HSD Test Results for MAP Grade 5 Communication Arts and Elementary School Size

Size	Size	Mean Difference	*p*
Very Small	Small	4.593	.052
	Medium	-2.096	.707
	Large	-4.454	.105
	Very Large	-11.289	.000
Small	Very Small	-4.593	.052
	Medium	-6.689	.000
	Large	-9.048	.000
	Very Large	-15.883	.000
Medium	Very Small	2.096	.707
	Small	6.689	.000
	Large	-2.358	.666
	Very Large	-9.193	.000
Large	Very Small	4.454	.105
	Small	9.048	.000
	Medium	2.358	.666
	Very Large	-6.835	.004
Very Large	Very Small	11.289	.000
	Small	15.883	.000
	Medium	9.193	.000
	Large	6.835	.004

The results of the Tukey HSD post hoc indicated a statistically significant difference between the MAP Grade 5 Communication Arts mean scores of very small schools (47.660) and very large schools (58.950). Very small schools' scores were lower (*MD* = -11.289, *p* = .000) than very large schools' scores. The results also indicated a statistically significant difference between the mean scores of small schools (43.066) when compared to medium (49.756), large (52.114), and very large schools (58.949). The small schools' scores were lower (*MD* = -6.689, *p* = .000) than medium schools' scores, (*MD* = -9.048, *p* = .000) large schools' scores, and (*MD* = -15.883, *p* = .000) very large schools' scores.

Additionally, there was a statistically significant difference between the MAP Grade 5 Communication Arts mean scores of medium schools (49.756) and very large schools (58.950). Scores of medium schools were lower (*MD* = -9.193, *p* = .000). Statistically significant differences were also found between mean scores of large schools (52.114) and very large schools (58.950). The large schools' scores were lower (*MD* = -6.835, *p* = .004) than very large schools' scores. Thus, the results of the above ANOVA and follow-up post hoc indicated that there is mixed evidence that achievement as measured by the MAP Grade 5 Communication Arts Assessment is affected by the five categories of elementary school size: very small, small, medium, large, and very large.

RQ 2: To what extent does a relationship exist between elementary school size and student achievement as measured by the MAP Grade-Level Assessment in mathematics?

H 2: There is a statistically significant difference in student achievement as measured by the MAP Grade 5 Mathematics Assessment among the five categories of elementary school size: very small, small, medium, large, and very large.

A one factor (School Size) ANOVA was used to determine if statistically significant differences in the MAP Grade 5 Mathematics Assessment existed among very small, small, medium, large, and very large elementary schools. Below, Table 12 includes the sample size, mean achievement level, and standard deviation for each elementary school size.

Table 12

MAP Grade 5 Mathematics Means Disaggregated by Elementary School Size

Size	*n*	*M*	*SD*
Very Small	190	49.862	20.940
Small	202	44.728	19.624
Medium	226	50.292	18.218
Large	150	52.768	16.704
Very Large	149	59.885	15.700

Table 13 reports the results of the one factor (School Size) ANOVA (F (*4, 912*) = 14.956, $p < .05$) that indicated a statistically significant difference in the student achievement means among elementary schools of different sizes.

Table 13

ANOVA (School Size) Results for Elementary School Grade 5 Mathematics

Source	Sum of Squares	*df*	*MS*	*F*	*p*
School Size	20533.884	4	5133.471	14.956	.000
Error	313029.901	912	343.235		
Total	333563.785	916			

A Tukey Honestly Significant Difference (HSD) post hoc was used to determine which means were different. Table 14 includes the results of the comparisons between school sizes using the Tukey HSD.

Table 14

Tukey HSD Test Results for MAP Grade 5 Mathematics and Elementary School Size

Size	Size	Mean Difference	*p*
Very Small	Small	5.134	.049
	Medium	-.429	.999
	Large	-2.906	.604
	Very Large	-10.022	.000
Small	Very Small	-5.134	.049
	Medium	-5.564	.017
	Large	-8.040	.001
	Very Large	-15.157	.000
Medium	Very Small	.429	.999
	Small	5.564	.017
	Large	-2.476	.710
	Very Large	-9.592	.000
Large	Very Small	2.906	.604
	Small	8.040	.001
	Medium	2.476	.710
	Very Large	-7.116	.008
Very Large	Very Small	10.022	.049
	Small	15.157	.999
	Medium	9.592	.604
	Large	7.116	.000

The results of the Tukey HSD post hoc indicated a statistically significant difference between the MAP Grade 5 Mathematics mean scores of very small schools (49.862) compared to small schools (44.728) and very large schools (59.885). Very small schools' scores were higher (*MD* = 5.134, *p* = .049) than small schools' scores and lower (*MD* = -10.022, *p* = .000) than very large schools' scores. The results also indicated a statistically significant difference between the mean scores of small schools (44.728) when compared to medium (50.292), large (52.768), and very large schools (59.885). The small schools' scores were lower (*MD* = -5.564, *p* = .017) than medium schools' scores, (-8.040, *p* = .001) large schools' scores, and (*MD* = -15.157, *p* = .000) very large schools' scores.

Additionally, there was a statistically significant difference between the MAP Grade 5 Mathematics mean scores of medium schools (50.292) and very large schools (59.885). Scores of medium schools were lower (*MD* = -9.582, *p* = .000) than scores of very large schools. Significant differences were also discovered between mean scores of large schools (52.767) and very large schools (59.885). The large schools' scores were lower (*MD* = -7.116, *p* = .008) than very large schools' scores. Thus, the results of the above ANOVA and follow-up post hoc indicated that there is mixed evidence that achievement measured by the MAP Grade 5 Mathematics Assessment is affected by the five categories of elementary school size: very small, small, medium, large, and very large.

RQ 3: To what extent does a relationship exist between middle school size and student achievement as measured by the MAP Grade-Level Assessment in communication arts?

H 3: There is a statistically significant difference in student achievement as measured by the MAP Grade 8 Communication Arts Assessment among the five categories of middle school size: very small, small, medium, large, and very large.

A one factor (School Size) ANOVA was used to determine if statistically significant differences in the MAP Grade 8 Communication Arts Assessment existed among very small, small, medium, large, and very large middle schools. Below, Table 15 includes the sample size, mean achievement level, and standard deviation for each middle school size.

Table 15

MAP Grade 8 Communication Arts Means Disaggregated Middle School Size

Size	*n*	*M*	*SD*
Very Small	68	52.298	12.227
Small	67	45.710	15.663
Medium	76	50.215	11.435
Large	51	53.519	13.546
Very Large	51	59.503	10.438

Table 16 reports the results of the one factor (School Size) ANOVA ($F(4, 308) = 8.924$, $p < .05$) that indicated a statistically significant difference in the student achievement means among middle schools of different sizes.

Table 16

ANOVA (School Size) Results for Middle School Grade 8 Communication Arts

Source	Sum of Squares	*df*	*MS*	*F*	*p*
School Size	5869.240	4	1467.310	8.924	.000
Error	50640.313	308	164.417		
Total	56509.553	312			

A Tukey Honestly Significant Difference (HSD) post hoc was used to determine which means were different. Table 17 includes the results of the comparisons between school sizes using the Tukey HSD.

Table 17

Tukey HSD Test Results for MAP Grade 8 Communication Arts and Middle School Size

Size	Size	Mean Difference	*p*
Very Small	Small	6.588	.025
	Medium	2.082	.867
	Large	-1.221	.986
	Very Large	-7.205	.022
Small	Very Small	-6.588	.025
	Medium	-4.505	.224
	Large	-7.809	.010
	Very Large	-13.793	.000
Medium	Very Small	-2.082	.867
	Small	4.505	.224
	Large	-3.303	.613
	Very Large	-9.288	.001
Large	Very Small	1.221	.986
	Small	7.809	.010
	Medium	3.303	.613
	Very Large	-5.984	.130
Very Large	Very Small	7.205	.022
	Small	13.793	.000
	Medium	9.288	.001
	Large	5.984	.130

The results of the Tukey HSD post hoc indicated a statistically significant difference between the MAP Grade 8 Communication Arts mean scores of very small schools (52.298) compared to small schools (45.710) and very large schools (59.503). Very small schools' scores were higher (*MD* = 6.588, *p* = .025) than small schools' scores and lower (*MD* = -7.205, *p* = .022) than very large schools' scores. The results also indicated a statistically significant difference between the mean scores of small schools (45.710) when compared to large (53.519) and very large schools (59.503). The small schools' scores were lower (*MD* = -7.809, *p* = .010) than large schools' scores and lower (*MD* = -13.793, *p* = .000) than very large schools' scores.

Additionally, there was a statistically significant difference between the MAP Grade 8 Communication Arts mean scores of medium schools (50.215) and very large schools (59.503). Scores of medium schools were lower (*MD* = -9.288, *p* = .001) than scores of very large schools. Thus, the results of the above ANOVA and follow-up post hoc indicated that there is mixed evidence that achievement as measured by the MAP Grade 8 Communication Arts Assessment is affected by the five categories of middle school size: very small, small, medium, large, and very large.

RQ 4: To what extent does a relationship exist between middle school size and student achievement as measured by the MAP Grade-Level Assessment in mathematics?

H 4: There is a statistically significant difference in student achievement as measured by the MAP Grade 8 Mathematics Assessment among the five categories of middle school size: very small, small, medium, large, and very large.

A one factor (School Size) ANOVA was used to determine if statistically significant differences in the MAP Grade 8 Mathematics Assessment existed among very small, small, medium, large, and very large middle schools. Below, Table 18 includes the sample size, mean achievement level, and standard deviation for each middle school size.

Table 18

MAP Grade 8 Mathematics Means Disaggregated by Middle School Size

Size	*n*	*M*	*SD*
Very Small	68	50.442	13.677
Small	67	46.958	17.974
Medium	76	49.218	13.402
Large	51	52.090	14.498
Very Large	51	58.751	11.671

Table 19 reports the results of the one factor (School Size) ANOVA (F (*4, 308*) = 5.337, $p < .05$) that indicated a statistically significant difference in the student achievement means among middle schools of different sizes.

Table 19

ANOVA (School Size) Results for Middle School Grade 8 Mathematics

Source	Sum of Squares	*df*	*MS*	*F*	*p*
School Size	4481.296	4	1120.324	5.337	.000
Error	64652.036	308	209.909		
Total	69133.332	312			

A Tukey Honestly Significant Difference (HSD) post hoc was used to determine which means were different. Table 20 includes the results of the comparisons between school sizes using the Tukey HSD.

Table 20

Tukey HSD Test Results for MAP Grade 8 Mathematics and Middle School Size

Size	Size	Mean Difference	*p*
Very Small	Small	3.484	.630
	Medium	1.224	.987
	Large	-1.647	.973
	Very Large	-8.308	.018
Small	Very Small	-3.484	.630
	Medium	-2.260	.885
	Large	-5.131	.316
	Very Large	-11.792	.000
Medium	Very Small	-1.224	.987
	Small	2.260	.885
	Large	-2.871	.809
	Very Large	-9.532	.003
Large	Very Small	1.647	.973
	Small	5.131	.316
	Medium	2.871	.809
	Very Large	-6.660	.141
Very Large	Very Small	8.308	.018
	Small	11.792	.000
	Medium	9.532	.003
	Large	6.660	.141

The results of the Tukey HSD post hoc indicated a statistically significant difference between the MAP Grade 8 Mathematics mean scores of very small schools (50.442) compared to very large schools (58.751). Very small schools' scores were lower (*MD* = -8.308, *p* = .018) than very large schools' scores. The results also indicated a statistically significant difference between the mean scores of small schools (46.958) when compared to very large (58.751). The small schools' scores were lower (*MD* = -11.792, *p* = .010) than very large schools' scores.

Additionally, there was a statistically significant difference between the MAP Grade 8 Mathematics mean scores of medium schools (49.218) and very large schools (58.751). Scores of medium schools were lower (*MD* = -9.532, *p* = .003) than scores of very large schools. Thus, the results of the above ANOVA and follow-up post hoc indicated that there is mixed evidence that achievement as measured by the MAP Grade 8 Mathematics Assessment is affected by the five categories of middle school size: very small, small, medium, large, and very large.

RQ 5: To what extent does a relationship exist between high school size and student achievement as measured by the MAP EOC Assessment in English II?

H 5: There is a statistically significant difference in student achievement as measured by the MAP EOC Assessment in English II among the five categories of high school size: very small, small, medium, large, and very large.

A one factor (School Size) ANOVA was used to determine if statistically significant differences in the MAP EOC Assessment in English II existed among very small, small, medium, large, and very large high schools. Below, Table 21 includes the sample size, mean achievement level, and standard deviation for each high school size.

Table 21

MAP English II Means Disaggregated by High School Size

Size	*n*	*M*	*SD*
Very Small	106	70.009	14.689
Small	106	73.966	11.137
Medium	114	72.262	9.851
Large	72	67.650	15.209
Very Large	82	76.134	10.573

Table 22 reports the results of the one-way (School Size) ANOVA (F (*4*, *475*) = 5.920, $p < .05$) that indicated a statistically significant difference in the student achievement means among high schools of different sizes.

Table 22

ANOVA (School Size) Results for High School English II

Source	Sum of Squares	*df*	*MS*	*F*	*p*
School Size	3595.595	4	898.899	5.920	.000
Error	72129.060	475	151.851		
Total	75724.656	479			

A Tukey Honestly Significant Difference (HSD) post hoc was used to determine which means were different. Table 23 includes the results of the comparisons between school sizes using the Tukey HSD.

Table 23

Tukey HSD Test Results for MAP English II and High School Size

Size	Size	Mean Difference	*p*
Very Small	Small	-3.956	.135
	Medium	-2.252	.657
	Large	2.359	.720
	Very Large	-6.124	.007
Small	Very Small	3.956	.135
	Medium	1.703	.844
	Large	6.316	.008
	Very Large	-2.168	.754
Medium	Very Small	2.252	.657
	Small	-1.703	.844
	Large	4.612	.095
	Very Large	-3.871	.193
Large	Very Small	-2.359	.720
	Small	-6.316	.008
	Medium	-4.612	.095
	Very Large	-8.484	.000
Very Large	Very Small	6.124	.007
	Small	2.168	.754
	Medium	3.871	.193
	Large	8.484	.000

The results of the Tukey HSD post hoc indicated a statistically significant difference between the MAP English II mean scores of very small schools (70.009) compared to very large schools (76.134). Very small schools' scores were lower (*MD* = -6.124, *p* = .007) than very large schools' scores. The results also indicated a statistically significant difference between the mean scores of small schools (73.966) when compared to large schools (67.650). The small schools' scores were higher (*MD* = 6.316, *p* = .008) than large schools' scores.

Additionally, there was a statistically significant difference between the MAP English II mean scores of large schools (67.650) and very large schools (76.134). Scores of large schools were lower (*MD* = -8.485, *p* = .000) than scores of very large schools. Thus, the results of the above ANOVA and follow-up post hoc indicated that there is mixed evidence that achievement as measured by the MAP English II Assessment is affected by the five categories of high school size: very small, small, medium, large, and very large.

RQ 6: To what extent does a relationship exist between high school size and student achievement as measured by the MAP EOC Assessment in Algebra I?

H 6: There is a statistically significant difference in student achievement as measured by the MAP EOC Assessment in Algebra I among the five categories of high school size: very small, small, medium, large, and very large.

A one factor (School Size) ANOVA was used to determine if statistically significant differences in the MAP EOC Assessment in Algebra I existed among very small, small, medium, large, and very large high schools. Below, Table 24 includes the sample size, mean achievement level, and standard deviation for each high school size.

Table 24

MAP Algebra I Means Disaggregated by High School Size

Size	*n*	*M*	*SD*
Very Small	104	51.209	22.975
Small	108	54.418	20.430
Medium	118	51.859	16.345
Large	81	45.344	21.377
Very Large	83	47.713	19.875

Table 25 reports the results of the one factor (School Size) ANOVA (F (*4, 489*) = 2.900, $p < .05$) that indicated a statistically significant difference in the student achievement means among high schools of different sizes.

Table 25

ANOVA (School Size) Results for High School Algebra I

Source	Sum of Squares	*df*	*MS*	*F*	*p*
School Size	4726.110	4	1181.528	2.900	.022
Error	199248.314	489	407.461		
Total	203974.424	493			

A Tukey Honestly Significant Difference (HSD) post hoc was used to determine which means were different. Table 26 includes the results of the comparisons between school sizes using the Tukey HSD.

Table 26

Tukey HSD Test Results for MAP Algebra I and High School Size

Size	Size	Mean Difference	*p*
Very Small	Small	-3.208	.776
	Medium	-.649	.999
	Large	5.865	.287
	Very Large	3.496	.765
Small	Very Small	3.208	.776
	Medium	2.559	.876
	Large	9.074	.020
	Very Large	6.705	.155
Medium	Very Small	.649	.999
	Small	-2.559	.876
	Large	6.514	.168
	Very Large	4.146	.606
Large	Very Small	-5.865	.287
	Small	-9.074	.020
	Medium	-6.514	.168
	Very Large	-2.368	.944
Very Large	Very Small	-3.496	.765
	Small	-6.705	.155
	Medium	-4.146	.606
	Large	2.368	.944

The results of the Tukey HSD post hoc indicated a statistically significant difference between the MAP Algebra I mean scores of small schools (54.418) compared to large schools (45.344). Small schools' scores were higher (*MD* = 9.074, *p* = .020) than large schools' scores. Thus, the results of the above ANOVA and follow-up post hoc indicated that there is mixed evidence that achievement as measured by the MAP Algebra I Assessment is affected by the five categories of high school size: very small, small, medium, large, and very large.

RQ 7: To what extent does a relationship exist between high school size and student achievement as measured by the MAP EOC Assessment in biology?

H 7: There is a statistically significant difference in student achievement as measured by the MAP EOC Assessment in biology among the five categories of high school size: very small, small, medium, large, and very large.

A one factor (School Size) ANOVA was used to determine if statistically significant differences in the MAP EOC Assessment in biology existed among very small, small, medium, large, and very large high schools. Below, Table 27 includes the sample size, mean achievement level, and standard deviation for each high school size.

Table 27

MAP Biology Means Disaggregated by High School Size

Size	*n*	*M*	*SD*
Very Small	104	44.458	19.815
Small	106	54.788	15.422
Medium	114	55.918	15.340
Large	76	48.852	20.917
Very Large	82	61.023	15.604

Table 28 reports the results of the one factor (School Size) ANOVA ($F(4, 477) = 12.773$, $p < .05$) that indicated a statistically significant difference in the student achievement means among high schools of different sizes.

Table 28

ANOVA (School Size) Results for High School Biology

Source	Sum of Squares	*df*	*MS*	*F*	*p*
School Size	15481.938	4	3870.485	12.773	.000
Error	144546.025	477	303.031		
Total	160027.964	481			

A Tukey Honestly Significant Difference (HSD) post hoc was used to determine which means were different. Table 29 includes the results of the comparisons between school sizes using the Tukey HSD.

Table 29

Tukey HSD Test Results for MAP Biology and High School Size

Size	Size	Mean Difference	*p*
Very Small	Small	-10.330	.000
	Medium	-11.459	.000
	Large	-4.393	.452
	Very Large	-16.564	.000
Small	Very Small	10.330	.000
	Medium	-1.129	.989
	Large	5.936	.157
	Very Large	-6.234	.108
Medium	Very Small	11.459	.000
	Small	1.129	.989
	Large	7.065	.050
	Very Large	-5.104	.255
Large	Very Small	4.393	.452
	Small	-5.936	.157
	Medium	-7.065	.050
	Very Large	-12.170	.000
Very Large	Very Small	16.564	.000
	Small	6.234	.108
	Medium	5.104	.255
	Large	12.170	.000

The results of the Tukey HSD post hoc indicated a statistically significant difference between the MAP Biology mean scores of very small schools (44.458) compared to small (54.788), medium (55.918), and very large schools (61.023). Very small schools' scores were lower (*MD* = -10.330, *p* = .000) than small schools' scores, lower (*MD* = -11.459, *p* = .000) than medium schools scores, and lower (*MD* = -16.564, *p* = .000) than very large schools' scores. The results also indicated a statistically significant difference between the mean scores of medium schools (55.918) when compared to large schools (48.852). The medium schools' scores were higher (*MD* = 7.065, *p* = .050) than large schools' scores.

Additionally, there was a statistically significant difference between the MAP Biology mean scores of large schools (48.852) and very large schools (61.023). Scores of large schools were lower (*MD* = -12.564, *p* = .000) than scores of very large schools. Thus, the results of the above ANOVA and follow-up post hoc indicated that there is mixed evidence that achievement as measured by the MAP Biology assessment is affected by the five categories of high school size: very small, small, medium, large, and very large.

RQ 8: To what extent does a relationship exist between high school size and student achievement as measured by the MAP EOC Assessment in government?

H 8: There is a statistically significant difference in student achievement as measured by the MAP EOC Assessment in government among the five categories of high school size: very small, small, medium, large, and very large.

A one factor (School Size) ANOVA was used to determine if statistically significant differences in the MAP EOC Assessment in government existed among very small, small, medium, large, and very large high schools. Below, Table 30 includes the sample size, mean achievement level, and standard deviation for each high school size.

Table 30

MAP Government Means Disaggregated by High School Size

Size	*n*	*M*	*SD*
Very Small	101	40.440	18.444
Small	100	42.711	14.943
Medium	111	43.972	13.932
Large	74	39.655	19.372
Very Large	83	53.641	18.239

Table 31 reports the results of the one factor (School Size) ANOVA (F (*4, 464*) = 9.266, $p < .05$) indicated a statistically significant difference in the student achievement means among high schools of different sizes.

Table 31

ANOVA (School Size) Results for High School Government

Source	Sum of Squares	*df*	*MS*	*F*	*p*
School Size	10556.982	4	2639.246	9.266	.000
Error	132155.808	464	284.819		
Total	142712.791	468			

A Tukey Honestly Significant Difference (HSD) post hoc was used to specify which means were different. Table 32 includes the results of the comparisons between school sizes using the Tukey HSD.

Table 32

Tukey HSD Test Results for MAP Government and High School Size

Size	Size	Mean Difference	*p*
Very Small	Small	-2.270	.876
	Medium	-3.531	.549
	Large	.785	.998
	Very Large	-13.200	.000
Small	Very Small	2.270	.876
	Medium	-1.261	.983
	Large	3.055	.762
	Very Large	-10.929	.000
Medium	Very Small	3.531	.549
	Small	1.261	.983
	Large	4.316	.432
	Very Large	-9.668	.001
Large	Very Small	-.785	.998
	Small	-3.055	.762
	Medium	-4.316	.432
	Very Large	-13.985	.000
Very Large	Very Small	13.200	.000
	Small	10.929	.000
	Medium	9.668	.001
	Large	13.985	.000

The results of the Tukey HSD post hoc indicated a statistically significant difference between the MAP Government mean scores of very small schools (40.440) compared to very large schools (53.641). Very small schools' scores were lower (*MD* = -13.200, *p* = .000) than very large schools' scores. The results also indicated a statistically significant difference between the mean scores of small schools (42.711) when compared to very large schools (53.641). The small schools' scores were lower (*MD* = -10.929, *p* = .000) than very large schools' scores.

Additionally, there was a statistically significant difference between the MAP Government mean scores of medium schools (43.972) and very large schools (53.641). Scores of medium schools were lower (*MD* = -9.668, *p* = .001) than scores of very large schools. The results also indicated a statistically significant difference between the mean scores of large schools (39.655) when compared to very large schools (53.641). The large schools' scores were lower (*MD* = -13.985, *p* = .000) than very large schools' scores. Thus, the results of the above ANOVA and follow-up post hoc indicated that there is mixed evidence that achievement as measured by the MAP Government Assessment is affected by the five categories of high school size: very small, small, medium, large, and very large.

RQ 9: To what extent is the relationship between elementary school size and student achievement as measured by the MAP Grade-Level Assessment in communication arts impacted by any of the following variables: location, ethnicity, poverty, or special education classifications?

H 9: The difference in student achievement on the MAP Grade 5 Communication Arts Assessment between elementary schools of different sizes (very small, small, medium, large, and very large) is affected by location classification.

A two factor (School Size x Location) ANOVA was used to determine the effect of the interaction between elementary schools of different sizes (very small, small, medium, large, and very large) and different locations (rural, town, suburban, and urban) on achievement. Below, Table 33 includes the sample size, mean Grade 5 Communication Arts achievement level, and standard deviation for each elementary school size by location.

Table 33

MAP Grade 5 Communication Arts by Elementary School Size and Location

Size	Location	*n*	*M*	*SD*
Very Small	City	15	39.120	18.214
	Suburb	3	63.300	12.286
	Town	11	48.009	13.756
	Rural	161	48.140	18.717
Small	City	81	35.977	19.408
	Suburb	25	47.180	19.228
	Town	15	49.026	12.973
	Rural	81	47.781	13.158
Medium	City	61	42.050	19.097
	Suburb	75	55.213	18.899
	Town	24	53.379	10.724
	Rural	66	49.359	9.502
Large	City	30	45.066	13.655
	Suburb	83	54.934	17.003
	Town	21	49.323	10.683
	Rural	16	54.362	10.524
Very Large	City	24	58.441	15.315
	Suburb	82	63.591	13.871
	Town	23	51.343	9.167
	Rural	20	49.275	8.646

Table 34, reports the results of the two factor (School Size x Location) ANOVA (F (*12*, *897*) = 2.020, $p < .05$) that indicated a statistically significant interaction between the size and location of elementary schools. The results of the above ANOVA indicated that at least two means were different and a follow-up post hoc specified statistically significant differences.

Table 34

ANOVA (School Size x Location) Results for Grade 5 Communication Arts

Source	Sum of Squares	*df*	*MS*	*F*	*p*
Size	6615.283	4	1653.821	6.387	.000
Location	7453.286	3	2484.429	9.595	.000
Size*Location	6274.952	12	522.913	2.020	.020
Error	232251.198	897	258.920		
Total	2545405.700	917			

A Tukey Honestly Significant Difference (HSD = 16.400) post hoc was used to specify which interactions were statistically significantly different. Appendix D, Table D1 contains the results of the pairwise comparisons between school sizes and locations using the Tukey HSD.

The results of the Tukey HSD post hoc indicated a statistically significant difference between the MAP Grade 5 Communication Arts mean scores of very small city schools (39.120) and very small suburban schools (63.300). Very small city schools' scores were lower (-24.18) than very small suburban schools' scores. The results also indicated a statistically significant difference between the mean scores of very small city schools (39.120) and very large city schools (58.442). The very small city schools' scores were lower (-19.32) than very large city schools' scores. Moreover, there was a statistically significant difference between the mean scores of very small city schools (39.120) and very large suburban schools (63.591). Scores of very small city schools were lower (-24.47) than very large suburban schools.

Additionally, there was a statistically significant difference between the MAP Grade 5 Communication Arts mean scores between very small suburban schools (63.300) and small city schools (35.978). Scores of very small suburban schools were higher (27.32) than scores of small city schools. There was also a statistically significant difference between the scores of very small suburban schools (63.300) and medium city schools (42.051). Very small suburban schools' scores were higher (21.25) than medium city schools' scores. Moreover, results indicated a statistically significant difference between very small suburban schools (63.300) and large city schools (45.067). Scores of very small suburban schools were higher (18.23) than scores of large city schools.

The results also indicated a statistically significant difference between the mean scores of small city schools (35.978) when compared to medium suburban schools (55.213). Scores of small city schools were lower (-19.24) than scores of medium suburban schools. A statistically significant difference was also found between the scores of small city schools (35.978) and medium town schools (53.379). Small city schools' scores were lower (-17.40) than medium town schools' scores. Small city schools' (35.978) scores were statistically significantly different than large suburban schools' (54.935) and large rural schools' (54.363) scores. Scores of small city schools were lower (-18.96) than scores of large suburban schools and lower (-18.38) than scores of large rural schools. Moreover, there was a statistically significant difference between the scores of small city schools (35.978) and very large suburban (63.591) and very large city (58.442) schools. Scores of small city schools were lower (-27.61) than scores of very large suburban schools, and lower (-22.46) than scores of very large city schools.

The results indicated a statistically significant difference between mean scores of small suburban schools (47.180) and very large suburban schools (63.591). Scores of small suburban schools were lower (-16.41) than scores of large suburban schools. In addition, mean scores of medium city schools (42.051) were statistically significantly different than very large suburban schools (63.591). Scores of medium city schools were lower (-21.54) than scores of very large suburban schools. A statistically significant difference was also revealed between the scores of large city schools (45.067) and very large suburban schools (63.591). Large city schools' scores were lower (-18.52) than large suburban schools' scores.

In summary, the mixed results indicated that to some extent, location affected the differences in achievement among elementary schools of different sizes. Scores of very small city schools were lower than scores of very small suburban, very large city, and very large suburban schools. However, scores of very small suburban schools were higher than scores of small city, medium city, and large city schools. Small city schools' scores were lower than medium, large and very large suburban, medium town, and large rural schools' scores. Additionally, scores of small suburban schools were lower than scores of very large city and very large suburban schools. Medium city schools' scores were lower than very large suburban schools' scores. Large city schools' scores were also lower than very large suburban schools' scores.

H 10: The difference in student achievement on the MAP Grade 5 Communication Arts Assessment between elementary schools of different sizes (very small, small, medium, large, and very large) is affected by ethnicity classifications.

A two factor (School Size x Ethnicity) ANOVA was used to determine the effect of the interaction between elementary schools of different sizes (very small, small, medium, large, and very large) and different ethnicity classifications (low minority, moderate minority, and high minority) on achievement. Below, Table 35 includes the sample size, mean Grade 5 Communication Arts achievement level, and standard deviation for each elementary school size by ethnicity classification.

Table 35

MAP Grade 5 Communication Arts by Elementary School Size and Ethnicity

Size	Ethnicity	*n*	*M*	*SD*
Very Small	Low Minority	81	48.258	18.397
	Moderate Minority	76	48.926	19.245
	High Minority	15	40.733	19.690
Small	Low Minority	34	48.082	14.318
	Moderate Minority	73	49.906	12.373
	High Minority	82	33.485	19.206
Medium	Low Minority	24	51.600	9.210
	Moderate Minority	91	55.397	14.001
	High Minority	99	43.421	18.626
Large	Low Minority	5	46.420	8.781
	Moderate Minority	68	59.573	12.414
	High Minority	64	44.717	15.934
Very Large	Low Minority	5	45.900	15.965
	Moderate Minority	104	62.493	11.369
	High Minority	32	48.925	16.667

Table 36 reports the results of the two factor (School Size x Ethnicity) ANOVA (F (*8, 838*) = 1.253, $p > .05$) that did not indicate a statistically significant interaction between the size and ethnicity classification of elementary school. Thus, there was not enough evidence to reject the null hypothesis. Ethnicity did not affect differences in communication arts scores because of differences in elementary school size.

Table 36

ANOVA (School Size x Ethnicity) Results for Grade 5 Communication Arts

Source	Sum of Squares	*df*	*MS*	*F*	*p*
Size	4616.990	4	1154.247	4.581	.001
Ethnicity	21812.236	2	10906.118	43.288	.000
Size*Ethnicity	2525.557	8	315.695	1.253	.265
Error	211128.618	838	251.943		
Total	2362153.580	853			

H 11: The difference in student achievement on the MAP Grade 5 Communication Arts Assessment between elementary schools of different sizes (very small, small, medium, large, and very large) is affected by poverty classifications.

A two factor (School Size x Poverty) ANOVA was used to determine the effect of the interaction between elementary schools of different sizes (very small, small, medium, large, and very large) and different ethnicity classifications (low poverty, moderate poverty, and high poverty) on achievement. Below, Table 37 includes the sample size, mean Grade 5 Communication Arts achievement level, and standard deviation for each elementary school size by poverty classification.

Table 37

MAP Grade 5 Communication Arts by Elementary School Size and Poverty

Size	Poverty	*n*	*M*	*SD*
Very Small	Low Poverty	15	65.466	16.624
	Moderate Poverty	96	49.087	17.467
	High Poverty	69	42.581	18.262
Small	Low Poverty	15	62.513	11.764
	Moderate Poverty	72	50.537	12.562
	High Poverty	110	35.010	16.621
Medium	Low Poverty	52	62.513	12.305
	Moderate Poverty	100	50.537	10.748
	High Poverty	71	35.010	13.260
Large	Low Poverty	46	67.267	8.083
	Moderate Poverty	60	50.728	9.267
	High Poverty	41	36.500	12.445
Very Large	Low Poverty	71	69.360	8.442
	Moderate Poverty	59	52.598	7.112
	High Poverty	17	37.358	13.676

Table 38 reports the results of the two factor (School Size x Poverty) ANOVA (F $(8, 879) = 1.873$, $p > .05$) that did not indicate a statistically significant interaction between the size and poverty classification of elementary schools. Thus, there was not enough evidence to reject the null hypothesis. Poverty did not affect differences in communication arts scores because of differences in elementary school size.

Table 38

ANOVA (School Size x Poverty) Results for Grade 5 Communication Arts

Source	Sum of Squares	*df*	*MS*	*F*	*p*
Size	803.188	4	200.797	1.136	.338
Poverty	68802.241	2	34401.120	194.614	.000
Size*Poverty	2648.275	8	331.034	1.873	.061
Error	155377.515	879	176.766		
Total	2485652.300	894			

H 12: The difference in student achievement on the MAP Grade 5 Communication Arts Assessment between elementary schools of different sizes (very small, small, medium, large, and very large) is affected by special education classifications.

A two factor (School Size x Special Education) ANOVA was used to determine the effect of the interaction between elementary schools of different sizes (very small, small, medium, large, and very large) and different special education classifications (low special education, moderate special education, and high special education) on achievement. Below, Table 39 includes the sample size, mean Grade 5 Communication Arts achievement level, and standard deviation for each elementary school size by special education classification.

Table 39

MAP Grade 5 Communication Arts by Elementary School Size and Special Education

Size	Special Education	*n*	*M*	*SD*
Very Small	Low Special Education	21	51.995	17.682
	Moderate Special Education	114	48.372	19.516
	High Special Education	55	44.527	16.372
Small	Low Special Education	19	46.068	19.609
	Moderate Special Education	148	43.314	17.766
	High Special Education	35	40.385	15.617
Medium	Low Special Education	22	58.504	20.435
	Moderate Special Education	180	48.313	16.177
	High Special Education	23	53.017	15.120
Large	Low Special Education	15	49.753	16.192
	Moderate Special Education	116	52.783	15.137
	High Special Education	19	49.894	16.997
Very Large	Low Special Education	24	64.162	14.483
	Moderate Special Education	107	58.639	14.133
	High Special Education	18	53.844	11.100

Table 40 reports the results of the two factor (School Size x Special Education) ANOVA (F ($8, 901$) = 1.132, $p > .05$) that did not indicate a statistically significant interaction between the size and special education classification of elementary schools. Thus, there was not enough evidence to reject the null hypothesis. Special Education did not affect differences in communication arts scores because of differences in elementary school size.

Table 40

ANOVA (School Size x Special Education) Results for Grade 5 Communication Arts

Source	Sum of Squares	*df*	*MS*	*F*	*p*
Size	12629.175	4	3157.294	11.409	.000
Special Education	1890.212	2	945.106	3.415	.033
Size*Special Education	2506.800	8	313.350	1.132	.339
Error	249345.895	901	276.744		
Total	2543650.090	916			

RQ 10: To what extent is the relationship between elementary school size and student achievement as measured by the MAP Grade-Level Assessment in mathematics impacted by any of the following variables: location, ethnicity, poverty, or special education classification?

H 13: The difference in student achievement on the MAP Grade 5 Mathematics Assessment between elementary schools of different sizes (very small, small, medium, large, and very large) is affected by location classifications.

A two factor (School Size x Location) ANOVA was used to determine the effect of the interaction between elementary schools of different sizes (very small, small, medium, large, and very large) and different locations (rural, town, suburban, and urban) on achievement. Below, Table 41 includes the sample size, mean Grade 5 Mathematics achievement level, and standard deviation for each elementary school size by location.

Table 41

MAP Grade 5 Mathematics by Elementary School Size and Location

Size	Location	*n*	*M*	*SD*
Very Small	City	15	35.786	17.566
	Suburb	3	51.833	24.544
	Town	11	49.354	22.437
	Rural	161	51.172	20.775
Small	City	81	36.796	21.657
	Suburb	25	46.696	19.649
	Town	15	49.106	11.613
	Rural	81	51.242	15.737
Medium	City	61	44.954	20.499
	Suburb	75	54.446	20.963
	Town	24	53.716	10.717
	Rural	66	49.260	12.961
Large	City	30	48.053	14.092
	Suburb	83	55.663	18.848
	Town	21	48.828	10.980
	Rural	16	51.762	13.079
Very Large	City	24	60.537	16.029
	Suburb	82	63.962	15.992
	Town	23	52.134	11.527
	Rural	20	51.300	11.933

Table 42 reports the results of the two factor (School Size x Location) ANOVA (F (*12, 897*) = 2.159, p < .05) that indicated a statistically significant interaction between the size and location of elementary schools. The results of the above ANOVA indicated that at least two means were different and a follow-up post hoc specified statistically significant differences.

Table 42

ANOVA (School Size x Location) Results for Grade 5 Mathematics

Source	Sum of Squares	*df*	*MS*	*F*	*p*
Size	7472.574	4	1868.144	5.748	.000
Location	4680.622	3	1560.207	4.801	.003
Size*Location	8421.764	12	701.814	2.159	.012
Error	291531.877	897	325.008		
Total	2713206.530	917			

A Tukey Honestly Significant Difference (HSD = 18.179) post hoc was used to specify which interactions were statistically significantly different. Appendix D, Table D2 contains the results of the pairwise comparisons between school sizes and locations using the Tukey HSD.

The results of the Tukey HSD post hoc indicated a statistically significant difference between the MAP Grade 5 Mathematics mean scores of very small city schools (35.78) and medium suburban schools (54.44). Very small city schools' scores were lower (-18.66) than medium suburban schools' scores. The results also indicated a statistically significant difference between the mean scores of very small city schools

(35.78) and large suburban schools (55.66). The very small city schools' scores were lower (-19.88) than large suburban schools' scores. Moreover, there was a statistically significant difference between the mean scores of very small city schools (35.78) and very large city schools (60.53). Scores of very small city schools were lower (-24.75) than very large city schools. The results also indicated a statistically significant difference between the mean scores of very small city schools (35.78) and very large suburban schools (63.92). The very small city schools' scores were lower (-28.18) than very large suburban schools' scores.

Additionally, there was a statistically significant difference between the MAP Grade 5 Mathematics mean scores between small city schools (36.79) and large suburban schools (55.66). Scores of small city schools were lower (-18.87) than scores of large suburban schools. There was also a statistically significant difference between the scores of small city schools (36.79) and very large city schools (60.53). Small city schools' scores were lower (-23.74) than very large city schools' scores. Likewise, results indicated a statistically significant difference between small city schools (36.79) and very large suburban schools (63.92). Scores of small city schools were lower (-27.17) than scores of very large suburban schools. The results also indicated a statistically significant difference between the mean scores of medium city schools (44.95) when compared to very large suburban schools (63.96). Scores of medium city schools were lower (-19.01) than scores of very large suburban schools.

In summary, the mixed results indicated that to some extent, location affected the differences in achievement among elementary schools of different sizes. Scores of very small city schools were lower than scores of medium suburban, large suburban, very large city, and very large suburban schools. Scores of small city schools were also lower than scores of large suburban, very large city, and very large suburban schools. Lastly, scores of medium city schools were lower than scores of very large suburban schools.

H 14: The difference in student achievement on the MAP Grade 5 Mathematics Assessment between elementary schools of different sizes (very small, small, medium, large, and very large) is affected by ethnicity classifications.

A two factor (School Size x Ethnicity) ANOVA was used to determine the effect of the interaction between elementary schools of different sizes (very small, small, medium, large, and very large) and different ethnicity classifications (low minority, moderate minority, and high minority) on achievement. Below, Table 43 includes the sample size, mean Grade 5 Mathematics achievement level, and standard deviation for each elementary school size by ethnicity classification.

Table 43

MAP Grade 5 Mathematics by Elementary School Size and Ethnicity

Size	Ethnicity	*n*	*M*	*SD*
Very Small	Low Minority	81	51.543	20.298
	Moderate Minority	76	50.827	21.739
	High Minority	15	35.873	18.292
Small	Low Minority	34	54.288	16.569
	Moderate Minority	73	51.175	13.907
	High Minority	82	34.125	21.246
Medium	Low Minority	24	51.162	13.150
	Moderate Minority	91	57.002	15.039
	High Minority	99	43.435	19.791
Large	Low Minority	5	51.700	9.655
	Moderate Minority	68	60.404	13.990
	High Minority	64	45.570	17.248
Very Large	Low Minority	5	53.560	17.004
	Moderate Minority	104	63.002	13.569
	High Minority	32	50.343	18.754

Table 44 reports the results of the two factor (School Size x Ethnicity) ANOVA (F (*8, 838*) = 1.051, $p > .05$) that did not indicate a statistically significant interaction between the size and ethnicity classification of elementary schools. Thus, there was not enough evidence to reject the null hypothesis. Ethnicity did not affect differences in mathematics scores because of differences in elementary school size.

Table 44

ANOVA (School Size x Ethnicity) Results for Grade 5 Mathematics

Source	Sum of Squares	*df*	*MS*	*F*	*p*
Size	4288.554	4	1072.138	3.474	.008
Ethnicity	26975.511	2	13487.755	43.704	.000
Size*Ethnicity	2593.807	8	324.226	1.051	.396
Error	258618.931	838	308.614		
Total	2524260.030	853			

H 15: The difference in student achievement on the MAP Grade 5 Mathematics Assessment between elementary schools of different sizes (very small, small, medium, large, and very large) is affected by poverty classifications.

A two factor (School Size x Poverty) ANOVA was used to determine the effect of the interaction between elementary schools of different sizes (very small, small, medium, large, and very large) and different ethnicity classifications (low poverty, moderate poverty, and high poverty) on achievement. Below, Table 45 includes the sample size, mean Grade 5 Mathematics achievement level, and standard deviation for each elementary school size by poverty classification.

Table 45

MAP Grade 5 Mathematics by Elementary School Size and Poverty

Size	Poverty	*n*	*M*	*SD*
Very Small	Low Poverty	15	62.826	18.492
	Moderate Poverty	96	52.383	19.725
	High Poverty	69	43.211	21.072
Small	Low Poverty	15	62.553	13.464
	Moderate Poverty	72	52.113	15.746
	High Poverty	110	37.114	19.275
Medium	Low Poverty	52	69.017	11.572
	Moderate Poverty	100	50.910	13.638
	High Poverty	71	36.159	15.286
Large	Low Poverty	46	68.873	9.560
	Moderate Poverty	60	50.120	10.727
	High Poverty	41	37.314	13.267
Very Large	Low Poverty	71	70.005	10.096
	Moderate Poverty	59	53.755	11.622
	High Poverty	17	38.741	15.650

Table 46 reports the results of the two factor (School Size x Poverty) ANOVA (F ($8, 879$) = 1.272, $p > .05$) that did not indicate a statistically significant interaction between the size and poverty classification of elementary schools. Thus, there was not enough evidence to reject the null hypothesis. Poverty did not affect differences in mathematics scores because of differences in elementary school size.

Table 46

ANOVA (School Size x Poverty) Results for Grade 5 Mathematics

Source	Sum of Squares	*df*	*MS*	*F*	*p*
Size	687.136	4	171.784	.716	.581
Poverty	65015.602	2	32507.801	135.410	.000
Size*Poverty	2443.804	8	305.475	1.272	.254
Error	211020.790	879	240.069		
Total	2637941.540	894			

H 16: The difference in student achievement on the MAP Grade 5 Mathematics Assessment between elementary schools of different sizes (very small, small, medium, large, and very large) is affected by special education classifications.

A two factor (School Size x Special Education) ANOVA was used to determine the effect of the interaction between elementary schools of different sizes (very small, small, medium, large, and very large) and different special education classifications (low special education, moderate special education, and high special education) on achievement. Below, Table 47 includes the sample size, mean Grade 5 Mathematics achievement level, and standard deviation for each elementary school size by special education classification.

Table 47

MAP Grade 5 Mathematics by Elementary School Size and Special Education

Size	Special Education	*n*	*M*	*SD*
Very Small	Low Special Education	21	54.961	20.179
	Moderate Special Education	114	51.093	20.867
	High Special Education	55	45.365	20.948
Small	Low Special Education	19	50.231	21.658
	Moderate Special Education	148	45.010	19.941
	High Special Education	35	40.548	16.547
Medium	Low Special Education	22	60.459	21.294
	Moderate Special Education	180	49.128	17.457
	High Special Education	23	50.482	18.764
Large	Low Special Education	15	53.193	19.505
	Moderate Special Education	116	53.037	16.389
	High Special Education	19	50.789	17.112
Very Large	Low Special Education	24	67.612	15.266
	Moderate Special Education	107	59.086	15.349
	High Special Education	18	54.327	15.513

Table 48 reports the results of the two factor (School Size x Special Education) ANOVA (F (*8, 901*) = .688, p > .05) that did not indicate a statistically significant interaction between the size and special education classification of elementary schools. Thus, there was not enough evidence to reject the null hypothesis. Special Education did not affect differences in mathematics scores because of differences in elementary school size.

Table 48

ANOVA (School Size x Special Education) Results for Grade 5 Mathematics

Source	Sum of Squares	*df*	*MS*	*F*	*p*
Size	10985.143	4	2746.286	8.113	.000
Special Education	4563.942	2	2281.971	6.741	.001
Size*Special Education	1863.217	8	232.902	.688	.702
Error	304996.888	901	338.509		
Total	2712195.290	916			

RQ 11: To what extent is the relationship between middle school size and student achievement as measured by the MAP Grade-Level Assessment in communication arts impacted by any of the following variables: location, ethnicity, poverty, or special education classification?

H 17: The difference in student achievement on the MAP Grade 8 Communication Arts Assessment between middle schools of different sizes (very small, small, medium, large, and very large) is affected by location classifications.

A two-way (School Size x Location) ANOVA was used to determine the effect of the interaction between middle schools of different sizes (very small, small, medium, large, and very large) and different locations (rural, town, suburban, and urban) on achievement. Due to only a single very small city school and a single very large rural school in the sample, two schools were eliminated from the analysis. Below, Table 49 includes the sample size, mean Grade 8 Communication Arts achievement level, and standard deviation for each middle school size by location.

Table 49

MAP Grade 8 Communication Arts by Middle School Size and Location

Size	Location	*n*	*M*	*SD*
Very Small	Suburb	3	63.366	5.651
	Town	7	46.442	8.009
	Rural	57	53.352	10.490
Small	City	12	28.816	24.504
	Suburb	2	28.950	13.647
	Town	20	47.785	10.350
	Rural	33	51.612	8.183
Medium	City	14	44.292	9.934
	Suburb	16	47.287	19.067
	Town	28	51.782	7.261
	Rural	18	54.988	5.638
Large	City	9	54.788	14.740
	Suburb	24	54.050	16.456
	Town	12	52.491	9.142
	Rural	6	51.550	6.799
Very Large	City	7	57.314	11.456
	Suburb	37	60.981	10.729
	Town	6	52.200	3.524

Table 50 reports the results of the two factor (School Size x Location) ANOVA (F (*10, 293*) = 2.957, $p < .05$) that indicated a statistically significant interaction between the size and location of middle schools. The results of the above ANOVA indicated that at least two means were different and a follow-up post hoc specified statistically significant differences.

Table 50

ANOVA (School Size x Location) Results for Grade 8 Communication Arts

Source	Sum of Squares	*df*	*MS*	*F*	*p*
Size	4722.761	4	1180.690	8.564	.000
Location	1335.807	3	445.269	3.230	.023
Size*Location	4076.290	10	407.629	2.957	.001
Error	40393.312	293	137.861		
Total	890828.250	311			

A Tukey Honestly Significant Difference (HSD = 18.019) was used to specify which interactions were statistically significantly different. Appendix D, Table D3 contains the results of the pairwise comparisons between school sizes and locations using the Tukey HSD.

The results of the Tukey HSD post hoc indicated a statistically significant difference between the MAP Grade 8 Communication Arts mean scores of very small suburban schools (63.36) and small city schools (28.81). Very small suburban schools' scores were higher (34.55) than small city schools' scores. The results also indicated a statistically significant difference between the mean scores of very small suburban schools (63.36) and small suburban schools (28.95). The very small suburban schools' scores were higher (34.42) than small suburban schools' scores. Moreover, there was a statistically significant difference between the mean scores of very small suburban schools (63.36) and medium city schools (44.29). Scores of very small suburban were higher (19.07) than scores of medium city schools.

Additionally, there was a statistically significant difference between the MAP Grade 8 Communication Arts mean scores between very small rural schools (53.35) and small city schools (28.81). Scores of very small rural schools were higher (24.54) than scores of small city schools. There was also a statistically significant difference between the scores of very small rural schools (53.35) and small suburban schools (28.95). Very small rural schools' scores were higher (24.40) than small suburban schools' scores.

The results also indicated a statistically significant difference between the mean scores of small city schools (28.81) and small town schools (47.78). Scores of small city schools were lower (-18.97) than scores of small town schools. The difference between mean scores of small city schools (28.81) and small rural schools (51.61) was also significant. Small city schools' scores were lower (-22.80) than small rural schools' scores. In addition, there was a statistically significant difference between the scores of small city schools (28.81) and medium suburban schools (47.28). Scores of small city schools were lower (-18.47) than scores of medium suburban schools. The difference between scores of small city schools (28.81) and medium town schools (51.78) was also significant. Small city schools' scores were lower (-22.97) than medium town schools' scores. Moreover, the results indicated a statistically significant difference between scores of small city schools (28.81) and medium rural schools (54.98). Scores of small city schools were lower (-26.17) than scores of medium rural schools.

Furthermore, results indicated a statistically significant difference between the Grade 8 Communication Arts mean scores of small city schools (28.81) and all location classifications of large schools: large city schools (54.78), large suburban schools (54.05), large town schools (52.49), and large rural schools (51.55). Small city schools' scores were lower (-25.97) than large city schools' scores, lower (-25.23) than large suburban schools' scores, lower (-23.68) than large town schools' scores, and lower (-22.73) than large rural schools' scores.

Likewise, results indicated a statistically significant difference between the Grade 8 Communication Arts mean scores of small city schools (28.81) and all location classifications of very large schools: very large city schools (57.31), very large suburban schools (60.98), and very large town schools (52.20). Scores of small city schools were lower (-28.50) than very large city schools, lower (-32.16) than very large suburban schools, and lower (-23.38) than very large town schools.

The results also indicated a statistically significant difference between the mean scores of small suburban (28.95) and small town schools (47.78). Scores of small suburban schools were lower (-18.84) than scores of small town schools. The difference between the mean scores of small suburban schools (28.95) and small rural schools (51.61) was also significant. Small suburban schools' scores were lower (-22.66) than small rural schools' scores. In addition, there was a statistically significant difference between the scores of small suburban schools (28.95) and medium suburban schools (47.28). Scores of small suburban schools were lower (-18.34) than scores of medium suburban schools. The difference between scores of small suburban schools (28.95) and medium town schools (51.78) was also significant. Small suburban schools' scores were lower (-22.83) than medium town schools' scores. Moreover, the results indicated a statistically significant difference between scores of small suburban schools (28.95) and medium rural schools (54.98). Scores of small suburban schools were lower (-26.04) than scores of medium rural schools.

Additionally, results indicated a statistically significant difference between the Grade 8 Communication Arts mean scores of small suburban schools (28.95) and all location classifications of large schools: large city schools (54.78), large suburban schools (54.05), large town schools (52.49), and large rural schools (51.55). Small suburban school's scores were lower (-25.84) than large city schools' scores, lower (25.10) than large suburban school's scores, lower (-23.54) than large town schools' scores, and lower (-22.60) than large rural schools' scores.

Likewise, results indicated a statistically significant difference between the Grade 8 Communication Arts mean scores of small suburban schools (28.95) and all location classifications of very large schools: very large city schools (57.31), very large suburban schools (60.98), and very large town schools (52.20). Scores of small suburban schools were lower (-28.36) than very large city schools, lower (-32.03) than very large suburban schools, and lower (-23.25) than very large town schools.

In summary, the mixed results indicated that to some extent, location affected the differences in achievement among middle schools of different sizes. Scores of very small suburban schools were higher than scores of small city, small suburban, and medium city schools. Scores of very small rural schools were also higher than scores of small city and small suburban schools. Additionally, small city and small suburban schools' scores were lower than small town, small rural, medium suburban, medium town, and medium rural schools, as well as all location classifications of large and very large schools.

H 18: The difference in student achievement on the MAP Grade 8 Communication Arts Assessment between middle schools of different sizes (very small, small, medium, large, and very large) is affected by ethnicity classifications.

A two factor (School Size x Ethnicity) ANOVA was used to determine the effect of the interaction between middle schools of different sizes (very small, small, medium, large, and very large) and different ethnicity classifications (low minority, moderate minority, and high minority) on achievement. The sample did not include any large or very large middle schools in the low minority classification. Thus, the categories were omitted from the analysis. Below, Table 51 includes the sample size, mean Grade 8 Communication Arts achievement level, and standard deviation for each middle school size by ethnicity classification.

Table 51

MAP Grade 8 Communication Arts by Middle School Size and Ethnicity

Size	Ethnicity	*n*	*M*	*SD*
Very Small	Low Minority	18	55.672	6.804
	Moderate Minority	32	51.737	11.6437
	High Minority	6	45.616	25.191
Small	Low Minority	10	52.580	8.882
	Moderate Minority	32	50.478	8.429
	High Minority	18	31.077	21.338
Medium	Low Minority	6	57.000	5.705
	Moderate Minority	43	52.314	7.871
	High Minority	18	41.455	17.171
Large	Moderate Minority	28	59.910	9.149
	High Minority	17	43.488	14.557
Very Large	Moderate Minority	29	62.244	6.943
	High Minority	19	54.615	12.318

Table 52 reports the results of the two factor (School Size x Ethnicity) ANOVA (F (*6, 263*) = 1.490, $p > .05$) that did not indicate a statistically significant interaction between the size and ethnicity classification of middle schools. Thus, there was not enough evidence to reject the null hypothesis. Ethnicity did not affect differences in communication scores because of differences in middle school size.

Table 52

ANOVA (School Size x Ethnicity) Results for Grade 8 Communication Arts

Source	Sum of Squares	*df*	*MS*	*F*	*p*
Size	7241.662	4	1810.416	13.107	.000
Ethnicity	7540.983	2	3770.492	27.298	.000
Size*Ethnicity	1234.918	6	205.820	1.490	.182
Error	36326.259	263	138.123		
Total	786618.460	276			

H 19: The difference in student achievement on the MAP Grade 8 Communication Arts Assessment between middle schools of different sizes (very small, small, medium, large, and very large) is affected by poverty classifications.

A two factor (School Size x Poverty) ANOVA was used to determine the effect of the interaction between middle schools of different sizes (very small, small, medium, large, and very large) and different poverty classifications (low poverty, moderate poverty, and high poverty) on achievement. Below, Table 53 includes the sample size, mean Grade 8 Communication Arts achievement level, and standard deviation for each middle school size by poverty classification.

Table 53

MAP Grade 8 Communication Arts by Middle School Size and Poverty

Size	Poverty	*n*	*M*	*SD*
Very Small	Low Poverty	4	64.625	11.075
	Moderate Poverty	51	52.096	9.848
	High Poverty	11	47.727	19.638
Small	Low Poverty	6	61.966	5.805
	Moderate Poverty	41	50.017	9.635
	High Poverty	17	30.082	18.079
Medium	Low Poverty	11	62.872	7.715
	Moderate Poverty	46	51.402	6.184
	High Poverty	18	39.583	14.600
Large	Low Poverty	16	66.568	6.677
	Moderate Poverty	27	51.929	8.504
	High Poverty	8	32.787	7.508
Very Large	Low Poverty	31	65.206	7.159
	Moderate Poverty	17	52.129	7.135
	High Poverty	2	35.700	3.959

Table 54 reports the results of the two factor (School Size x Poverty) ANOVA (F ($8, 291$) = 2.033, $p < .05$) that indicated a statistically significant interaction between the size and poverty classification of middle schools. The results of the above ANOVA indicated that at least two means were different and a follow-up post hoc identified statistically significant differences.

Table 54

ANOVA (School Size x Poverty) Results for Grade 8 Communication Arts

Source	Sum of Squares	*df*	*MS*	*F*	*p*
Size	848.342	4	212.086	2.097	.081
Poverty	12878.545	2	6439.273	63.659	.000
Size*Poverty	1645.380	8	205.672	2.033	.043
Error	29435.375	291	101.152		
Total	876698.960	306			

A Tukey Honestly Significant Difference (HSD = 14.656) post hoc was used to specify which interactions were statistically significantly different. Appendix D, Table D4 contains the results of the pairwise comparisons between the school sizes and poverty classifications using the Tukey HSD.

The results of the Tukey HSD post hoc indicated a statistically significant difference between the MAP Grade 8 Communication Arts mean scores of very small low poverty schools (64.62) and all school size classifications with high poverty: very small high poverty schools (47.72), small high poverty schools (30.08), medium high poverty schools (25.04), large high poverty schools (32.78), and very large high poverty schools (35.70). Very small low poverty schools' scores were higher (16.90) than very small high poverty, higher (34.54) than small high poverty, higher (25.04) than medium high poverty (25.04), higher than large high poverty (31.84), and higher (28.93) than very large high poverty schools' scores. The results also indicated a statistically significant difference between the mean scores of very small moderate poverty schools (52.09) and small high poverty schools (30.08). The very small moderate poverty schools' scores were higher (22.01) than small high poverty schools' scores. Moreover, there was a statistically significant difference between the mean scores of very small moderate poverty schools (52.09) and large high poverty schools (32.78). Scores of very small moderate poverty schools were higher (19.31) than large high poverty schools. Mean scores of very small moderate poverty schools (52.09) were also statistically significantly different from scores of very large high poverty schools (32.70). Very small moderate poverty schools' scores were higher (16.40) than very large high poverty schools' scores.

Additionally, there was a statistically significant difference between the MAP Grade 8 Communication Arts mean scores between very small high poverty schools (47.72) and small high poverty schools (30.08). Scores of very small high poverty schools were higher (17.64) than scores of small high poverty schools. There was also a statistically significant difference between the scores of very small high poverty schools (47.72) and medium low poverty schools (62.87). Very small high poverty schools' scores were lower (-15.15) than medium low poverty schools' scores. The results also indicated a statistically significant difference between the mean scores of very small high poverty schools (47.72) and small large low poverty schools (66.57). Scores of very small high poverty schools were lower (-18.84) than scores of large low poverty schools. The difference between mean scores of very small high poverty schools (47.72) and large high poverty schools (32.78) was also significant. Very small high poverty schools' scores were higher (14.94) than large high poverty schools' scores. In addition, there was a statistically significant difference between the scores of very small high poverty schools

(47.72) and very large low poverty schools (65.20). Scores of very small high poverty schools were lower (-17.48) than scores of very large low poverty schools.

The results indicated a statistically significant difference between the Grade 8 Communication Arts mean scores of small low poverty schools (61.96) and all size classifications of high poverty schools: small high poverty schools (30.08), medium high poverty schools (25.04), large high poverty (32.78), and very large high poverty schools (35.70). Small low poverty school's scores were higher (31.88) than small high poverty schools' scores, higher (22.38) than medium high poverty school's scores, higher (28.18) than large high poverty schools' scores, and higher (26.27) than very large high poverty schools' scores.

The results also indicated a statistically significant difference between the Grade 8 Communication Arts mean scores of small moderate poverty schools (50.01) and small high poverty schools (30.08). Scores of small moderate poverty schools were higher (19.93) than small high poverty schools. Scores of small moderate poverty schools (50.01) were also statistically significantly different from scores of large high poverty schools (32.78). Small moderate poverty schools' scores were higher (17.23) than large high poverty schools' scores. However, results indicated a statistically significant difference between small moderate poverty schools (50.01) and large low poverty schools (66.56). Scores of small moderate poverty schools were lower (-16.55) than scores of large low poverty schools. Scores of small moderate poverty schools (50.01) were also statistically significantly different from very large low poverty schools (65.20). Small moderate poverty schools' scores were lower (-15.19) than very large low poverty schools' scores.

MAP Grade 8 Communication Arts mean scores of small high poverty schools (30.08) were statistically significantly different from scores of medium low poverty schools (62.87). Small high poverty schools' scores were lower (32.79) than medium low poverty schools' scores. The difference between the mean scores of small high poverty schools (30.08) and medium moderate poverty schools (51.40) was also significant. Small high poverty schools' scores were lower (-21.32) than medium moderate poverty schools' scores. In addition, there was a statistically significant difference between the scores of small high poverty schools (30.08) and large low poverty schools (66.56). Scores of small high poverty schools were lower (-36.49) than scores of large low poverty schools. The difference between scores of small high poverty schools (30.08) and large moderate poverty schools (51.92) was also significant. Small high poverty schools' scores were lower (-21.85) than large moderate poverty schools' scores. Moreover, the results indicated a statistically significant difference between scores of small high poverty schools (30.08) and very large low poverty schools (64.20). Scores of small high poverty schools were lower (-35.12) than scores of very large low poverty schools. The difference between small high poverty schools (30.08) and very large moderate poverty schools (52.12) was also significant. Small high poverty schools' scores were lower (-22.05) than very large moderate poverty schools' scores.

Additionally, results indicated a statistically significant difference between the Grade 8 Communication Arts mean scores of medium low poverty schools (62.87) and medium high poverty schools (39.58). Medium low poverty school's scores were higher (23.29) than medium high poverty schools' scores. Likewise, results indicated a statistically significant difference between the mean scores of medium low poverty schools (62.87) and large high poverty schools (32.78). Scores of medium low poverty schools were higher (30.09) than large high poverty schools. The mean scores of medium low poverty schools (62.87) were also statistically significantly different from the scores of very large high poverty schools (35.70). Medium low poverty schools' scores were higher (27.17) than very large high poverty schools' scores.

In addition, results indicated significant differences in mean scores between medium moderate poverty schools (51.40) and large low poverty schools (66.56). Scores of medium moderate poverty schools were lower (-15.17) than scores of large low poverty schools. Medium moderate poverty schools' mean scores (51.40) were also statistically significantly different from large high poverty schools' mean scores (32.78). Scores of medium moderate poverty schools were higher (18.61) than scores of large high poverty schools. Likewise, results indicated significant differences between scores of medium moderate poverty schools (51.40) and very large high poverty schools (35.70). Medium moderate poverty schools' scores were higher (15.70) than very large high poverty schools' scores.

Significant differences were also indicated between mean scores of medium high poverty schools (39.58) and large low poverty schools (66.56). Scores of medium high poverty schools were lower (-26.99) than large low poverty schools. Similarly, mean scores of medium high poverty schools (39.58) were statistically significantly different from the mean scores of very large low poverty schools (65.20). Medium high poverty schools' scores were lower (-25.62) than very large low poverty schools' scores.

The results also indicated significant differences in mean scale scores between large low poverty schools (66.56) and large high poverty schools (32.78). Large low poverty schools' scores were higher (33.78) than large high poverty schools' scores. Mean scores of large low poverty schools (66.56) were also statistically significantly different from scores of very large high poverty schools (35.70). Scores of large low poverty schools were higher (30.87) than scores of very large high poverty schools. Additionally, large moderate poverty schools' mean scores (51.93) were statistically significantly different from large high poverty schools' mean scores (32.78). Scores of large moderate poverty schools were higher (19.14) than scores of large high poverty schools. The results also indicated significant differences between mean scores of large moderate poverty schools (51.92) and very large high poverty schools (35.70). Large moderate poverty schools' scores were higher (16.23) than very large high poverty schools' scores.

The mean scores of large high poverty schools (32.78) were statistically significantly different from the mean scores of very large low poverty schools (65.20). Large high poverty schools' scores were lower (-32.42) than very large low poverty schools' scores. Likewise, large high poverty schools' mean scores (32.78) were statistically significantly different from mean scores of very large moderate poverty schools (52.12). Scores of large high poverty schools were lower (-19.34) than scores of very large moderate poverty schools. However, the results indicated significant differences between mean scores of very large low poverty (65.20) schools and very large high poverty schools (35.70). Very large low poverty schools' scores were higher (29.51) than very large high poverty school's scores. Similarly, very large moderate poverty schools' mean scores (52.12) were statistically significantly different from mean scores of very large high poverty schools (35.70). Scores of very large moderate poverty schools were higher (16.42) than very large high poverty schools.

In summary, the mixed results indicated that to some extent, poverty affected the differences in achievement among middle schools of different sizes. Scores of very small low poverty schools were higher than high poverty schools of all sizes. Very small moderate poverty schools' scores were higher than small, large, and very large high poverty schools' scores. Scores of very small high poverty schools were higher than scores of small and large high poverty schools, but lower than scores of medium, large, and very large low poverty schools.

Small low poverty schools' scores were higher than scores of small, medium, large, and very large high poverty schools. Scores of small moderate poverty schools were higher than scores of small and large high poverty schools, but lower than scores of large and very large low poverty schools. Small high poverty schools' scores were lower than scores of medium, large, and very large low poverty schools and medium, large, and very large moderate poverty schools.

Medium low poverty schools' scores were higher than scores of medium, large, and very large high poverty schools. Scores of medium moderate poverty schools were lower than scores of large low poverty schools, but higher than scores of large and very large high poverty schools. Medium high poverty schools' scores were lower than scores of large and very large low poverty schools.

Large low poverty and large moderate poverty schools' scores were higher than scores of large and very large high poverty schools. Scores of large high poverty schools were lower than scores of very large low and moderate poverty schools. Very large low poverty and very large moderate poverty schools' scores were higher than scores of very large high poverty schools.

H 20: The difference in student achievement on the MAP Grade 8 Communication Arts Assessment between middle schools of different sizes (very small, small, medium, large, and very large) is affected by special education classifications.

A two factor (School Size x Special Education) ANOVA was used to determine the effect of the interaction between middle schools of different sizes (very small, small, medium, large, and very large) and different special education classifications (low special education, moderate special education, and high special education) on achievement. Below, Table 55 includes the sample size, mean Grade 8 Communication Arts achievement level, and standard deviation for each middle school size by special education classification.

Table 55

MAP Grade 8 Communication Arts by Middle School Size and Special Education

Size	Special Education	*n*	*M*	*SD*
Very Small	Low Special Education	9	57.444	11.306
	Moderate Special Education	46	51.719	10.645
	High Special Education	13	50.784	17.347
Small	Low Special Education	10	58.590	12.153
	Moderate Special Education	46	46.221	13.236
	High Special Education	11	31.863	17.883
Medium	Low Special Education	9	54.733	7.694
	Moderate Special Education	58	50.624	11.291
	High Special Education	9	43.066	13.294
Large	Low Special Education	6	62.733	8.954
	Moderate Special Education	40	51.267	13.932
	High Special Education	5	60.480	7.904
Very Large	Low Special Education	6	63.350	2.680
	Moderate Special Education	42	58.509	11.077
	High Special Education	3	65.733	8.203

Table 56 reports the results of the two factor (School Size x Special Education) ANOVA (F ($8, 298$) = 2.400, $p < .05$) that a statistically significant interaction between the size and special education classification of middle schools. The results of the above ANOVA indicated that at least two means were different and a follow-up post hoc specified statistically significant differences.

Table 56

ANOVA (School Size x Special Education) Results for Grade 8 Communication Arts

Source	Sum of Squares	*df*	*MS*	*F*	*p*
Size	4846.846	4	1211.712	8.074	.000
Special Education	2095.230	2	1047.615	6.981	.001
Size*Special Education	2881.044	8	360.131	2.400	.016
Error	44722.337	298	150.075		
Total	894924.250	313			

A Tukey Honestly Significant Difference (HSD = 17.757) post hoc was used to specify which interactions were statistically significantly different. Appendix D, Table D5 contains the results of the pairwise comparisons between the school sizes and special education classifications using the Tukey HSD.

The results of the Tukey HSD post hoc indicated a statistically significant difference between the MAP Grade 8 Communication Arts mean scores of very small low special education schools (57.44) and small high special education schools (31.86). Very small low special education schools' scores were higher (25.58) than small high special education schools' scores. The results also indicated a statistically significant difference between the mean scores of very small moderate special education schools (51.71) and small high special education schools (31.86). The very small moderate special education schools' scores were higher (19.86) than small high special education schools' scores. Moreover, there was a statistically significant difference between the mean scores of very small high special education schools (50.78) and small high special education schools (31.86). Scores of very small high special education schools were higher (18.92) than small high special education schools.

Mean scores of small low special education schools (58.59) were also statistically significantly different from scores of small high special education schools (31.86). Small low special education schools' scores were higher (26.73) than small high special education schools' scores. Results also indicated a statistically significant difference between the mean score of small moderate special education schools (46.22) and very large high special education schools (65.73). Scores of small moderate special education schools were lower (-19.51) than scores of very large high special education schools.

Additionally, there was a statistically significant difference between the MAP Grade 8 Communication Arts mean scores between small high special education schools (31.86) and medium low special education schools (54.73) and medium moderate special education schools (50.62). Scores of small high special education schools were lower (-22.87) than scores of medium low special education schools, and lower (-18.76) than scores of medium moderate special education schools. There was also a statistically significant difference between the scores of small high special education schools (31.86) and all classifications of large schools: large low special education (62.73), large moderate special education (51.26), and large high special education (60.48). Small high special education schools' scores were lower (-30.86) than large low special education schools' scores, lower (-19.40) than large moderate special education schools' scores, and lower (-28.62) than large high special education schools' scores.

The results also indicated a statistically significant difference between the mean scores of small high special education schools (31.86) and all classifications of very large schools: very large low special education (63.35), very large moderate special education (58.50), and very large high special education (65.73). Scores of small high special education schools were lower (-31.49) than scores of very large low special education schools, lower (-26.65) than scores of very large moderate special education schools, and lower (-33.87) than scores of very large high special education schools. The difference between mean scores of medium high special education schools (43.06) and large low special education schools (62.73) was also significant. Medium high special education schools' scores were lower (-19.67) than large low special education schools' scores. In addition, there was a statistically significant difference between the scores of medium high special education schools (43.06) and very large low special education schools (63.35). Scores of medium high special education schools were lower (-20.28) than scores of very large low special education schools. Results also indicated a statistically significant difference between the scores of medium high special education schools (43.06) and very large high special education schools (65.73). Medium high special education schools' scores were lower (-22.67) than very large high special education schools' scores.

In summary, the mixed results indicated that to some extent, special education affected the differences in achievement among middle schools of different sizes. Mean scores of very small low, moderate, and high special education schools were higher than scores of small high special education schools. Small low special education schools' scores were also higher than small high special education schools' scores. Small moderate special education schools scored higher than very large high special education schools. Scores of small high special education schools were lower than scores of medium low and moderate special education schools, large low, moderate, and high special education schools, and very large low, moderate, and high special education schools. Medium high special education schools' scores were lower than large low special education schools' scores and very large low and high special education schools' scores.

RQ 12: To what extent is the relationship between middle school size and student achievement as measured by the MAP Grade-Level Assessment in mathematics impacted by any of the following variables: location, ethnicity, poverty, or special education classifications?

H 21: The difference in student achievement on the MAP Grade 8 Mathematics Assessment between middle schools of different sizes (very small, small, medium, large, and very large) is affected by location classifications.

A two factor (School Size x Location) ANOVA was used to determine the effect of the interaction between middle schools of different sizes (very small, small, medium, large, and very large) and different locations (rural, town, suburban, and urban) on achievement. Due to only a single very small city school and a single very large rural school in the sample, two schools were eliminated from the analysis. Below, Table 57 includes the sample size, mean Grade 8 Mathematics achievement level, and standard deviation for each middle school size by location.

Table 57

MAP Grade 8 Mathematics by Middle School Size and Location

Size	Location	*n*	*M*	*SD*
Very Small	Suburb	3	55.666	18.389
	Town	7	38.057	5.986
	Rural	57	52.573	11.713
Small	City	12	31.400	27.701
	Suburb	2	37.400	16.263
	Town	20	48.815	14.184
	Rural	33	52.069	12.218
Medium	City	14	44.200	13.223
	Suburb	16	45.818	20.383
	Town	28	50.450	9.238
	Rural	18	54.227	9.791
Large	City	9	51.622	14.744
	Suburb	24	52.200	18.114
	Town	12	51.683	9.568
	Rural	6	53.166	6.420
Very Large	City	7	57.971	13.697
	Suburb	37	60.078	11.501
	Town	6	49.983	7.906

Table 58 reports the results of the two factor (School Size x Location) ANOVA (F (10, 293) = 1.720, p > .05) that did not indicate a statistically significant interaction between the size and location of middle schools. Thus, there was not enough evidence to reject the null hypothesis. Location did not affect the differences in mathematics scores because of differences in middle school size.

Table 58

ANOVA (School Size x Location) Results for Grade 8 Mathematics

Source	Sum of Squares	*df*	*MS*	*F*	*p*
Size	3081.059	4	770.265	4.102	.003
Location	2231.806	3	743.935	3.962	.009
Size*Location	3229.129	10	322.913	1.720	.076
Error	55020.851	293	187.784		
Total	879356.790	311			

H 22: The difference in student achievement on the MAP Grade 8 Mathematics Assessment between middle schools of different sizes (very small, small, medium, large, and very large) is affected by ethnicity classifications.

A two factor (School Size x Ethnicity) ANOVA was used to determine the effect of the interaction between middle schools of different sizes (very small, small, medium, large, and very large) and different ethnicity classifications (low minority, moderate minority, and high minority) on achievement. The sample did not include any large or very large middle schools in the low minority classification. Thus, the categories were omitted from the analysis. Below, Table 59 includes the sample size, mean Grade 8 Mathematics achievement level, and standard deviation for each middle school size by ethnicity classification.

Table 59

MAP Grade 8 Mathematics by Middle School Size and Ethnicity

Size	Ethnicity	*n*	*M*	*SD*
Very Small	Low Minority	18	56.333	11.897
	Moderate Minority	32	48.165	12.462
	High Minority	6	42.266	25.584
Small	Low Minority	10	53.350	9.683
	Moderate Minority	32	53.996	9.981
	High Minority	18	30.161	24.041
Medium	Low Minority	6	55.250	6.946
	Moderate Minority	43	51.769	10.186
	High Minority	18	39.355	18.389
Large	Moderate minority	28	58.178	9.083
	High Minority	17	41.376	16.400
Very Large	Moderate Minority	29	62.434	8.568
	High Minority	19	53.557	13.671

Table 60 reports the results of the two-way (School Size x Ethnicity) ANOVA (F $(6, 263) = 1.842$, $p > .05$) that did not indicate a statistically significant interaction between the size and ethnicity classification of middle schools. Thus, there was not enough evidence to reject the null hypothesis. Ethnicity did not affect differences in mathematics scores because of differences in middle school size.

Table 60

ANOVA (School Size x Ethnicity) Results for Grade 8 Mathematics

Source	Sum of Squares	*df*	*MS*	*F*	*p*
Size	6678.774	4	1669.693	9.433	.000
Ethnicity	9461.395	2	4730.698	26.727	.000
Size*Ethnicity	1956.681	6	326.113	1.842	.091
Error	46551.523	263	177.002		
Total	779628.940	276			

H 23: The difference in student achievement on the MAP Grade 8 Mathematics Assessment between middle schools of different sizes (very small, small, medium, large, and very large) is affected by poverty classifications.

A two factor (School Size x Poverty) ANOVA was used to determine the effect of the interaction between middle schools of different sizes (very small, small, medium, large, and very large) and different ethnicity classifications (low poverty, moderate poverty, and high poverty) on achievement. Below, Table 61 includes the sample size, mean Grade 8 Mathematics achievement level, and standard deviation for each middle school size by poverty classification.

Table 61

MAP Grade 8 Mathematics by Middle School Size and Poverty

Size	Poverty	*n*	*M*	*SD*
Very Small	Low Poverty	4	59.625	10.065
	Moderate Poverty	51	52.227	11.851
	High Poverty	11	41.372	18.389
Small	Low Poverty	6	61.083	8.006
	Moderate Poverty	41	52.195	11.675
	High Poverty	17	31.658	21.803
Medium	Low Poverty	11	64.145	6.281
	Moderate Poverty	46	50.169	9.165
	High Poverty	18	37.294	15.719
Large	Low Poverty	16	66.056	6.981
	Moderate Poverty	27	50.463	8.881
	High Poverty	8	29.650	8.513
Very Large	Low Poverty	31	65.264	7.113
	Moderate Poverty	17	50.558	8.593
	High Poverty	2	30.350	2.757

Table 62 reports the results of the two-way (School Size x Poverty) ANOVA ($F(8, 291) = 1.112$, $p > .05$) that did not indicate a statistically significant interaction between the size and poverty classification of middle schools. Thus, there was not enough evidence to reject the null hypothesis. Poverty did not affect differences in mathematics scores because of differences in middle school size.

Table 62

ANOVA (School Size x Poverty) Results for Grade 8 Mathematics

Source	Sum of Squares	*df*	*MS*	*F*	*p*
Size	203.080	4	50.770	.384	.820
Poverty	14849.293	2	7424.646	56.176	.000
Size*Poverty	1175.686	8	146.961	1.112	.355
Error	38460.833	291	132.168		
Total	870769.000	306			

H 24: The difference in student achievement on the MAP Grade 8 Mathematics Assessment between middle schools of different sizes (very small, small, medium, large, and very large) is affected by special education classifications.

A two factor (School Size x Special Education) ANOVA was used to determine the effect of the interaction between middle schools of different sizes (very small, small, medium, large, and very large) and different special education classifications (low special education, moderate special education, and high special education) on achievement. Below, Table 63 includes the sample size, mean Grade 8 Mathematics achievement level, and standard deviation for each middle school size by special education classification.

Table 63

MAP Grade 8 Mathematics by Middle School Size and Special Education

Size	Special Education	*n*	*M*	*SD*
Very Small	Low Special Education	9	51.022	15.936
	Moderate Special Education	46	50.528	11.664
	High Special Education	13	49.738	19.082
Small	Low Special Education	10	59.840	10.745
	Moderate Special Education	46	47.389	16.352
	High Special Education	11	33.445	21.392
Medium	Low Special Education	9	55.000	7.379
	Moderate Special Education	58	49.546	13.149
	High Special Education	9	41.322	17.000
Large	Low Special Education	6	63.200	7.569
	Moderate Special Education	40	49.575	14.916
	High Special Education	5	58.880	8.967
Very Large	Low Special Education	6	66.300	1.088
	Moderate Special Education	42	57.376	12.234
	High Special Education	3	62.900	9.880

Table 64 reports the results of the two factor (School Size x Special Education) ANOVA (F ($8, 298$) = 2.013, $p < .05$) that indicated a statistically significant interaction between the size and special education classification of middle schools. The results of the above ANOVA indicated that at least two means were different and a follow-up post hoc specified statistically significant differences.

Table 64

ANOVA (School Size x Special Education) Results for Grade 8 Mathematics

Source	Sum of Squares	*df*	*MS*	*F*	*p*
Size	3967.650	4	991.913	5.061	.001
Special Education	2407.501	2	1203.751	6.142	.002
Size*Special Education	3156.349	8	394.544	2.013	.045
Error	58400.434	298	195.975		
Total	883940.080	313			

A Tukey Honestly Significant Difference (HSD = 20.292) post hoc was used to specify which interactions were statistically significantly different. Appendix D, Table D6 contains the results of the pairwise comparisons between the school sizes and special education classifications using the Tukey HSD.

The results of the Tukey HSD post hoc indicated a statistically significant difference between the MAP Grade 8 Mathematics mean scores of small low special education schools (59.84) and small high special education schools (33.45). Small low special education schools' scores were higher (26.39) than small high special education schools' scores. The results also indicated a statistically significant difference between the mean scores of small high special education schools (33.45) and medium low special education schools (55.00). The small high special education schools' scores were lower (-21.55) than medium low special education schools' scores. Moreover, there was a statistically significant difference between the mean scores of small high special education schools (33.45) and large low special education schools (63.20). Scores of small high special education schools were lower (-29.75) than large low special education schools. Mean scores of small high special education schools (33.45) were also statistically significantly different from scores of large low special education schools (58.88). Small high special education schools' scores were lower (-25.43) than large high special education schools' scores. Results also indicated a statistically significant difference between the mean score of small high special education schools (33.45) and all classification of very large schools: very large low special education (66.30), very large moderate special education (57.38), and very large high special education (62.90). Scores of small high special education schools were lower (-32.85) than scores of very large low special education schools, lower (-23.93) than scores of very large moderate special education schools, and lower (-29.45) scores of very large high special education schools.

Additionally, there was a statistically significant difference between the MAP Grade 8 Mathematics mean scores between medium high special education schools (41.32) and large low special education schools (63.20). Scores of medium high special education schools were lower (-21.88) than scores of large low special education schools. There was also a statistically significant difference between the scores of medium high special education schools (41.32) and very large low special education schools (66.30). Medium high special education schools' scores were lower (-24.98) than very large low special education schools' scores. Lastly, mean scores of medium high special education schools (41.32) were statistically significantly different from scores of very large high special education schools (62.90). Medium high special education schools' scores were lower (-21.58) than very large high special education schools' scores.

In summary, the mixed results indicated that to some extent, special education affected the differences in achievement among schools of different sizes. Mean scores of very small low special education schools were higher than scores of small high special education schools. Scores of small high special education schools were lower than scores of medium low special education schools, large low and high special education schools, and very large low, moderate, and high special education schools. Medium high special education schools' scores were lower than large low special education schools' scores and very large low and high special education schools' scores.

RQ 13: To what extent is the relationship between high school size and student achievement as measured by the MAP EOC Assessment in English II impacted by any of the following variables: location, ethnicity, poverty, or special education classifications?

H 25: The difference in student achievement on the MAP EOC Assessment in English II between high schools of different sizes (very small, small, medium, large, and very large) is affected by location classifications.

A two factor (School Size x Location) ANOVA was used to determine the effect of the interaction between high schools of different sizes (very small, small, medium, large, and very large) and different locations (rural, town, suburban, and urban) on achievement. Due to only a single very small suburban school and a single small city school in the sample, two schools were eliminated from the analysis. Additionally, the sample did not contain any very small town schools. Below, Table 65 includes the sample size, mean English II achievement level, and standard deviation for each high school size by location.

Table 65

MAP English II EOC Assessment by High School Size and Location

Size	Location	*n*	*M*	*SD*
Very Small	City	2	74.200	29.416
	Rural	103	70.068	14.535
Small	Suburb	3	60.767	22.962
	Town	8	71.175	5.517
	Rural	94	74.728	10.887
Medium	City	4	69.450	21.592
	Suburb	5	71.420	9.974
	Town	33	70.836	11.492
	Rural	72	73.131	8.211
Large	City	19	52.768	17.707
	Suburb	9	68.667	19.374
	Town	33	72.358	6.397
	Rural	11	78.400	4.998
Very Large	City	15	74.567	9.355
	Suburb	48	77.577	12.225
	Town	14	73.479	5.464
	Rural	5	74.420	6.479

Table 66 reports the results of the two factor (School Size x Location) ANOVA (F (*9, 461*) = 3.044, $p < .05$) that indicated a statistically significant interaction between the size and location of high schools. The results of the above ANOVA indicated that at least two means were different and a follow-up post hoc specified statistically significant differences.

Table 66

ANOVA (School Size x Location) Results for English II

Source	Sum of Squares	*df*	*MS*	*F*	*p*
Size	1491.457	4	372.864	2.664	.032
Location	845.596	3	281.865	2.014	.111
Size*Location	3834.947	9	426.105	3.044	.002
Error	64526.653	461	139.971		
Total	2564471.080	478			

A Tukey Honestly Significant Difference (HSD = 18.661) post hoc was used to specify which interactions were statistically significantly different. Appendix D, Table D7 contains the results of the pairwise comparisons between school sizes and locations using the Tukey HSD.

The results of the Tukey HSD post hoc indicated a statistically significant difference between the MAP English II EOC Assessment mean scores of very small city schools (74.20) and large city schools (52.77). Very small city schools' scores were higher (21.43) than large city schools' scores. The results also indicated a statistically significant difference between the mean scores of small rural schools (74.73) and large city schools (52.77). The small rural schools' scores were higher (21.96) than large city schools' scores. Moreover, there was a statistically significant difference between the mean scores of medium rural schools (73.13) and large city schools (52.77). Scores of medium rural were higher (20.36) than large city schools.

Additionally, there was a statistically significant difference between the MAP English II EOC Assessment mean scores between large city schools (52.77) and large town schools (72.36). Scores of large city schools were lower (-19.59) than scores of large town schools. There was also a statistically significant difference between the scores of large city schools (52.77) and large rural schools (78.40). Large city schools' scores were lower (-25.63) than large rural schools' scores. There were also significant differences in mean scores of large city schools (52.77) and all classifications of very large schools: very large city (74.57), very large suburban (77.58), very large town (73.48), and very large rural (74.42). Scores of large city schools were lower (-21.80) than scores of very large city schools, lower (-24.81) than scores of very large suburban schools, lower (-20.71) than scores of very large town schools, and lower (-21.65) than scores of very large rural schools.

In summary, the mixed results indicated that to some extent, location affected the differences in achievement among high schools of different sizes. Scores of very small city, small rural, and medium rural schools were higher than scores of large city schools. Scores of large city schools were lower than scores of large town and large rural schools. Additionally, large city schools' scores were lower than scores of all classifications of very large schools.

H 26: The difference in student achievement on the MAP EOC Assessment in English II between high schools of different sizes (very small, small, medium, large, and very large) is affected by ethnicity classifications.

A two factor (School Size x Ethnicity) ANOVA was used to determine the effect of the interaction between high schools of different sizes (very small, small, medium, large, and very large) and different ethnicity classifications (low minority, moderate minority, and high minority) on achievement. The sample did not include any very large high schools in the low minority classification. Thus, the category was omitted from the analysis. Below, Table 67 includes the sample size, mean English II achievement level, and standard deviation for each high school size by ethnicity classification.

Table 67

MAP English II EOC Assessment by High School Size and Ethnicity

Size	Ethnicity	*n*	*M*	*SD*
Very Small	Low Minority	47	70.926	17.477
	Moderate Minority	36	67.408	10.413
	High Minority	4	66.900	19.253
Small	Low Minority	41	76.995	10.621
	Moderate Minority	40	74.270	10.149
	High Minority	9	64.944	12.396
Medium	Low Minority	29	72.697	8.964
	Moderate Minority	55	73.182	7.565
	High Minority	15	67.587	17.487
Large	Low Minority	3	83.533	1.332
	Moderate Minority	39	73.633	7.899
	High Minority	21	51.976	17.695
Very Large	Moderate Minority	49	79.822	7.678
	High Minority	26	69.419	13.094

Table 68 reports the results of the two factor (School Size x Ethnicity) ANOVA (F $(7, 400) = 3.134$, $p < .05$) that indicated a statistically significant interaction between the size and ethnicity of high schools. The results of the above ANOVA indicated that at least two means were different and a follow-up post hoc specified statistically significant differences.

Table 68

ANOVA (School Size x Ethnicity) Results for English II

Source	Sum of Squares	*df*	*MS*	*F*	*p*
Size	2336.291	4	584.073	4.319	.002
Ethnicity	4370.875	2	2185.438	16.161	.000
Size*Ethnicity	2967.056	7	423.865	3.134	.003
Error	54090.768	400	135.227		
Total	2216620.490	414			

A Tukey Honestly Significant Difference (HSD = 14.197) post hoc was used to specify which interactions were statistically significantly different. Appendix D, Table D8 contains the results of the pairwise comparisons between school sizes and ethnicity classifications using the Tukey HSD.

The results of the Tukey HSD post hoc indicated a statistically significant difference between the MAP English II EOC Assessment mean scores of very small low minority schools (70.93) and large high minority schools (51.98). Very small low minority schools' scores were higher (18.95) than large high minority schools' scores. The results also indicated a statistically significant difference between the mean scores of very small moderate minority schools (67.41) and large low minority schools (83.53). The very small moderate minority schools' scores were lower (-16.13) than large low minority schools' scores. Moreover, there was a statistically significant difference between the mean scores of very small moderate minority schools (67.41) and large high minority schools (51.98). Scores of very small moderate minority schools were higher

(15.43) than large high minority schools. Scores were also statistically significantly different between very small high minority schools (66.90) and large low minority schools (83.53). Very small high minority schools' scores were lower (-16.63) than large low minority schools' scores. Results also indicated a statistically significant difference between mean scores of very small high minority schools (66.90) and large high minority schools (51.98). Scores of very small high minority schools were higher (14.92) than scores of large high minority schools.

Additionally, there was a statistically significant difference between the MAP English II EOC Assessment mean scores between small low minority schools (77.00) and large high minority schools (51.98). Scores of small low minority schools were higher (25.02) than scores of large high minority schools. There was also a statistically significant difference between the scores of small moderate minority schools (74.27) and large high minority schools (51.98). Small moderate minority schools' scores were higher (22.29) than large high minority schools' scores. Moreover, mean scores of small high minority schools (64.94) were statistically significantly different from scores of large low minority schools (83.53). Small high minority schools' scores were lower (-18.59) than large low minority schools' scores. There was also a statistically significant difference between scores of small high minority schools (64.94) and scores of very large moderate minority schools (79.82). Small high minority schools' scores were lower (-14.88) than very large moderate minority schools' scores.

The results also indicated a statistically significant difference between the MAP English II EOC Assessment mean scores of medium low minority schools (72.70) and large high minority schools (51.98). Medium low minority schools' scores were higher

(20.72) than large high minority schools' scores. The results also indicated a statistically significant difference between the mean scores of medium moderate minority schools (73.18) and large high minority schools (51.98). The medium moderate minority schools' scores were higher (21.21) than large high minority schools' scores. Moreover, there was a statistically significant difference between the mean scores of medium high minority schools (67.59) and large low minority schools (83.53). Scores of medium high minority schools were lower (-15.95) than large low minority schools. Scores were also statistically significantly different between medium high minority schools (67.59) and large high minority schools (51.98). Medium high minority schools' scores were higher (15.61) than large high minority schools' scores.

Additionally, there was a statistically significant difference between the MAP English II EOC Assessment mean scores between large low minority schools (83.53) and large high minority schools (51.98). Scores of large low minority schools were higher (31.56) than scores of large high minority schools. There was also a statistically significant difference between the scores of large moderate minority schools (73.63) and large high minority schools (51.98). Large moderate minority schools' scores were higher (21.66) than large high minority schools' scores. Moreover, mean scores of large high minority schools (51.98) were statistically significantly different from scores of very large moderate minority schools (79.82). Large high minority schools' scores were lower (-27.85) than very large moderate minority schools' scores. There was also a statistically significant difference between scores of large high minority schools (51.98) and scores of very large high minority schools (69.42). Large high minority schools' scores were lower (-17.44) than very large high minority schools' scores.

In summary, the mixed results indicated that to some extent, ethnicity affected the differences in achievement among high schools of different sizes. Scores of very small low, moderate, and high minority schools were higher than scores of large high minority schools, but lower than scores of large low minority schools. Small low and moderate minority schools' scores were higher than large high minority schools' scores. However, scores of small high minority schools were lower than scores of large low and very large moderate minority schools. Medium low, moderate, and high minority schools' scores were higher than large high minority schools' scores. Scores of medium high minority schools were lower than scores of large low minority schools. Large low and moderate minority schools' scores were higher than large high minority schools' scores. Scores of large high minority schools were lower than scores of very large moderate and high minority schools.

H 27: The difference in student achievement on the MAP EOC Assessment in English II between high schools of different sizes (very small, small, medium, large, and very large) is affected by poverty classifications.

A two factor (School Size x Poverty) ANOVA was used to determine the effect of the interaction between high schools of different sizes (very small, small, medium, large, and very large) and different poverty classifications (low poverty, moderate poverty, and high poverty) on achievement. Below, Table 69 includes the sample size, mean English II achievement level, and standard deviation for each high school size and poverty classification.

Table 69

MAP English II EOC Assessment by High School Size and Poverty

Size	Poverty	*n*	*M*	*SD*
Very Small	Low Poverty	12	77.900	11.885
	Moderate Poverty	80	69.750	15.304
	High Poverty	12	61.850	8.278
Small	Low Poverty	17	76.924	9.151
	Moderate Poverty	74	74.578	10.485
	High Poverty	13	68.762	15.001
Medium	Low Poverty	21	79.243	6.287
	Moderate Poverty	78	71.117	8.997
	High Poverty	10	65.100	15.202
Large	Low Poverty	21	78.219	5.700
	Moderate Poverty	38	66.245	15.149
	High Poverty	10	50.400	10.645
Very Large	Low Poverty	48	82.625	5.163
	Moderate Poverty	29	68.455	7.889
	High Poverty	3	52.467	3.983

Table 70 reports the results of the two factor (School Size x Poverty) ANOVA (F $(8, 451) = 2.427$, $p < .05$) that indicated a statistically significant interaction between the size and poverty of high schools. The results of the above ANOVA indicated that at least two means were different and a follow-up post hoc specified statistically significant differences.

Table 70

ANOVA (School Size x Poverty) Results for English II

Source	Sum of Squares	*df*	*MS*	*F*	*p*
Size	2316.759	4	579.190	4.735	.001
Poverty	10955.677	2	5477.838	44.783	.000
Size*Poverty	2374.867	8	296.858	2.427	.014
Error	55165.691	451	122.319		
Total	2497966.370	466			

A Tukey Honestly Significant Difference (HSD = 13.088) post hoc was used to specify which interactions were statistically significantly different. Appendix D, Table D9 contains the results of the pairwise comparisons between the school sizes and poverty classifications using the Tukey HSD.

The results of the Tukey HSD post hoc indicated a statistically significant difference between the MAP English II EOC Assessment mean scores of very small low poverty schools (77.90) and very small (61.85), large (50.40), and very large (52.47) high poverty schools. Very small low poverty schools' scores were higher (16.05) than very small high poverty, higher (27.50) than large high poverty, and higher (25.43) than very large high poverty (25.04) schools' scores. The results also indicated a statistically significant difference between the mean scores of very small moderate poverty schools (69.75) and large high poverty schools (50.50). The very small moderate poverty schools' scores were higher (19.35) than large high poverty schools' scores. Moreover, there was a statistically significant difference between the mean scores of very small moderate poverty schools (69.75) and very large high poverty schools (52.47). Scores of very small moderate poverty schools were higher (17.28) than very large high poverty schools.

Additionally, there was a statistically significant difference between the MAP English II EOC Assessment mean scores between very small high poverty schools (61.85) and small low poverty schools (76.92). Scores of very small high poverty schools were lower (-15.07) than scores of small low poverty schools. There was also a statistically significant difference between the scores of very small high poverty schools (61.85) and medium low poverty schools (79.24). Very small high poverty schools' scores were lower (-17.39) than medium low poverty schools' scores. The results also indicated a statistically significant difference between the mean scores of very small high poverty schools (61.85) and small large low poverty schools (78.22). Scores of very small high poverty schools were lower (-16.37) than scores of large low poverty schools. The difference between mean scores of very small high poverty schools (61.85) and very large low poverty schools (82.63) was also significant. Very small high poverty schools' scores were lower (-20.78) than very large low poverty schools' scores.

The results indicated a statistically significant difference between the English II EOC Assessment mean scores of small low poverty schools (76.92) and large high poverty schools (50.40). Small low poverty school's scores were higher (26.52) than large high poverty schools' scores. Mean scores of small low poverty schools (76.92) were also statistically significantly different from mean scores of very large high poverty schools (52.47). Small low poverty schools' scores were higher (24.46) than very large high poverty schools' scores. Results also indicated a statistically significant difference between the mean scores of small moderate poverty schools (74.58) and large high poverty schools (50.40). Scores of small moderate poverty schools were higher (24.18) than large high poverty schools. Scores of small moderate poverty schools (74.58) were also statistically significantly different from scores of very large high poverty schools (52.47). Small moderate poverty schools' scores were higher (22.11) than very large high poverty schools' scores.

MAP English II EOC Assessment mean scores of small high poverty schools (68.76) were statistically significantly different from scores of large high poverty schools (50.40). Small high poverty schools' scores were higher (18.36) than large high poverty schools' scores. The difference between the mean scores of small high poverty schools (68.76) and very large low poverty schools (82.63) was also significant. Small high poverty schools' scores were lower (-13.86) than very large low poverty schools' scores. In addition, there was a statistically significant difference between the scores of small high poverty schools (68.76) and very large high poverty schools (52.47). Scores of small high poverty schools were higher (16.29) than scores of very large high poverty schools.

Additionally, results indicated a statistically significant difference between the English II EOC Assessment mean scores of medium low poverty schools (79.24) and medium high poverty schools (64.10). Medium low poverty school's scores were higher (14.14) than medium high poverty schools' scores. Likewise, results indicated a statistically significant difference between the mean scores of medium low poverty schools (79.24) and large high poverty schools (50.40). Scores of medium low poverty schools were higher (28.84) than large high poverty schools. The mean scores of medium low poverty schools (79.24) were also statistically significantly different from the scores of very large high poverty schools (52.47). Medium low poverty schools' scores were higher (26.78) than very large high poverty schools' scores.

In addition, results indicated significant differences in mean scores between medium moderate poverty schools (71.12) and large high poverty schools (50.40). Scores of medium moderate poverty schools were higher (20.72) than scores of large high poverty schools. Medium moderate poverty schools' mean scores (71.12) were also statistically significantly different from very large high poverty schools' mean scores (52.47). Scores of medium moderate poverty schools were higher (18.65) than scores of very large high poverty schools.

Significant differences were also indicated between mean scores of medium high poverty schools (65.10) and large low poverty schools (78.12). Scores of medium high poverty schools were lower (-13.12) than large low poverty schools. However, mean scores of medium high poverty schools (65.10) were statistically significantly different from the man scores of large high poverty schools (50.40). Medium high poverty schools' scores were higher (14.70) than large high poverty schools' scores. Mean scores of medium high poverty schools (65.10) were also statistically significantly different from the mean scores of very large low poverty schools (82.63). Medium high poverty schools' scores were lower (-17.53) than very large low poverty schools' scores.

The results also indicated significant differences in mean scale scores between large low poverty schools (78.22) and large high poverty schools (50.40). Large low poverty schools' scores were higher (27.82) than large high poverty schools' scores. Mean scores of large low poverty schools (78.22) were also statistically significantly different from scores of very large high poverty schools (52.47). Scores of large low poverty schools were higher (25.75) than scores of very large high poverty schools. Additionally, large moderate poverty schools' mean scores (66.24) were statistically significantly different from large high poverty schools' mean scores (50.40). Scores of large moderate poverty schools were higher (15.84) than scores of large high poverty schools. The results also indicated significant differences between mean scores of large moderate poverty schools (66.24) and very large low poverty schools (82.63). Large moderate poverty schools' scores were lower (-16.38) than very large low poverty schools' scores. Moreover, there was a statistically significant difference between mean scores of large moderate poverty schools (66.24) and very large high poverty schools (52.47). Large moderate poverty schools' scores were higher (13.78) than very large high poverty schools' scores.

The mean scores of large high poverty schools (50.40) were statistically significantly different from the mean scores of very large low poverty schools (82.63). Large high poverty schools' scores were lower (-32.23) than very large low poverty schools' scores. Likewise, large high poverty schools' mean scores (50.40) were statistically significantly different from mean scores of very large moderate poverty schools (68.46). Scores of large high poverty schools were lower (-18.06) than scores of very large moderate poverty schools. The results also indicated significant differences between mean scores of very large low poverty (82.63) schools and very large moderate poverty schools (68.46). Very large low poverty schools' scores were higher (14.17) than very large moderate poverty school's scores. Similarly, very large low poverty schools' mean scores (82.63) were statistically significantly different from mean scores of very large high poverty schools (52.47). Scores of very large low poverty schools were higher (30.16) than very large high poverty schools. In addition, there was a statistically significant difference between mean scores of very large moderate poverty schools (68.46) and very large high poverty schools (52.47). Very large moderate poverty schools' scores were higher (15.99) than very large high poverty schools' scores.

In summary, the mixed results indicated that to some extent, poverty affected the differences in achievement among high schools of different sizes. Scores of very small low poverty schools were higher than very small, large, and very large high poverty schools. Very small moderate poverty schools' scores were higher than large and very large high poverty schools' scores. Scores of very small high poverty schools were lower than scores of small, medium, large, and very large low poverty schools

Small low poverty schools' scores were higher than scores of large and very large high poverty schools. Scores of small moderate poverty schools were also higher than scores of large and very large high poverty schools. Small high poverty schools' scores were higher than large and very large high poverty schools' scores, but lower than very large low poverty schools' scores.

Medium low poverty schools' scores were higher than scores of medium, large, and very large high poverty schools. Scores of medium moderate poverty schools were higher than scores of large and very large high poverty schools. Medium high poverty schools' scores were higher than large high poverty schools' scores, but lower than large and very large low poverty schools' scores.

Large low poverty and large moderate poverty schools' scores were higher than scores of large and very large high poverty schools, but scores of large moderate poverty schools were lower than very large low poverty schools. Scores of large high poverty schools were lower than scores of very large low and moderate poverty schools. Very large low poverty and very large moderate poverty schools' scores were higher than scores of very large high poverty schools. Very large low poverty schools' scores were also higher than very large moderate poverty schools' scores.

H 28: The difference in student achievement on the MAP EOC Assessment in English II between high schools of different sizes (very small, small, medium, large, and very large) is affected by special education classifications.

A two factor (School Size x Special Education) ANOVA was used to determine the effect of the interaction between high schools of different sizes (very small, small, medium, large, and very large) and different special education classifications (low special education, moderate special education, and high special education) on achievement. Below, Table 71 includes the sample size, mean English II achievement level, and standard deviation for each high school size by special education classification.

Table 71

MAP English II EOC Assessment by High School Size and Special Education

Size	Special Education	*n*	*M*	*SD*
Very Small	Low Special Education	19	72.605	19.815
	Moderate Special Education	64	69.888	13.197
	High Special Education	23	68.204	14.165
Small	Low Special Education	24	70.250	10.420
	Moderate Special Education	73	74.985	11.561
	High Special Education	9	75.611	7.676
Medium	Low Special Education	20	77.475	11.024
	Moderate Special Education	87	71.934	9.004
	High Special Education	7	61.443	7.221
Large	Low Special Education	13	74.477	8.432
	Moderate Special Education	48	70.585	10.962
	High Special Education	11	46.773	20.273
Very Large	Low Special Education	17	79.594	8.835
	Moderate Special Education	63	74.929	10.896
	High Special Education	2	84.700	1.980

Table 72 reports the results of the two factor (School Size x Special Education) ANOVA (F (*8, 465*) = 5.220, $p < .05$) that indicated a statistically significant interaction between the size and special education of high schools. The results of the above ANOVA indicated that at least two means were different and a follow-up post hoc specified statistically significant differences.

Table 72

ANOVA (School Size x Special Education) Results for English II

Source	Sum of Squares	*df*	*MS*	*F*	*p*
Size	3915.657	4	978.914	7.127	.000
Special Education	1246.582	2	623.291	4.538	.011
Size*Special Education	5735.454	8	716.932	5.220	.000
Error	63865.585	465	137.345		
Total	2571696.930	480			

A Tukey Honestly Significant Difference (HSD = 15.097) post hoc was used to specify which interactions were statistically significantly different. Appendix D, Table D10 contains the results of the pairwise comparisons between the school sizes and special education classifications using the Tukey HSD.

The results of the Tukey HSD post hoc indicated a statistically significant difference between the MAP English II EOC Assessment mean scores of very small low special education schools (72.61) and large high special education schools (46.77). Very small low special education schools' scores were higher (25.83) than small high special education schools' scores. The results also indicated a statistically significant difference between the mean scores of very small moderate special education schools (69.89) and large high special education schools (46.77). The very small moderate special education schools' scores were higher (23.11) than large high special education schools' scores. Moreover, there was a statistically significant difference between the mean scores of very small high special education schools (68.20) and large high special education schools

(46.77). Scores of very small high special education schools were higher (21.43) than large high special education schools. Mean scores of very small high special education schools (68.20) were also statistically significantly different from scores of very large high special education schools (84.70). Very small high special education schools' scores were lower (-16.50) than very large high special education schools' scores.

Results also indicated a statistically significant difference between the mean scores of small low (70.25), moderate (74.98), and high (75.61) special education schools and large high special education schools (46.77). Scores of small low special education schools were higher (23.58) than scores of large high special education schools. Scores of small moderate special education schools were also higher (28.21) than scores of large high special educations schools. Moreover, scores of small high special education schools were higher (28.84) than scores of large high special education schools.

Additionally, there was a statistically significant difference between the MAP English II EOC Assessment mean scores between medium low special education schools (77.48) and medium high special education schools (61.44). Scores of medium low special education schools were higher (16.03) than scores of medium high special education schools. There was also a statistically significant difference between the scores of medium low special education schools (77.48) and large high special education schools (46.77). Medium low special education schools' scores were higher (30.70) than large high special education schools' scores. Likewise, mean scores of medium moderate special education schools (71.93) were statistically significantly different from scores of large high special education schools (46.77). Medium moderate special education schools' scores were higher (25.16) than large high special education schools' scores.

Results also indicated a statistically significant difference between the mean scores of medium high special education schools (61.44) and very large low special education schools (79.59). Medium high special education schools' scores were lower (-18.15) than very large low special education schools' scores. In addition, medium high special education schools' mean scores (61.44) were statistically significantly different from mean scores of very large high special education schools (84.70). Scores of medium high special education schools were lower (-23.26) than scores of very large high special education schools.

There was also a statistically significant difference between mean scores of large low special education schools (74.48) and large high special education schools (46.77). Large low special education schools' scores were higher (27.70) than large high special education schools' scores. The results also indicated a statistically significant difference between the mean scores of large moderate special education schools (70.59) and large high special education schools (46.77). The large moderate special education schools' scores were higher (23.81) than large high special education schools' scores.

Moreover, there was a statistically significant difference between the mean scores of large high special education schools (46.77) and very large low special education (79.59), very large moderate special education (74.93), and very large high special education (84.70) schools. Scores of large high special education schools were lower (-32.82) than scores of very large low special education schools, lower (-28.16) than scores of very large moderate special education schools, and lower (-37.93) than scores of very large high special education schools.

In summary, the mixed results indicated that to some extent, special education affected the differences in achievement among high schools of different sizes. Mean scores of very small low, moderate, and high special education schools were higher than scores of large high special education schools. Scores of very small high special education schools were lower than scores of very large high special education schools. Small low, moderate, and high special education schools' scores were higher than large high special education school's scores. Medium low special education schools' scores were higher than medium high and large high special education schools' scores. Medium moderate special education schools' scores were higher than large high special education schools' scores. Scores of medium high special education schools were lower than scores of both very large low and very large high special education schools. Large low and large moderate special education schools' scores were also higher than large high special education schools' scores. Scores of large high special education schools were lower than scores of very large low, moderate, and high special education schools.

RQ 14: To what extent is the relationship between high school size and student achievement as measured by the MAP EOC Assessment in Algebra I impacted by any of the following variables: location, ethnicity, poverty, or special education classifications?

H 29: The difference in student achievement on the MAP EOC Assessment in Algebra I between high schools of different sizes (very small, small, medium, large, and very large) is affected by location classifications.

A two factor (School Size x Location) ANOVA was used to determine the effect of the interaction between high schools of different sizes (very small, small, medium, large, and very large) and different locations (rural, town, suburban, and urban) on achievement. Due to only a single very small city, a single very small suburban school, and a single small city school in the sample, three schools were eliminated from the analysis. Additionally, the sample did not contain any very small town schools. Below, Table 73 includes the sample size, mean Algebra I achievement level, and standard deviation for each high school size by location.

Table 73

MAP Algebra I EOC Assessment by High School Size and Location

Size	Location	*n*	*M*	*SD*
Very Small	Rural	102	51.248	22.744
Small	Suburb	3	32.333	31.487
	Town	9	54.689	24.997
	Rural	95	55.340	19.454
Medium	City	4	50.325	23.751
	Suburb	6	58.900	19.758
	Town	35	48.200	16.576
	Rural	73	53.119	15.538
Large	City	23	28.235	19.940
	Suburb	11	50.482	23.253
	Town	35	51.354	17.364
	Rural	12	55.900	15.164
Very Large	City	15	40.227	20.299
	Suburb	49	50.186	19.498
	Town	14	47.664	18.422
	Rural	5	46.080	26.500

Table 74, reports the results of the two factor (School Size x Location) ANOVA (F (*8, 475*) = 1.494, $p > .05$) that did not indicate a statistically significant interaction between the size and location of high schools. Thus, there was not enough evidence to reject the null hypothesis. Location did not affect differences in Algebra I scores because of differences in high school size.

Table 74

ANOVA (School Size x Location) Results for Algebra I

Source	Sum of Squares	*df*	*MS*	*F*	*p*
Size	1533.226	4	383.307	.993	.411
Location	3185.672	3	1061.891	2.751	.042
Size*Location	4614.585	8	576.823	1.494	.157
Error	183344.764	475	385.989		
Total	1456743.950	491			

H 30: The difference in student achievement on the MAP EOC Assessment in Algebra I between high schools of different sizes (very small, small, medium, large, and very large) is affected by ethnicity classifications.

A two factor (School Size x Ethnicity) ANOVA was used to determine the effect of the interaction between high schools of different sizes (very small, small, medium, large, and very large) and different ethnicity classifications (low minority, moderate minority, and high minority) on achievement. The sample did not include any very large high schools in the low minority classification. Thus, the category was omitted from the analysis. Below, Table 75 reports the sample size, mean Algebra I achievement level, and standard deviation for each high school size by ethnicity classification.

Table 75

MAP Algebra I EOC Assessment by High School Size and Ethnicity

Size	Ethnicity	*n*	*M*	*SD*
Very Small	Low Minority	47	49.511	25.267
	Moderate Minority	35	55.620	19.961
	High Minority	3	28.433	20.932
Small	Low Minority	42	58.862	18.070
	Moderate Minority	41	55.622	19.830
	High Minority	9	35.556	27.470
Medium	Low Minority	29	50.276	15.301
	Moderate Minority	59	54.164	16.241
	High Minority	15	43.173	19.318
Large	Low Minority	3	43.500	14.724
	Moderate Minority	44	53.314	18.195
	High Minority	25	30.428	21.506
Very Large	Moderate Minority	50	52.806	18.427
	High Minority	26	36.538	20.514

Table 76 reports the results of the two factor (School Size x Ethnicity) ANOVA (F ($7, 414$) = 3.134, p > .05) that did not indicate a statistically significant interaction between the size and location of high schools. Thus, there was not enough evidence to reject the null hypothesis. Ethnicity did not affect differences in Algebra I scores because of differences in high school size.

Table 76

ANOVA (School Size x Ethnicity) Results for Algebra I

Source	Sum of Squares	*df*	*MS*	*F*	*p*
Size	1342.025	4	335.506	.874	.480
Ethnicity	13631.087	2	6815.544	17.752	.000
Size*Ethnicity	2563.135	7	366.162	.954	.465
Error	158950.409	414	383.938		
Total	1270980.650	428			

H31: The difference in student achievement on the MAP EOC Assessment in Algebra I between high schools of different sizes (very small, small, medium, large, and very large) is affected by poverty classifications.

A two factor (School Size x Poverty) ANOVA was used to determine the effect of the interaction between high schools of different sizes (very small, small, medium, large, and very large) and different poverty classifications (low poverty, moderate poverty, and high poverty) on achievement. Below, Table 77 includes the sample size, mean Algebra I achievement level, and standard deviation for each high school size by poverty classification.

Table 77

MAP Algebra I EOC Assessment by High School Size and Poverty

Size	Poverty	*n*	*M*	*SD*
Very Small	Low Poverty	12	62.258	17.343
	Moderate Poverty	78	49.429	23.359
	High Poverty	12	50.492	25.038
Small	Low Poverty	18	55.433	14.842
	Moderate Poverty	75	54.928	19.232
	High Poverty	13	49.631	32.944
Medium	Low Poverty	22	57.600	14.819
	Moderate Poverty	81	50.633	16.677
	High Poverty	10	50.710	18.654
Large	Low Poverty	26	53.954	14.623
	Moderate Poverty	42	46.112	22.606
	High Poverty	10	22.620	14.544
Very Large	Low Poverty	49	55.214	16.963
	Moderate Poverty	29	40.638	17.900
	High Poverty	3	13.500	4.636

Table 78 reports the results of the two factor (School Size x Poverty) ANOVA ($F(8, 465) = 2.277$, $p < .05$) that indicated a statistically significant interaction between the size and poverty of high schools. The results of the above ANOVA indicated that at least two means were different and a follow-up post hoc specified statistically significant differences.

Table 78

ANOVA (School Size x Poverty) Results for Algebra I

Source	Sum of Squares	*df*	*MS*	*F*	*p*
Size	10639.130	4	2659.783	6.973	.000
Poverty	11243.153	2	5621.577	14.737	.000
Size*Poverty	6947.858	8	868.482	2.277	.021
Error	177378.481	465	381.459		
Total	1432971.590	480			

A Tukey Honestly Significant Difference (HSD = 22.91) post hoc was used to specify which interactions were statistically significantly different. Appendix D, Table D11 contains the results of the pairwise comparisons between the school sizes and poverty classifications using the Tukey HSD.

The results of the Tukey HSD post hoc indicated a statistically significant difference between the MAP Algebra I EOC Assessment mean scores of very small low poverty schools (62.26) and large (22.62) and very large (13.50) high poverty schools. Very small low poverty schools' scores were higher (39.64) than large high poverty schools and higher (48.76) than very large high poverty schools. The results also indicated a statistically significant difference between the mean scores of very small moderate poverty schools (49.43) and large (22.62) and very large (13.50) high poverty schools. The very small moderate poverty schools' scores were higher (26.81) than large high poverty schools' scores, and higher (35.93) than very large high poverty schools' scores. Moreover, there was a statistically significant difference between the mean scores of very small high poverty schools (50.49) and large (22.62) and very large (13.50) high poverty schools. Scores of very small high poverty schools were higher (27.87) than scores of large high poverty schools, and higher (36.99) than scores of very large high poverty schools.

The results indicated a statistically significant difference between the Algebra I EOC Assessment mean scores of small low poverty schools (55.43) and large (22.62) and very large (13.50) high poverty schools. Small low poverty school's scores were higher (32.81) than large high poverty schools' scores and higher (41.93) than very large high poverty schools' scores. Results also indicated a statistically significant difference between the mean scores of small moderate poverty schools (54.93) and large (22.62) and very large (13.50) high poverty schools. Scores of small moderate poverty schools were higher (32.21) than scores of large high poverty schools and higher (41.93) than scores of very large high poverty schools. Mean scores of small high poverty schools (49.63) were also statistically significantly different from scores of large (22.62) and very large (13.50) high poverty schools. Small high poverty schools' scores were higher (27.01) than scores of large high poverty schools' scores and higher (36.13) than scores of very large high poverty schools.

Additionally, results indicated a statistically significant difference between the Algebra I EOC Assessment mean scores of medium low poverty schools (79.24) and scores of large (22.62) and very large (13.50) high poverty schools. Medium low poverty school's scores were higher (34.98) than large high poverty schools' scores and higher (36.13) than very large high poverty schools' scores. Likewise, results indicated significant differences in mean scores between medium moderate poverty schools (71.12) and large (22.62) and very large (13.50) high poverty schools. Scores of medium moderate poverty schools were higher (28.01) than scores of large high poverty schools, and higher (37.13) than scores of very large high poverty school. Significant differences were also indicated between mean scores of medium high poverty schools (50.71) and large (22.62) and very large (13.50) high poverty schools. Scores of medium high poverty schools were higher (28.09) than scores of large high poverty schools and higher (37.21) than scores of very large high poverty schools.

The results also indicated significant differences in mean scale scores between large low poverty schools (53.95) and large (22.62) and very large (13.50) high poverty schools. Large low poverty schools' scores were higher (31.33) than large high poverty schools' scores and higher (40.45) than very large high poverty schools' scores. Additionally, large moderate poverty schools' mean scores (46.11) were statistically significantly different from large (22.62) and very large (13.50) high poverty schools' mean scores. Scores of large moderate poverty schools were higher (23.49) than scores of large high poverty schools and higher (32.61) than scores of very large high poverty schools. The results also indicated significant differences between mean scores of large high poverty schools (22.62) and very large low poverty schools (55.21). Large high poverty schools' scores were lower (-32.59) than very large low poverty schools' scores.

The mean scores of very large low poverty schools (55.21) were statistically significantly different from the mean scores of very large high poverty schools (13.50). Very large low poverty schools' scores were higher (41.71) than very large high poverty schools' scores. Likewise, very large moderate poverty schools' mean scores (40.64) were statistically significantly different from mean scores of very large high poverty schools (13.50). Scores of very large moderate poverty schools were higher (27.14) than scores of very large high poverty schools.

In summary, the mixed results indicated that to some extent, poverty affected the differences in achievement among high schools of different sizes. Regardless of poverty classification, scores of very small, small, and medium schools were higher than scores of large and very large high poverty schools. Large low poverty and large moderate poverty schools' scores were higher than large and very large high poverty schools' scores. Scores of large high poverty schools were lower than scores of very large low poverty schools. Both very large low and very large moderate poverty schools' scores were higher than very large high poverty schools' scores.

H 32: The difference in student achievement on the MAP EOC Assessment in Algebra I between high schools of different sizes (very small, small, medium, large, and very large) is affected by special education classifications.

A two factor (School Size x Special Education) ANOVA was used to determine the effect of the interaction between high schools of different sizes (very small, small, medium, large, and very large) and different special education classifications (low special education, moderate special education, and high special education) on achievement. Below, Table 79 includes the sample size, mean Algebra I achievement level, and standard deviation for each high school size by special education classification.

Table 79

MAP Algebra I EOC Assessment by High School Size and Special Education

Size	Special Education	*n*	*M*	*SD*
Very Small	Low Special Education	19	52.795	24.061
	Moderate Special Education	62	50.666	22.141
	High Special Education	23	51.365	25.211
Small	Low Special Education	24	46.633	23.076
	Moderate Special Education	75	56.155	19.347
	High Special Education	9	60.711	18.307
Medium	Low Special Education	22	54.295	18.980
	Moderate Special Education	89	51.879	15.686
	High Special Education	7	43.957	15.675
Large	Low Special Education	16	57.938	18.427
	Moderate Special Education	54	46.585	19.042
	High Special Education	11	20.936	17.535
Very Large	Low Special Education	18	51.644	25.330
	Moderate Special Education	63	46.094	18.207
	High Special Education	2	63.350	0.212

Table 80 reports the results of the two factor (School Size x Special Education) ANOVA (F (*8, 479*) = 3.655, $p < .05$) that indicated a statistically significant interaction between the size and special education of high schools. The results of the above ANOVA indicated that at least two means were different and a follow-up post hoc specified statistically significant differences.

Table 80

ANOVA (School Size x Special Education) Results for Algebra I

Source	Sum of Squares	*df*	*MS*	*F*	*p*
Size	5022.652	4	1255.663	3.226	.013
Special Education	627.043	2	313.522	.805	.448
Size*Special Education	11381.396	8	1422.674	3.655	.000
Error	186470.703	479	389.292		
Total	1464656.570	494			

A Tukey Honestly Significant Difference (HSD = 23.165) post hoc was used to specify which interactions were statistically significantly different. Appendix D, Table D12 contains the results of the pairwise comparisons between the school sizes and special education classifications using the Tukey HSD.

The results of the Tukey HSD post hoc indicated a statistically significant difference between the MAP Algebra I EOC Assessment mean scores of very small low special education schools (52.79) and large high special education schools (20.94). Very small low special education schools' scores were higher (31.86) than large high special education schools' scores. The results also indicated a statistically significant difference between the mean scores of very small moderate special education schools (50.67) and large high special education schools (20.94). The very small moderate special education schools' scores were higher (29.73) than large high special education schools' scores. Moreover, there was a statistically significant difference between the mean scores of very small high special education schools (51.37) and large high special education schools

(20.94). Scores of very small high special education schools were higher (30.43) than scores of large high special education schools.

Results also indicated a statistically significant difference between the mean scores of small low special education schools (46.63) and large high special education schools (20.94). Small low special education schools' scores were higher (25.70) than large high special education schools' scores. Mean scores of small moderate special education schools (56.15) and large high special education schools (20.94) were statistically significantly different. The small moderate special education schools' scores were higher (35.22) than large high special education schools' scores. Moreover, there was a statistically significant difference between the mean scores of small high special education schools (60.71) and large high special education schools (20.94). Scores of small high special education schools were higher (39.77) than scores of large high special education schools.

Additionally, there was a statistically significant difference between the MAP Algebra I EOC Assessment mean scores between medium low special education schools (54.30) and large high special education schools (20.94). Scores of medium low special education schools were higher (33.36) than scores of large high special education schools. There was also a statistically significant difference between the scores of medium moderate special education schools (51.88) and large high special education schools (20.94). Medium moderate special education schools' scores were higher (30.94) than large high special education schools' scores. Likewise, mean scores of medium high special education schools (43.96) were statistically significantly different from scores of large high special education schools (20.94). Medium high special education schools' scores were higher (23.02) than large high special education schools' scores.

There was also a statistically significant difference between mean scores of large low special education schools (57.94) and large high special education schools (20.94). Large low special education schools' scores were higher (37.00) than large high special education schools' scores. The results also indicated a statistically significant difference between the mean scores of large moderate special education schools (46.59) and large high special education schools (20.94). The large moderate special education schools' scores were higher (25.65) than large high special education schools' scores.

Moreover, there was a statistically significant difference between the mean scores of large high special education schools (20.94) and very large low special education (51.64), very large moderate special education (46.09), and very large high special education (63.35) schools. Scores of large high special education schools were lower (-30.71) than scores of very large low special education schools, lower (-25.16) than scores of very large moderate special education schools, and lower (-42.41) than scores of very large high special education schools.

In summary, the mixed results indicated that to some extent, special education affected the differences in achievement among high schools of different sizes. Mean scores of very small low, moderate, and high special education schools were higher than scores of large high special education schools. Small low, moderate, and high special education schools' scores were higher than large high special education school's scores. Medium low, moderate, and high special education schools' scores were higher than large high special education schools' scores. Large low special education schools' scores were also higher than large high special education schools' scores. Scores of large high special education schools were lower than scores of very large low, moderate, and high special education schools.

RQ 15: To what extent is the relationship between high school size and student achievement as measured by the MAP EOC Assessment in biology impacted by any of the following variables: location, ethnicity, poverty, or special education classifications?

H 33: The difference in student achievement on the MAP EOC Assessment in biology between high schools of different sizes (very small, small, medium, large, and very large) is affected by location classifications.

A two factor (School Size x Location) ANOVA was used to determine the effect of the interaction between high schools of different sizes (very small, small, medium, large, and very large) and different locations (rural, town, suburban, and urban) on achievement. Due to only a single very small suburban school and a single small city school in the sample, two schools were eliminated from the analysis. Additionally, the sample did not contain any very small town schools. Below, Table 81 reports the sample size, mean biology achievement level, and standard deviation for each high school size by location.

Table 81

MAP Biology EOC Assessment by High School Size and Location

Size	Location	*n*	*M*	*SD*
Very Small	City	2	32.650	29.486
	Rural	101	44.426	19.639
Small	Suburb	3	49.200	11.601
	Town	8	52.000	13.967
	Rural	94	55.266	15.770
Medium	City	4	38.050	35.055
	Suburb	5	56.980	15.579
	Town	33	52.785	18.592
	Rural	72	58.274	11.176
Large	City	19	23.379	17.504
	Suburb	11	53.255	23.168
	Town	35	57.017	11.168
	Rural	11	62.473	8.804
Very Large	City	15	59.653	15.364
	Suburb	48	61.510	17.524
	Town	14	58.536	11.011
	Rural	5	67.420	4.400

Table 82 reports the results of the two-way (School Size x Location) ANOVA (F $(9, 463) = 2.888$, $p < .05$) that indicated a statistically significant interaction between the size and location of high schools. The results of the above ANOVA indicated that at least two means were different and a follow-up post hoc specified statistically significant differences.

Table 82

ANOVA (School Size x Location) Results for Biology

Source	Sum of Squares	*df*	*MS*	*F*	*p*
Size	5637.671	4	1409.418	5.259	.000
Location	5996.752	3	1998.917	7.459	.000
Size*Location	6964.690	9	773.854	2.888	.002
Error	124077.362	463	267.986		
Total	1503998.330	480			

A Tukey Honestly Significant Difference (HSD = 25.688) post hoc was used to specify which interactions were statistically significantly different. Appendix D, Table D13 contains the results of the pairwise comparisons between school sizes and locations using the Tukey HSD.

The results of the Tukey HSD post hoc indicated a statistically significant difference between the MAP Biology EOC Assessment mean scores of very small city schools (32.65) and large rural schools (62.47). Very small city schools' scores were lower (-29.82) than large rural schools' scores. The results also indicated a statistically significant difference between the mean scores of very small city schools (32.65) and very large city schools (59.65). The very small city schools' scores were lower (-27.00) than very large city schools' scores. Moreover, there was a statistically significant difference between the mean scores of very small city schools (32.65) and very large suburban schools (61.51). Scores of very small city schools were lower (-28.86) than scores of very large suburban schools. Very small city schools' (32.64) mean scores were statistically significantly different from very large town schools' (58.54) mean scores. Scores of very small city schools were lower (-25.89) than scores of very large town schools. Similarly, there was a statistically significant difference between scores of very small city schools (32.65) and scores of very large rural schools (67.42). Very small city schools' scores were lower (-34.77) than very large rural schools' scores.

Additionally, there was a statistically significant difference between the MAP Biology EOC Assessment mean scores between small suburban schools (49.20) and large city schools (23.38). Scores of small suburban schools were higher (25.82) than scores of large city schools. There was also a statistically significant difference between the scores of small town schools (52.00) and large city schools (23.38). Small town schools' scores were higher (28.62) than large city schools' scores. There were also significant differences in mean scores of small rural schools (55.27) and scores of large city schools (23.38). Scores of small rural schools were higher (31.89) than scores of large city schools.

The results indicated a statistically significant difference between mean scores of medium city schools (38.05) and very large rural schools (67.42). Medium city schools' scores were lower (-29.37) than very large rural schools' scores. Medium suburban schools' (56.98) scores were also statistically significantly different from large city schools' (23.38). Scores of medium suburban schools were higher (33.60) than scores of large city schools. In addition, results indicated a statistically significant difference between scores of medium town schools (52.78) and scores of large city schools (23.38).

Medium town schools' scores were higher (29.41) than large city schools' scores. Furthermore, medium rural schools' scores were statistically significantly different from large city schools' scores. Scores of medium rural schools were higher (34.89) than scores of large city schools.

There were also significant differences between mean scores of large city schools (23.38) and large suburban (53.25), large town (57.02), and large rural (62.47) schools. Scores of large city schools were lower (-29.88) than scores of large suburban schools, lower (-33.64) than scores of large town schools, and lower (-39.09) than scores of large rural schools. Similarly, mean scores of large city schools (23.38) were statistically significantly different from mean scores of all classifications of very large schools: city (59.65), suburban (61.51), town (58.54), and rural (67.42). Scores of large city schools were lower (-36.27) than scores of very large city schools, lower (-38.16) than scores of very large suburban schools, lower (-35.16) than scores of very large town schools, and lower (-44.04) than scores of very large rural schools.

In summary, the mixed results indicated that to some extent, location affected the differences in achievement among high schools of different sizes. Scores of very small city schools were lower than scores of large rural and all classifications of very large schools. Scores of small suburban, town, and rural schools were higher than scores of large city schools. Additionally, medium city schools' scores were lower than scores of all very large rural school. Medium suburban, town, and rural schools' scores were higher than large city schools' scores. Scores of large city schools were lower than scores of large suburban, town, and rural schools. Lastly, scores of large city schools were lower than scores of all classifications of very large schools.

H 34: The difference in student achievement on the MAP EOC Assessment in biology between high schools of different sizes (very small, small, medium, large, and very large) is affected by ethnicity classifications.

A two factor (School Size x Ethnicity) ANOVA was used to determine the effect of the interaction between high schools of different sizes (very small, small, medium, large, and very large) and different ethnicity classifications (low minority, moderate minority, and high minority) on achievement. The sample did not include any very large high schools in the low minority classification. Thus, the category was omitted from the analysis. Below, Table 83 includes the sample size, mean biology achievement level, and standard deviation for each high school size by ethnicity classification.

Table 83

MAP Biology EOC Assessment by High School Size and Ethnicity

Size	Ethnicity	*n*	*M*	*SD*
Very Small	Low Minority	46	47.578	19.451
	Moderate Minority	36	41.772	18.908
	High Minority	4	36.400	18.410
Small	Low Minority	41	58.356	16.044
	Moderate Minority	40	54.270	13.640
	High Minority	9	40.089	14.910
Medium	Low Minority	29	54.076	12.493
	Moderate Minority	55	59.495	11.852
	High Minority	15	46.007	27.017
Large	Low Minority	3	68.433	5.163
	Moderate Minority	43	58.616	11.455
	High Minority	21	24.619	21.356
Very Large	Moderate Minority	49	66.510	11.074
	High Minority	26	50.846	19.377

Table 84 reports the results of the two-way (School Size x Ethnicity) ANOVA (F $(7, 403) = 3.751$, $p < .05$) that indicated a statistically significant interaction between the size and ethnicity of high schools. The results of the above ANOVA indicated that at least two means were different and a follow-up post hoc specified statistically significant differences.

Table 84

ANOVA (School Size x Ethnicity) Results for Biology

Source	Sum of Squares	*df*	*MS*	*F*	*p*
Size	8811.154	4	2202.789	8.702	.000
Ethnicity	11919.179	2	5959.589	23.542	.000
Size*Ethnicity	6646.128	7	949.447	3.751	.001
Error	102018.862	403	253.149		
Total	1315885.870	417			

A Tukey Honestly Significant Difference (HSD = 19.406) post hoc was used to specify which interactions were statistically significantly different. Appendix D, Table D14 contains the results of the pairwise comparisons between school sizes and ethnicity classifications using the Tukey HSD.

The results of the Tukey HSD post hoc indicated a statistically significant difference between the MAP Biology EOC Assessment mean scores of very small low minority schools (47.58) and large low (68.43) and high (24.62) minority schools. Very small low minority schools' scores were lower (-20.86) than large low minority schools' scores, but higher (22.96) than large high minority schools' scores. The results also indicated a statistically significant difference between the mean scores of very small moderate minority schools (41.77) and large low minority schools (68.43) and very large moderate minority schools (66.41). The very small moderate minority schools' scores were lower (-26.66) than large low minority schools' scores and lower (-24.74) than very large moderate minority schools' scores.

Scores were also statistically significantly different between very small high minority schools (36.40) and small low minority schools (58.36). Very small high minority schools' scores were lower (-21.96) than small low minority schools' scores. Results also indicated a statistically significant difference between mean scores of very small high minority schools (36.40) and medium moderate minority schools (59.49). Scores of very small high minority schools were lower (-23.09) than scores of medium moderate minority schools. Furthermore, results indicated a statistically significant difference between mean scores of very small high minority schools (36.40) and both large low (68.43) and large moderate (58.62) minority schools. Very small high minority schools' scores were lower (-32.03) than large low minority schools' scores and lower (-22.22) than large moderate minority schools' scores. Very small high minority schools' (34.60) mean scores were also statistically significantly different from very large moderate minority schools' (66.51) scores. Scores of very small high minority schools were lower (-30.11) than scores of very large moderate minority schools.

Additionally, there was a statistically significant difference between the MAP Biology EOC Assessment mean scores between small low minority schools (58.36) and large high minority schools (24.62). Scores of small low minority schools were higher (33.74) than scores of large high minority schools. There was also a statistically significant difference between the scores of small moderate minority schools (54.27) and large high minority schools (24.62). Small moderate minority schools' scores were higher (29.65) than large high minority schools' scores. However, mean scores of small high minority schools (40.09) were statistically significantly different from scores of medium moderate minority schools (59.49). Small high minority schools' scores were lower (-19.41) than medium moderate minority schools' scores. There was also a statistically significant difference between scores of small high minority schools (40.09) and scores of large low minority schools (68.43). Small high minority schools' scores were lower (-28.34) than large low minority schools' scores. In addition, small high minority schools' (40.09) mean scores were statistically significantly different from very large moderate minority schools' (66.51) mean scores. Scores of small high minority schools were lower (-26.42) than scores of very large moderate minority schools.

The results also indicated a statistically significant difference between the MAP Biology EOC Assessment mean scores of medium low minority schools (54.08) and large high minority schools (24.62). Medium low minority schools' scores were higher (29.46) than large high minority schools' scores. The results also indicated a statistically significant difference between the mean scores of medium moderate minority schools (59.49) and large high minority schools (24.62). The medium moderate minority schools' scores were higher (34.88) than large high minority schools' scores. Moreover, there was a statistically significant difference between the mean scores of medium high minority schools (46.01) and large low minority schools (68.43). Scores of medium high minority schools were lower (-22.43) than large low minority schools. Scores were also statistically significantly different between medium high minority schools (46.01) and large high minority schools (24.62). Medium high minority schools' scores were higher (21.39) than large high minority schools' scores. Lastly, results indicated a statistically significant difference between mean scores of medium high minority schools (46.01) and very large moderate minority schools (66.51). Medium high minority schools' scores were lower (-20.50) than very large moderate minority schools' scores.

Additionally, there was a statistically significant difference between the MAP Biology EOC Assessment mean scores between large low minority schools (68.43) and large high minority schools (24.62). Scores of large low minority schools were higher (43.81) than scores of large high minority schools. There was also a statistically significant difference between the scores of large moderate minority schools (58.62) and large high minority schools (24.62). Large moderate minority schools' scores were higher (34.00) than large high minority schools' scores. Moreover, mean scores of large high minority schools (24.62) were statistically significantly different from scores of very large moderate minority schools (66.51). Large high minority schools' scores were lower (-41.89) than very large moderate minority schools' scores. There was also a statistically significant difference between scores of large high minority schools (24.52) and scores of very large high minority schools (50.85). Large high minority school's scores were lower (-26.23) than very large high minority schools' scores.

In summary, the mixed results indicated that to some extent, ethnicity affected the differences in achievement among high schools of different sizes. Scores of very small low minority schools were higher than scores of large high minority schools, but lower than scores of large low minority schools. Very small moderate minority schools' scores were lower than large low and very large moderate minority schools' scores. Additionally, very small high minority schools' scores were lower than small low, medium moderate, large low, large moderate, and very large moderate minority schools' scores.

Scores of small low and moderate minority schools were higher than scores of large high minority schools. Small high minority schools' scores were lower than medium moderate, large low, and very large moderate schools' score. Medium low, moderate, and high minority schools' scores were higher than large high minority schools' scores. Scores of medium high minority schools were lower than scores of large low and very large moderate minority schools. Large low and moderate minority schools' scores were higher than large high minority schools' scores. Scores of large high minority schools were lower than scores of very large moderate and high minority schools.

H 35: The difference in student achievement on the MAP EOC Assessment in biology between high schools of different sizes (very small, small, medium, large, and very large) is affected by poverty classifications.

A two factor (School Size x Poverty) ANOVA was used to determine the effect of the interaction between high schools of different sizes (very small, small, medium, large, and very large) and different poverty classifications (low poverty, moderate poverty, and high poverty) on achievement. Below, Table 85 includes the sample size, mean biology achievement level, and standard deviation for each high school size by poverty classification.

Table 85

MAP Biology EOC Assessment by High School Size and Poverty

Size	Poverty	*n*	*M*	*SD*
Very Small	Low Poverty	12	56.058	19.978
	Moderate Poverty	79	43.014	19.995
	High Poverty	12	42.500	16.623
Small	Low Poverty	17	60.235	12.381
	Moderate Poverty	74	55.054	14.912
	High Poverty	13	46.008	19.579
Medium	Low Poverty	21	61.724	7.848
	Moderate Poverty	78	55.371	14.231
	High Poverty	10	46.990	29.552
Large	Low Poverty	23	60.774	9.540
	Moderate Poverty	40	49.833	19.643
	High Poverty	10	17.500	8.093
Very Large	Low Poverty	48	68.988	8.276
	Moderate Poverty	29	53.028	13.696
	High Poverty	3	18.733	1.858

Table 86 reports the results of the two factor (School Size x Poverty) ANOVA (F ($8, 454$) = 4.230, $p < .05$) that indicated a statistically significant interaction between the size and poverty of high schools. The results of the above ANOVA indicated that at least two means were different and a follow-up post hoc specified statistically significant differences.

Table 86

ANOVA (School Size x Poverty) Results for Biology

Source	Sum of Squares	*df*	*MS*	*F*	*p*
Size	5501.366	4	1375.342	5.540	.000
Poverty	20322.343	2	10161.172	40.933	.000
Size*Poverty	8400.822	8	1050.103	4.230	.000
Error	112701.734	454	248.242		
Total	1471355.100	469			

A Tukey Honestly Significant Difference (HSD = 18.599) post hoc was used to specify which interactions were statistically significantly different. Appendix D, Table D15 contains the results of the pairwise comparisons between the school sizes and poverty classifications using the Tukey HSD.

The results of the Tukey HSD post hoc indicated a statistically significant difference between the MAP Biology EOC Assessment mean scores of very small low poverty schools (56.06) and large (17.50) and very large (18.73) high poverty schools. Very small low poverty schools' scores were higher (38.56) than large high poverty schools and higher (37.33) than very large high poverty schools. The results also indicated a statistically significant difference between the mean scores of very small moderate poverty schools (43.01) and large (17.50) and very large (18.73) high poverty schools. The very small moderate poverty schools' scores were higher (25.51) than large high poverty schools' scores, and higher (24.28) than very large high poverty schools' scores. In addition, mean scores of very small moderate poverty schools (43.01) were statistically significantly different from mean scores of medium low poverty (61.72) and very large low poverty (68.99) schools. Very small moderate poverty schools' scores were lower (-18.71) than medium low poverty schools' scores and lower (-25.97) than very large low poverty schools' scores. Moreover, there was a statistically significant difference between the mean scores of very small high poverty schools (42.50) and large (17.50) and very large (18.73) high poverty schools. Scores of very small high poverty schools were higher (25.00) than scores of large high poverty schools, and higher (23.77) than scores of very large high poverty schools. Results also indicated significant differences between the mean scores of very small high poverty schools (42.50) and medium low (61.72) and very large low (68.99) poverty schools. Very small high poverty schools' scores were lower (-19.22) than medium low poverty schools' scores and lower (-26.49) than very large low poverty schools' scores.

The results indicated a statistically significant difference between the Biology EOC Assessment mean scores of small low poverty schools (60.24) and large (17.50) and very large (18.73) high poverty schools. Small low poverty schools' scores were higher (42.74) than large high poverty schools' scores and higher (41.50) than very large high poverty schools' scores. Results also indicated a statistically significant difference between the mean scores of small moderate poverty schools (55.05) and large (17.50) and very large (18.73) high poverty schools. Scores of small moderate poverty schools were higher (37.55) than scores of large high poverty schools and higher (36.32) than scores of very large high poverty schools. Mean scores of small high poverty schools (46.01) were also statistically significantly different from scores of large (17.50) and very large (18.73) high poverty schools. Small high poverty schools' scores were higher (28.51) than scores of large high poverty schools' scores and higher (27.27) than scores of very large high poverty schools. Scores of small high poverty schools (46.01) were also statistically significantly different from scores of very large low poverty schools (68.99). Small high poverty schools' scores were lower (-22.98) than very large low poverty schools' scores.

Additionally, results indicated a statistically significant difference between the Biology EOC Assessment mean scores of medium low poverty schools (61.72) and scores of large (17.50) and very large (18.73) high poverty schools. Medium low poverty schools' scores were higher (44.22) than large high poverty schools' scores and higher (42.99) than very large high poverty schools' scores. Likewise, results indicated significant differences in mean scores between medium moderate poverty schools (55.37) and large (17.50) and very large (18.73) high poverty schools. Scores of medium moderate poverty schools were higher (37.87) than scores of large high poverty schools, and higher (36.65) than scores of very large high poverty school. Significant differences were also indicated between mean scores of medium high poverty schools (46.99) and large (17.50) and very large (18.73) high poverty schools. Scores of medium high poverty schools were higher (22.49) than scores of large high poverty schools and higher (28.26) than scores of very large high poverty schools. In addition, medium high poverty schools' mean scores (46.99) were statistically significantly different from very large low poverty schools' mean scores (68.99). Scores of medium high poverty schools were lower (-22.00) than scores of very large low poverty schools.

The results also indicated significant differences in mean scale scores between large low poverty schools (60.77) and large (17.50) and very large (18.73) high poverty schools. Large low poverty schools' scores were higher (43.27) than large high poverty schools' scores and higher (42.04) than very large high poverty schools' scores. Additionally, large moderate poverty schools' mean scores (49.83) were statistically significantly different from large (17.50) and very large (18.73) high poverty schools' mean scores. Scores of large moderate poverty schools were higher (32.33) than scores of large high poverty schools and higher (31.10) than scores of very large high poverty schools. Moreover, large moderate poverty schools' mean scores (49.83) were statistically significantly different from very large low poverty schools' mean scores (68.99). Scores of large moderate poverty schools were lower (-19.16) than scores of very large low poverty schools. The results also indicated significant differences between mean scores of large high poverty schools (17.50) and very large low (55.21) and very large moderate (53.03) poverty schools. Large high poverty schools' scores were lower (-51.49) than very large low poverty schools' scores and lower (-35.53) than very large moderate poverty schools' scores.

The mean scores of very large low poverty schools (68.99) were statistically significantly different from the mean scores of very large high poverty schools (18.73). Very large low poverty schools' scores were higher (50.25) than very large high poverty schools' scores. Likewise, very large moderate poverty schools' mean scores (53.03) were statistically significantly different from mean scores of very large high poverty schools (18.73). Scores of very large moderate poverty schools were higher (34.29) than scores of very large high poverty schools.

In summary, the mixed results indicated that to some extent, poverty affected the differences in achievement among high schools of different sizes. Regardless of poverty classification, scores of very small, small, and medium schools were higher than scores of large and very large high poverty schools. Very small moderate and very small high poverty schools' scores were lower than medium low and very large low poverty schools' scores. Small high, medium high, large moderate, and large high poverty schools' scores were also lower than very large low poverty schools' scores. Large low poverty and large moderate poverty schools' scores were higher than large and very large high poverty schools' scores. Scores of large high poverty schools were lower than scores of very large moderate poverty schools. Both very large low and very large moderate poverty schools' scores were higher than very large high poverty schools' scores.

H 36: The difference in student achievement on the MAP EOC Assessment in biology between high schools of different sizes (very small, small, medium, large, and very large) is affected by special education classifications.

A two factor (School Size x Special Education) ANOVA was used to determine the effect of the interaction between high schools of different sizes (very small, small, medium, large, and very large) and different special education classifications (low special education, moderate special education, and high special education) on achievement. Below, Table 87 includes the sample size, mean biology achievement level, and standard deviation for each high school size by special education classification.

Table 87

MAP Biology EOC Assessment by High School Size and Special Education

Size	Special Education	*n*	*M*	*SD*
Very Small	Low Special Education	19	44.295	20.860
	Moderate Special Education	63	44.927	19.830
	High Special Education	22	43.259	19.741
Small	Low Special Education	24	50.296	16.405
	Moderate Special Education	73	56.237	14.855
	High Special Education	9	55.022	16.794
Medium	Low Special Education	20	60.435	14.740
	Moderate Special Education	87	56.099	14.688
	High Special Education	7	40.771	17.770
Large	Low Special Education	15	59.700	15.762
	Moderate Special Education	50	51.376	17.418
	High Special Education	11	22.591	21.911
Very Large	Low Special Education	17	67.029	13.143
	Moderate Special Education	63	59.138	16.028
	High Special Education	2	69.350	7.425

Table 88 reports the results of the two factor (School Size x Special Education) ANOVA (F ($8, 467$) = 4.141, $p < .05$) that indicated a statistically significant interaction between the size and special education of high schools. The results of the above ANOVA indicated that at least two means were different and a follow-up post hoc specified statistically significant differences.

Table 88

ANOVA (School Size x Special Education) Results for Biology

Source	Sum of Squares	*df*	*MS*	*F*	*p*
Size	8724.685	4	2181.171	7.764	.000
Special Education	2237.707	2	1118.854	3.983	.019
Size*Special Education	9305.958	8	1163.245	4.141	.000
Error	131199.501	467	280.941		
Total	1511497.290	482			

A Tukey Honestly Significant Difference (HSD = 21.516) post hoc was used to specify which interactions were statistically significantly different. Appendix D, Table D16 contains the results of the pairwise comparisons between the school sizes and special education classifications using the Tukey HSD.

The results of the Tukey HSD post hoc indicated a statistically significant difference between the MAP Biology EOC Assessment mean scores of very small low special education schools (44.29) and large high special education schools (22.59). Very small low special education schools' scores were higher (21.70) than large high special education schools' scores. Mean scores were also statistically significantly different between very small low special education schools (44.29) and very large low (67.03) and very large high (69.35) special education schools. Very small low special education schools' scores were lower (-22.73) than very large low special education schools' scores and lower (-25.06) than very large high special education schools' scores.

Similarly, the results indicated a statistically significant difference between the mean scores of very small moderate special education schools (44.93) and large high special education schools (22.59). Very small moderate special education schools' scores were higher (22.34) than large high special education schools' scores. Mean scores were also statistically significantly different between very small moderate special education schools (44.93) and very large low (67.03) and very large high (69.35) special education schools. Very small moderate special education schools' scores were lower (-22.10) than very large low special education schools' scores and lower (-24.42) than very large high special education schools' scores.

Mean scores of very small high special education schools (43.26) and large high special education schools (22.59) were also statistically significantly different. Very small high special education schools' scores were higher (20.67) than large high special education schools' scores. Mean scores were also statistically significantly different between very small high special education schools (43.26) and very large low (67.03) and very large high (69.35) special education schools. Very small high special education schools' scores were lower (-23.77) than very large low special education schools' scores and lower (-26.09) than very large high special education schools' scores.

Results also indicated a statistically significant difference between the mean scores of small low special education schools (50.30) and large high special education schools (22.59). Small low special education schools' scores were higher (27.70) than large high special education schools' scores. Mean scores of small moderate special education schools (56.24) and large high special education schools (22.59) were statistically significantly different. The small moderate special education schools' scores were higher (33.65) than large high special education schools' scores. Moreover, there was a statistically significant difference between the mean scores of small high special education schools (55.02) and large high special education schools (22.59). Scores of small high special education schools were higher (32.43) than scores of large high special education schools.

Additionally, there was a statistically significant difference between the MAP Biology EOC Assessment mean scores between medium low special education schools (60.44) and large high special education schools (22.59). Scores of medium low special education schools were higher (37.84) than scores of large high special education schools. There was also a statistically significant difference between the scores of medium moderate special education schools (56.10) and large high special education schools (22.59). Medium moderate special education schools' scores were higher (33.51) than large high special education schools' scores. However, mean scores of medium high special education schools (40.77) were statistically significantly different from scores of very large low (67.03) and very large high (69.35) special education schools. Medium high special education schools' scores were lower (-26.26) than very large low special education schools' scores, and lower (-28.58) than very large high special education schools' scores.

There was also a statistically significant difference between mean scores of large low special education schools (59.70) and large high special education schools (22.59). Large low special education schools' scores were higher (37.11) than large high special education schools' scores. The results also indicated a statistically significant difference between the mean scores of large moderate special education schools (51.38) and large high special education schools (22.59). The large moderate special education schools' scores were higher (28.79) than large high special education schools' scores.

Moreover, there was a statistically significant difference between the mean scores of large high special education schools (22.59) and very large low special education (67.03), very large moderate special education (59.14), and very large high special education (69.35) schools. Scores of large high special education schools were lower (-44.44) than scores of very large low special education schools, lower (-36.55) than scores of very large moderate special education schools, and lower (-46.76) than scores of very large high special education schools.

In summary, the mixed results indicated that to some extent, special education affected the differences in achievement among high schools of different sizes. Mean scores of very small low, moderate, and high special education schools were higher than scores of large high special education schools, but lower than scores of very large low and very large high special education schools. Small low, moderate, and high special education schools' scores were higher than large high special education school's scores. Medium low and medium moderate special education schools' scores were higher than large high special education schools' scores. However, medium high special education schools' scores were lower than very large low and very large high special education schools' scores. Large low and large moderate special education schools' scores were also higher than large high special education schools' scores. Scores of large high special education schools were lower than scores of very large low, moderate, and high special education schools.

RQ 16: To what extent is the relationship between high school size and student achievement as measured by the MAP EOC Assessment in government impacted by any of the following variables: location, ethnicity, poverty, or special education classifications?

H 37: The difference in student achievement on the MAP EOC Assessment in government between high schools of different sizes (very small, small, medium, large, and very large) is affected by location classifications.

A two factor (School Size x Location) ANOVA was used to determine the effect of the interaction between high schools of different sizes (very small, small, medium, large, and very large) and different locations (rural, town, suburban, and urban) on achievement. Due to only a single very small suburban school and a single small city school in the sample, two schools were eliminated from the analysis. Additionally, the sample did not contain any very small town schools. Below, Table 89 includes the sample size, mean government achievement level, and standard deviation for each high school size by location.

Table 89

MAP Government EOC Assessment by High School Size and Location

Size	Location	*n*	*M*	*SD*
Very Small	City	2	53.150	46.033
	Rural	98	39.913	17.836
Small	Suburb	3	44.067	18.258
	Town	7	47.357	17.217
	Rural	89	42.455	14.813
Medium	City	4	45.925	36.837
	Suburb	6	43.483	12.341
	Town	31	40.316	14.575
	Rural	70	45.521	11.764
Large	City	23	28.152	23.392
	Suburb	9	38.900	19.731
	Town	31	46.458	14.499
	Rural	11	45.155	10.592
Very Large	City	15	52.440	15.307
	Suburb	49	54.678	20.812
	Town	14	50.500	14.755
	Rural	5	55.880	5.890

Table 90 reports the results of the two factor (School Size x Location) ANOVA (F (*9, 450*) = 1.697, p > .05) that did not indicate a statistically significant interaction between the size and location of high schools. Thus, there was not enough evidence to reject the null hypothesis. Location did not affect differences in government scores because of differences in high school size.

Table 90

ANOVA (School Size x Location) Results for Government

Source	Sum of Squares	*df*	*MS*	*F*	*p*
Size	4896.651	4	1224.163	4.403	.002
Location	67.190	3	22.397	.081	.971
Size*Location	4246.625	9	471.847	1.697	.087
Error	125110.407	450	278.023		
Total	1044286.640	467			

H 38: The difference in student achievement on the MAP EOC Assessment in government between high schools of different sizes (very small, small, medium, large, and very large) is affected by ethnicity classifications.

A two factor (School Size x Ethnicity) ANOVA was used to determine the effect of the interaction between high schools of different sizes (very small, small, medium, large, and very large) and different ethnicity classifications (low minority, moderate minority, and high minority) on achievement. The sample did not include any very large high schools in the low minority classification. Thus, the category was omitted from the analysis. Below, Table 91 includes the sample size, mean government achievement level, and standard deviation for each high school size by ethnicity classification.

Table 91

MAP Government EOC Assessment by High School Size and Ethnicity

Size	Ethnicity	*n*	*M*	*SD*
Very Small	Low Minority	45	41.236	19.103
	Moderate Minority	34	40.729	18.087
	High Minority	4	42.100	29.879
Small	Low Minority	37	41.343	14.701
	Moderate Minority	38	44.847	15.070
	High Minority	9	34.800	11.997
Medium	Low Minority	29	43.324	13.841
	Moderate Minority	54	46.278	10.896
	High Minority	15	37.047	22.002
Large	Low Minority	3	45.967	17.223
	Moderate Minority	37	48.657	12.338
	High Minority	25	26.124	22.170
Very Large	Moderate Minority	50	58.538	15.025
	High Minority	26	43.577	21.915

Table 92 shows the results of the two factor (School Size x Ethnicity) ANOVA (F $(7, 392) = 1.315$, $p > .05$) that did not indicate a statistically significant interaction between the size and ethnicity of high schools. Thus, there was not enough evidence to reject the null hypothesis. Ethnicity did not affect differences in government scores because of differences in high school size.

Table 92

ANOVA (School Size x Ethnicity) Results for Government

Source	Sum of Squares	*df*	*MS*	*F*	*p*
Size	5569.310	4	1392.328	5.137	.000
Ethnicity	4933.139	2	2466.570	9.101	.000
Size*Ethnicity	2494.626	7	356.375	1.315	.242
Error	106238.250	392	271.016		
Total	919189.800	406			

H 39: The difference in student achievement on the MAP EOC Assessment in government between high schools of different sizes (very small, small, medium, large, and very large) is affected by poverty classifications.

A two factor (School Size x Poverty) ANOVA was used to determine the effect of the interaction between high schools of different sizes (very small, small, medium, large, and very large) and different poverty classifications (low poverty, moderate poverty, and high poverty) on achievement. Below, Table 93 includes the sample size, mean government achievement level, and standard deviation for each high school size by poverty classification.

Table 93

MAP Government EOC Assessment by High School Size and Poverty

Size	Poverty	*n*	*M*	*SD*
Very Small	Low Poverty	12	45.817	17.101
	Moderate Poverty	75	40.796	18.075
	High Poverty	12	32.850	22.514
Small	Low Poverty	15	48.000	16.803
	Moderate Poverty	70	44.637	13.997
	High Poverty	13	27.800	8.354
Medium	Low Poverty	20	54.130	9.315
	Moderate Poverty	76	42.438	13.095
	High Poverty	10	34.400	18.215
Large	Low Poverty	22	52.300	12.727
	Moderate Poverty	39	39.623	16.843
	High Poverty	10	12.530	7.516
Very Large	Low Poverty	49	63.271	12.887
	Moderate Poverty	29	42.479	14.527
	High Poverty	3	17.200	0.954

Table 94 reports the results of the two factor (School Size x Poverty) ANOVA (F $(8, 440) = 3.382$, $p < .05$) that indicated a statistically significant interaction between the size and poverty of high schools. The results of the above ANOVA indicated that at least two means were different and a follow-up post hoc specified statistically significant differences.

Table 94

ANOVA (School Size x Poverty) Results for Government

Source	Sum of Squares	*df*	*MS*	*F*	*p*
Size	2165.270	4	541.318	2.447	.046
Poverty	20839.687	2	10419.844	47.097	.000
Size*Poverty	5985.451	8	748.181	3.382	.001
Error	97346.378	440	221.242		
Total	1024054.160	455			

A Tukey Honestly Significant Difference (HSD = 17.677) post hoc was used to specify which interactions were statistically significantly different. Appendix D, Table D17 contains the results of the pairwise comparisons between the school sizes and poverty classifications using the Tukey HSD.

The results of the Tukey HSD post hoc indicated a statistically significant difference between the MAP Government EOC Assessment mean scores of very small low poverty schools (45.82) and small (27.80), large (12.53) and very large (17.20) high poverty schools. Very small low poverty schools' scores were higher (18.02) than small high poverty schools' scores, higher (33.29) than large high poverty schools' scores, and higher (28.62) than very large high poverty schools' scores. The results also indicated a statistically significant difference between the mean scores of very small moderate poverty schools (40.80) and large (12.53) and very large (17.20) high poverty schools. The very small moderate poverty schools' scores were higher (28.27) than large high poverty schools' scores, and higher (23.60) than very large high poverty schools' scores.

In addition, mean scores of very small moderate poverty schools (40.80) were statistically significantly different from mean scores of very large low poverty schools (63.27). Very small moderate poverty schools' scores were lower (-22.48) than very large low poverty schools' scores. Moreover, there was a statistically significant difference between the mean scores of very small high poverty schools (32.85) and medium (54.13), large (52.30) and very large (63.27) low poverty schools. Scores of very small high poverty schools were lower (-21.28) than scores of medium low poverty schools, lower (-19.45) than scores of large low poverty schools, and lower (-30.42) than scores of very large low poverty schools. Results also indicated significant differences between the mean scores of very small high poverty schools (32.85) and large high poverty schools (12.53). Very small high poverty schools' scores were higher (20.32) than large high poverty schools' scores.

The results indicated a statistically significant difference between the Government EOC Assessment mean scores of small low poverty schools (48.00) and small (27.80) large (12.53) and very large (17.20) high poverty schools. Small low poverty schools' scores were higher (20.20) than small high poverty schools' scores, higher (35.47) than large high poverty schools' scores, and higher (30.80) than very large high poverty schools' scores. Results also indicated a statistically significant difference between the mean scores of small moderate poverty schools (44.64) and large (12.53) and very large (17.20) high poverty schools. Scores of small moderate poverty schools were higher (32.11) than scores of large high poverty schools and higher (27.44) than scores of very large high poverty schools. Statistically significant differences were also indicated between mean scores of small moderate poverty schools (44.64) and very large low poverty schools (63.27). Scores of small moderate poverty schools were lower (-18.63) than scores of very large low poverty schools. Mean scores of small high poverty schools (27.80) were also statistically significantly different from scores of medium (54.13), large (52.30) and very large (63.27) low poverty schools. Small high poverty schools' scores were lower (-26.33) than scores of medium low poverty schools' scores, lower (-24.50) than large low poverty schools' scores, and lower (-35.47) than scores of very large low poverty schools.

Additionally, results indicated a statistically significant difference between the Government EOC Assessment mean scores of medium low poverty schools (54.13) and scores of medium (34.40), large (12.53), and very large (17.20) high poverty schools. Medium low poverty school's scores were higher (19.73) than medium high poverty schools' scores, higher (41.60) than large high poverty schools' scores, and higher (36.93) than very large high poverty schools' scores. Likewise, results indicated significant differences in mean scores between medium moderate poverty schools (42.44) and large (12.53) and very large (17.20) high poverty schools. Scores of medium moderate poverty schools were higher (29.91) than scores of large high poverty schools, and higher (25.24) than scores of very large high poverty school. In addition, medium moderate poverty schools' scores (42.44) were statistically significantly different from very large low poverty schools' scores (63.27). Scores of medium moderate poverty schools were lower (-20.83) than scores of very large low poverty schools. Significant differences were also indicated between mean scores of medium high poverty schools (34.40) and large (52.30) and very large (63.27) low poverty schools. Scores of medium high poverty schools were lower (-17.90) than scores of large low poverty schools and lower (-28.87) than scores of very large low poverty schools. In addition, medium high poverty schools' mean scores (34.40) were statistically significantly different from large high poverty schools' mean scores (12.53). Scores of medium high poverty schools were higher (21.87) than scores of large high poverty schools.

The results also indicated significant differences in mean scale scores between large low poverty schools (52.30) and large (12.53) and very large (17.20) high poverty schools. Large low poverty schools' scores were higher (39.77) than large high poverty schools' scores and higher (35.10) than very large high poverty schools' scores. Additionally, large moderate poverty schools' mean scores (39.62) were statistically significantly different from large (12.53) and very large (17.20) high poverty schools' mean scores. Scores of large moderate poverty schools were higher (27.09) than scores of large high poverty schools and higher (22.42) than scores of very large high poverty schools. Moreover, large moderate poverty schools' mean scores (39.62) were statistically significantly different from very large low poverty schools' mean scores (63.27). Scores of large moderate poverty schools were lower (-23.65) than scores of very large low poverty schools. The results also indicated significant differences between mean scores of large high poverty schools (12.53) and very large low (63.27) and very large moderate (42.48) poverty schools. Large high poverty schools' scores were lower (-50.74) than very large low poverty schools' scores and lower (-29.95) than very large moderate poverty schools' scores.

The mean scores of very large low poverty schools (63.27) were statistically significantly different from the mean scores of very large moderate (42.48) and very large high (17.20) poverty schools. Very large low poverty schools' scores were higher

(20.79) than very large moderate poverty schools' scores, and higher (46.07) than very large high poverty schools' scores. Likewise, very large moderate poverty schools' mean scores (42.48) were statistically significantly different from mean scores of very large high poverty schools (17.20). Scores of very large moderate poverty schools were higher (25.28) than scores of very large high poverty schools.

In summary, the mixed results indicated that to some extent, poverty affected the differences in achievement among high schools of different sizes. Scores of all classifications of very small schools as well as small low and small moderate poverty schools were higher than scores of large high poverty schools. Very small and small low poverty schools' scores were higher than small high poverty schools' scores. Additionally, very small low and moderate poverty schools' scores and small low and moderate poverty schools' scores were higher than very large high poverty schools' scores. Both very small moderate and very small high poverty schools' scores were lower than very large low poverty schools' scores. Moreover, scores of very small high poverty schools were lower than scores of both medium and large low poverty schools. Small high poverty schools' scores were lower than medium, large, and very large low poverty schools' scores. Scores of small moderate poverty schools were lower than scores of very large low poverty schools.

Medium low, moderate, and high poverty schools' scores were lower than large high poverty schools' scores. Scores of medium low poverty schools were higher than medium high and very large high poverty schools. Medium moderate poverty schools' scores were lower than very large low poverty schools' scores, but higher than very large high poverty schools' scores. Scores of medium high poverty schools were lower than scores of both large and very large low poverty schools. Large low and large moderate poverty schools' scores were higher than both large high and very large high poverty schools' scores. However, scores of large moderate and large high poverty schools were lower than scores of very large low poverty schools. Large high poverty schools' scores were lower than very large moderate poverty schools' scores. However, very large low poverty schools' scores were higher than very large moderate and very large high poverty schools' scores. Lastly, scores of very large moderate poverty schools were higher than scores of very large high poverty schools.

H 40: The difference in student achievement on the MAP EOC Assessment in government between high schools of different sizes (very small, small, medium, large, and very large) is affected by special education classifications.

A two factor (School Size x Special Education) ANOVA was used to determine the effect of the interaction between high schools of different sizes (very small, small, medium, large, and very large) and different special education classifications (low special education, moderate special education, and high special education) on achievement. Below, Table 95 includes the sample size, mean government achievement level, and standard deviation for each high school size by special education classification.

Table 95

MAP Government EOC Assessment by High School Size and Special Education

Size	Special Education	*n*	*M*	*SD*
Very Small	Low Special Education	19	43.205	16.389
	Moderate Special Education	60	41.897	19.000
	High Special Education	22	34.082	17.892
Small	Low Special Education	24	38.929	14.602
	Moderate Special Education	68	44.481	14.755
	High Special Education	8	39.013	16.704
Medium	Low Special Education	20	48.330	15.384
	Moderate Special Education	85	43.886	12.914
	High Special Education	6	30.667	16.767
Large	Low Special Education	12	48.483	12.708
	Moderate Special Education	51	41.357	18.227
	High Special Education	11	22.136	21.332
Very Large	Low Special Education	18	60.306	17.784
	Moderate Special Education	63	51.208	18.036
	High Special Education	2	70.300	2.404

Table 96 reports the results of the two factor (School Size x Special Education) ANOVA (F (*8, 454*) = 2.301, p < .05) that indicated a statistically significant interaction between the size and special education of high schools. The results of the above ANOVA indicated that at least two means were different and a follow-up post hoc specified statistically significant differences.

Table 96

ANOVA (School Size x Special Education) Results for Government

Source	Sum of Squares	*df*	*MS*	*F*	*p*
Size	6805.718	4	1701.430	6.295	.000
Special Education	1667.314	2	833.657	3.085	.047
Size*Special Education	4974.089	8	621.761	2.301	.020
Error	122699.066	454	270.262		
Total	1049570.740	469			

A Tukey Honestly Significant Difference (HSD = 21.548) post hoc was used to specify which interactions were statistically significantly different. Appendix D, Table D18 contains the results of the pairwise comparisons between the school sizes and special education classifications using the Tukey HSD.

The results of the Tukey HSD post hoc indicated a statistically significant difference between the MAP Government EOC Assessment mean scores of very small low special education schools (43.21) and very large high special education schools (70.30). Very small low special education schools' scores were lower (-27.09) than very large high special education schools' scores. Mean scores were also statistically significantly different between very small moderate special education schools (41.90) and very large high (70.30) special education schools. Very small moderate special education schools' scores were lower (-28.40) than very large high special education schools' scores. Similarly, the results indicated a statistically significant difference between the mean scores of very small high special education schools (34.08) and very large low

(60.31) and very large high (70.30) special education schools. Very small high special education schools' scores were lower (-26.22) than very large low special education schools' scores, and lower (-36.22) than very large high special education schools' scores.

Results also indicated a statistically significant difference between the mean scores of small low special education schools (38.93) and very large high special education schools (70.30). Small low special education schools' scores were lower (-31.37) than very large high special education schools' scores. Mean scores of small moderate special education schools (44.48) and large high special education schools (22.14) were statistically significantly different. The small moderate special education schools' scores were higher (22.34) than large high special education schools' scores. Moreover, there was a statistically significant difference between the mean scores of small moderate special education schools (44.48) and very large high special education schools (70.30). Scores of small moderate special education schools were lower (-25.82) than scores of very large high special education schools. Furthermore, small high special education schools' mean scores (39.01) were statistically significantly different from very large high special education schools' mean scores (70.30). Scores of small high special education schools were lower (-31.29) than scores of very large high special education schools.

Additionally, there was a statistically significant difference between the MAP Government EOC Assessment mean scores between medium low special education schools (48.33) and large high special education schools (22.14). Scores of medium low special education schools were higher (26.19) than scores of large high special education schools. Scores of medium low special education schools (48.33) were also statistically significantly different from scores of very large high special education schools (70.30). Medium low special education schools' scores were lower (-21.97) than very large high special education schools' scores. There was also a statistically significant difference between the scores of medium moderate special education schools (43.89) and large high special education schools (22.14). Medium moderate special education schools' scores were higher (21.75) than large high special education schools' scores. Medium moderate special education schools' scores (43.89) were also statistically significantly different from very large high special education schools' scores (70.30). Scores of medium moderate special education schools were lower (-26.41) than scores of very large high special education schools. However, mean scores of medium high special education schools (30.67) were statistically significantly different from scores of very large low (60.31) and very large high (70.30) special education schools. Medium high special education schools' scores were lower (-29.64) than very large low special education schools' scores, and lower (-39.63) than very large high special education schools' scores.

There was also a statistically significant difference between mean scores of large low special education schools (48.48) and large high special education schools (22.14). Large low special education schools' scores were higher (26.35) than large high special education schools' scores. Scores of large low special education schools (48.48) were statistically significantly different from scores of very large high special education schools (70.30). Large low special education schools' scores were lower (-21.82) than very large high special education schools' scores. The results also indicated a statistically significant difference between the mean scores of large moderate special education schools (41.36) and very large high special education schools (70.30). The large moderate special education schools' scores were lower (-28.94) than very large high special education schools' scores. Moreover, there was a statistically significant difference between the mean scores of large high special education schools (22.14) and very large low special education (60.31), very large moderate special education (51.21), and very large high special education (70.30) schools. Scores of large high special education schools were lower (-38.17) than scores of very large low special education schools, lower (-29.07) than scores of very large moderate special education schools, and lower (-48.16) than scores of very large high special education schools.

In summary, the mixed results indicated that to some extent, special education affected the differences in achievement among high schools of different sizes. Regardless of special education classification, all very small, small, and medium schools' scores were lower than very large high special education schools' scores. Mean scores of large low and large moderate special education schools were also lower than scores of very large high special education schools. Small moderate, medium low, medium moderate, and large low special education schools' scores were higher than large high special education schools' scores. However, scores of very small high, medium high, and large high special education schools were lower than scores of very large low special education schools. Lastly, large high special education schools' scores were lower than both very large moderate and very large high special education schools' scores.

Summary

This chapter presented the results of ANOVAs utilized to answer each of the research questions. Results of hypothesis tests indicated the presence of a statistically significant relationship between student achievement and school size at all grade levels tested. However, the interaction of location, ethnicity, poverty, and special education on the relationship varied based on the grade-level and content area tested. Chapter five presents major findings of hypotheses testing, provides connections to literature, discusses implications for action, and makes recommendations for future study.

Chapter Five

Interpretation and Recommendations

The first four chapters introduced the background, purpose, and significance of the study; a review of the literature on school size with specific attention given to the impact of student achievement and variables impacting the relationship between school size and student achievement; the research methodology utilized in the study; and the results of hypothesis testing related to the research questions. This chapter presents a brief review of the problem, purpose, research questions, methodology, and major findings of the study. Additionally, findings related to relevant literature on school size and student achievement, implications for action, and recommendations for future research are addressed.

Study Summary

According to Roberts (2004), the study summary provides a "mini-version" of chapters one through four of the study. Thus, this section provides an overview of the problem, reviews the purpose statement, research question, and methodology, and presents the major findings of the study.

Overview of the Problem.

Dating back to the turn of the 20th century, educational researchers and reformers questioned the appropriate size for public schools in the United States (Cubberley, 1912; 1922; Foght, 1911; 1917; Kennedy, 1915). Small schools were generally considered inadequate educational facilities due to "fiscal inefficiencies, unprofessional leadership, unequally distributed resources, and backward educational practice" (Strang, 1987, p. 355). As the American economy and city became increasingly industrialized through the

1920s, larger urban schools became viewed as economically superior and more efficient to operate when compared to the plethora of traditionally small rural schools scattered throughout the country (Bard et al., 2006). Spurred on by numerous recommendations from governmental and professional education organizations as well as educational researchers, consolidation of small schools into larger more efficient schools became common practice in the United States through the 1980s (American Association of School Administrators, 1958; Conant, 1959; 1967; Dawson, 1934; National Education Association, 1948; Stemnock, 1974; Turner & Thrasher, 1970; U.S. Department of Interior, 1939b). From 1920 to 1980, the number of schools in the U.S. decreased by 68%. However, during the same time, the number of students enrolled in pubic schools nearly doubled with the average school size jumping from 80 students to well over 400 (U.S. Bureau of the Census, 1983; U.S. Federal Security Agency, 1947).

While Americans generally accepted consolidation and larger schools as part of the educational status quo, educational researchers began to question the impact of school consolidation and the effect of larger schools on student outcomes such as student achievement (Berry & West, 2010). Throughout the 1980s and 1990s, much of the educational research on school size favored smaller schools as more effective and capable of producing higher levels of student achievement (Raywid, 1999). However, as enrollments in U.S schools increased by 15% from 1990 through 2000, the number of schools in the U.S. only increased by 10% with the average school size reaching a historical high of over 500 students (U.S. Bureau of the Census, 1993; 2003). Thus, as local school districts struggle to meet the demands of rising student enrollments, increased accountability for improving student achievement, and shrinking financial resources, a great need exists for definitive research on the relationship between school size and student achievement and optimal school size that maximizes student achievement.

Review of Purpose Statement and Research Questions.

As stated in chapter one, the study was designed to examine the relationship between school size and student achievement in Missouri elementary, middle, and high schools. MAP Grade-Level assessments in communication arts and mathematics at elementary (grade 5) and middle school (grade 8) were used as the measures of achievement. MAP End-of-Course assessments in English II, Algebra I, biology, and government were used as the measures of achievement in high schools. The study also explored the extent to which the relationship between school size and student achievement at the elementary, middle, and high school levels was affected by school location, ethnicity, poverty, and special education classifications.

Review of Methodology.

This causal-comparative quantitative study involved all public schools in the state of Missouri meeting criteria for inclusion in the study and reporting MAP student achievement data for the 2009-2010 school year. Archived data from the Missouri Department of Elementary and Secondary Education (DESE) and the National Center for Education Statistics (NCES) were used for the study. The sizes of the schools, measured by the total January Membership Count comprised the independent variables. Using an adapted classification formula from the Missouri State High School Activities Association, schools were grouped into five size categories. Schools were also classified into three grade configurations (elementary, middle, and high school) based on definitions provided by the NCES.

Additional independent variables included location, ethnicity, poverty, and special education classifications. For purposes of the study, schools were categorized into four location classifications (city, suburb, town, rural) based on the urban-centric locale code of the school. Ethnicity was defined as the percentage of non-white (Hispanic, Black, Asian, and Indian) students enrolled in a school. Poverty included the percentage of students enrolled in a school eligible for free or reduced meals. Special education was defined as the percentage of students enrolled in a school with an Individualized Education Plan (IEP).

MAP Grade-Level assessment scores of fifth grade students for elementary schools and eighth grade students for middle schools, and MAP End-of-Couse (EOC) assessment scores of high school students were used as the dependent variable of student achievement. Additionally, student achievement scores included the percentage of students scoring at proficient and advanced levels on the MAP Grade-Level assessments in communication arts and mathematics at grade 5 in elementary schools and grade 8 in middle schools, and EOC assessments in English II, Algebra I, biology, and government in high schools.

One factor ANOVAs were used to address research questions to determine if statistically significant differences in student achievement existed between schools of different sizes. Two factor ANOVAs were used to address research questions to determine the interaction effect between the size of a school and location, ethnicity, poverty, and special education classifications. Tukey's HSD was utilized for all follow-up post hoc analysis.

Major Findings.

The researcher investigated the extent to which a relationship existed between elementary, middle, and high school size and student achievement in communication arts and mathematics at the elementary and middle school levels and English II, Algebra I, biology, and government at the high school level. While the findings were mixed, higher levels of student achievement were found in large and very large elementary schools in both communication arts and mathematics. Similar mixed results were discovered in middle schools with higher levels of student achievement in large and very large middle schools in both communication arts and mathematics. In high schools, findings were also mixed; however, results generally indicated higher student achievement in English II, biology, and government in very large high schools. The exception was achievement in Algebra I, where higher achievement was discovered in small high schools.

The researcher also examined the interaction effect of school location, ethnicity, poverty, and special education classification on elementary, middle, and high school size. In terms of variables impacting the relationship between school size and student achievement, the current study found mixed results. In elementary schools, only location affected the relationship. In both communication arts and mathematics achievement, regardless of size, suburban elementary schools produced higher levels of student achievement compared to city elementary schools. However, in middle schools, the current study revealed both small city and small suburban schools to produce lower levels of student achievement in communication arts, but not in mathematics. Large city high schools produced the lowest levels of student achievement in English II and biology.

While ethnicity classifications failed to impact the relationship between school size and student achievement at the elementary and middle school levels, high minority high schools produced the lowest levels of student achievement in English II and biology. In addition, among high ethnicity high schools, medium and very large high minority high schools produced higher levels of student achievement in English II and biology compared to large high minority high schools.

Poverty classifications failed to impact the relationship between elementary school size and student achievement. In middle schools, poverty only had an impact on the relationship between school size and mathematics achievement. However, the current study consistently indicated lower levels of student achievement in high poverty high schools in all four content areas tested. Moreover, among high poverty high schools, very small, small, and medium high poverty high schools produced higher levels of student achievement in Algebra I and biology compared to large and very large high poverty high schools, while small and medium high poverty schools produced higher levels of student achievement in English II compared to large and very large high poverty schools. In government, very small and medium high poverty schools produced higher levels of student achievement.

Lastly, in the current study, special education failed to impact the relationship between elementary school size and student achievement. However, at the middle and high school levels, high special education schools consistently produced the lowest levels of student achievement in all areas tested. Specifically, large and very large high special education middle schools produced higher levels of student achievement compared to small and medium high special education middle schools. In high special education high schools, large high schools produced lower levels of student achievement in English II, Algebra I, and biology.

Findings Related to the Literature

This section connects the current study's findings with previous studies related to school size and student achievement. Comparing and contrasting the results of this study to the studies presented in chapter two revealed similarities and differences. For example, the results of this study provided evidence that student achievement in communication arts and mathematics was highest in very large elementary schools. Such results are consistent with Plecki's (1991) findings that indicated a positive linear relationship between school size and student achievement in elementary schools. In addition, the current study's results concur with Huang and Howley's (1994) findings that students in smaller elementary schools had lower levels of student achievement. Moreover, the current study's findings are consistent with those of Zoda (2009) indicating higher student achievement in communication arts in larger elementary schools.

However, the current study's findings contrast those of Caldas (1993), Lee and Loeb (2000), and Borland and Howsen (2003). While the current study's results reveal higher levels of student achievement in communication arts and mathematics in elementary schools with enrollments of more than 503 students, Caldas (1993) determined that small urban elementary schools produced higher levels of student achievement when compared to large urban elementary schools. Likewise, Lee and

Loeb's (2000) findings of higher student achievement in small elementary schools with fewer than 400 students are not supported by those of the current study. Furthermore, results of the current study are in contrast to Borland and Howsen's (2003) findings of a nonlinear relationship between elementary school size and student achievement. While the researchers identified higher levels of student achievement in elementary schools as enrollments approached 760 students and decreased with enrollments over 760 students, the current study found higher levels of student achievement in elementary schools with enrollments of 503 to 1157 students.

The results of this study also provided evidence of higher levels of student achievement in large and very large middle schools in communication arts and in very large middle schools in mathematics. The findings of the study agree with Gilmore (2007) who discovered higher levels of student achievement in middle schools with enrollments of more than 1,199 students. Likewise, the current study found higher levels of student achievement in both communication arts and mathematics in middle schools with enrollments of 755 to 1,564 students. However, the current study's results are in contrast to the findings of Chamberlin (2007) who failed to find a relationship between middle school size and student achievement.

This study's results also provided evidence of higher levels of achievement for students enrolled in very large high schools. The current study's results agree with the findings of Hoagland (1995) who also identified significantly higher levels of student achievement in very large high schools in reading, written expression, and math. In addition, the current study's findings are similar to those of Gardner et al. (2000) that indicated higher levels of student performance on the SAT for students in large high schools. Whereas the current study revealed higher levels of student achievement in English II, biology, and government in high schools with enrollments of 1,041 to 2,421 students, Rumberger and Palardy (2005) also reported higher student achievement in math, science, and reading in high schools with enrollments of more than 1,200 students. In contrast with the current study, Lee and Smith (1997) discovered higher levels of student achievement in math and reading in high schools with enrollment of 600 to 900 students. Likewise, the current study does not support Stewart's (2009) findings of higher levels of student achievement in high schools with fewer than 414 students.

Regarding the impact of location of the relationship between elementary school size and achievement, the current study revealed higher levels of student achievement in suburban elementary schools regardless of school size. Such findings are in contrast to those of Friedkin and Necochea (1988). They indicated no differences in student achievement among schools located in metropolitan and non-metropolitan areas.

The current study also examined the impact of location, poverty, ethnicity, and special education on the relationship between middle school size and student achievement in communication arts and mathematics. While the findings were not significant regarding the impact of location, ethnicity, or poverty on the analysis of middle school size and mathematics achievement, location, poverty, and special education impacted the relationship between middle school size and communication arts achievement. The current study indicated lower levels of student achievement in small city and small suburban middle schools. The results do not support findings of Friedkin and Necochea (1988) who reported no differences in student achievement among schools located in metropolitan and non-metropolitan areas.

While high poverty middle schools produced the lowest levels of student achievement in communication arts, very small high poverty schools outperformed small and large high poverty middle schools in the current study. The results are consistent with Huang and Howley's (1994) findings of the ability of small high poverty schools to mitigate the impact of poverty compared to larger high poverty schools. Likewise, the current study's findings concur with those of Coldarci (2006) who indicated a weaker impact of poverty on student achievement in reading and mathematics among smaller middle schools when compared to larger middle schools. In contrast, the current study's results do not support the findings of Gilmore (2007) who discovered higher levels of reading and mathematics achievement in middle schools with low and high levels of poverty and more than 1,199 students.

The impact of location, poverty, ethnicity, and special education on the relationship between high school size and student achievement in English II, Algebra I, biology, and government was explored in the current study. Results indicated lower levels of student achievement in English II and biology in large city high schools. While none of the findings related to the literature are directly related to the impact of location the relationship between high school size and student achievement, several studies addressed the relationship between student achievement and school location. Thus, the current study's results cannot support, but are similar to Baird's (1969) findings of lower levels of student achievement on the ACT in high schools located in cities. The current study's findings are also similar to findings of Haller et al. (1993) who reported the absence of a relationship between student achievement and rural high schools. However, the current study's findings were not similar to Friedkin and Necochea (1988) who failed to find significant differences in student achievement among metropolitan and non-metropolitan schools.

Results of the current study revealed lower levels of student achievement in English II and biology among all high minority high schools regardless of school size. However, medium and very large high minority high schools produced higher levels of student achievement when compared to large high minority high schools. The current study supports the findings of Slate and Jones (2008) who reported mixed results regarding the examination of the relationship between Hispanic student achievement on end-of-course exams and high school size. However, the current study's findings are in contrast to those of Chavez (2002) who reported higher student achievement in large high and low minority high schools. Similarly, the current study's findings are in contrast to Gilmore's (2007) study that revealed higher student achievement in very large high and low minority high schools with enrollment of more than 1,199 students. Moreover, results of the current study fail to concur with Greeney's (2010) findings of higher levels of student achievement in high and low minority high schools with enrollments of more than 1,500 students.

In addition, the findings of the current study revealed lower levels of student achievement in English II, Algebra I, biology, and government in high poverty high schools regardless of size. However, among high poverty high schools, large and very large high schools with enrollments of 559 to 2,241 produced the lowest levels of student achievement. The findings of the current study concur with the those of Howley and Bickel (1999) who established that among high poverty schools, larger schools produce lower levels of student achievement when compared to smaller schools that are able to decrease the influence of poverty on student achievement. However, the current study's findings are in contrast to those of Durbin (2001) who discovered a positive relationship between student achievement and high school size after controlling for poverty. Findings of the current study also fail to support Brackett (2008). While controlling for poverty, Brackett (2008) revealed higher levels of student achievement in larger high schools with enrollments of more than 400 students. Furthermore, the current study's findings fail to support Lee and Smith (1997) who reported higher student achievement in both low and high poverty high schools with enrollments of 600 to 900 students.

Conclusions

The last section of chapter five provides closure for the study. This section presents practical applications of the findings, suggestions for additional research, and concluding remarks.

Implications for Action.

As stated in chapter one, school districts face difficult decisions as they search for ways to increase educational effectiveness while meeting the ever increasing demands to improve student achievement as mandated by NCLB and operate more efficiently as financial resources provided by state and local governments continue to decline. The findings of this study reveal that under certain conditions, districts may be able to address both issues of improved educational effectiveness and efficiency through consolidation and creation of larger schools. As was indicated in chapter four, higher student achievement was found in very large schools at nearly every grade-level and content area tested in the current study. However, the variables of location, ethnicity, poverty, and special education impacted the aforementioned findings with differing degrees of significance dependent on the grade-level and content area tested. Thus, it is important for policy makers, educational leaders, and communities to examine critically the complexities of the environment in which schools operate on an individual basis in order to make informed decisions about appropriate school size.

Findings of the current study revealed higher levels of student achievement in both communication arts and mathematics in very large elementary and middle schools. These findings have significant implications for small schools in the state of Missouri. As the state continues to withhold appropriations and reduce budgeted expenditures for public schools, legislators will likely examine the economic efficiency and ultimate viability of continuing to fund the Small Schools Grant that has kept most small school districts in the state from consolidation or closure. Specifically, the findings of the current study call into question the effectiveness and efficiency of Missouri's 74 K-8 school districts. With an average enrollment of 186 students, the K-8 school districts in the state represent a prime target for consolidation (Missouri DESE, 2010b).

Additionally, as local school districts consider facility utilization, renovation, and construction, the findings of the current study suggest that school leaders, local boards of education, and communities consider creating larger elementary and middle schools to maximize student achievement. The findings are consistent with recent construction trends toward building larger elementary and middle schools. According to Abramson (2011), the national median size for new elementary schools constructed in 2010 was 600 students while the median size for new middle schools constructed in 2010 was 936 students. However, the median size of newly constructed elementary and middle schools in 2010 for Region 8 (Iowa, Kansas, Missouri, and Nebraska) was significantly smaller than the national median size (Abramson, 2011). New elementary schools constructed in Region 8 averaged only 450 students, while newly constructed middle schools in Region 8 averaged 750 students (Abramson, 2011). Comparatively, the sizes of newly constructed elementary and middle schools in Region 8 were among the smallest in the nation (Abramson, 2011). Thus, considering the findings of the study, school leaders, local boards of education, and communities would be wise to consider building larger elementary and middle schools.

The current study's findings of higher levels of student achievement in larger high schools also have significant implications for consolidation in the state of Missouri. Over 40% of high schools in Missouri have fewer than 270 students (Missouri DESE, 2010b). Similar to the plight of the small K-8 districts in Missouri, small high schools in the state have also depended on the Small Schools Grant to provide the funding necessary to prevent consolidation or closure. Considering the current study's findings, local district leaders, boards of education, and communities may find it useful to reevaluate the effectiveness and efficiency of small high schools. Such suggestions are consistent with national pubic school construction trends. According to Abramson (2011), the national median size of newly constructed high schools in 2010 topped 1600 students. However, in Region 8 (Iowa, Kansas, Missouri, Nebraska), the median size of newly constructed high schools was half of the national median and the smallest in the nation at 750 students (Abramson, 2011). However, at the high school level, considering the current study's findings regarding the impact of high ethnicity, high poverty, and high special education on achievement in large high schools, school leaders in such schools would be wise to consider restructuring initiatives allowing for school-within-a-school configurations to create smaller learning environments that are more responsive to the individual needs of more vulnerable student populations. In addition, school leaders should also be cognizant of the demographics of the student populations of individual school buildings when creating school boundaries as to not create inherent inequities.

Recommendations for Future Research.

While the current study examined the relationship between elementary, middle, and high school size and student achievement and the impact of location, ethnicity, poverty, and special education on the relationship for elementary, middle, and high schools in the state of Missouri and added to the current research on school size and student achievement, additional research is needed in several areas due to mixed results:

1. Replicate the current study using data from other states to determine if the findings of the current study are mirrored in other states.
2. Replicate the current study using longitudinal data to assess the relationship between school size and student achievement over time.
3. Conduct additional causal-comparative studies on the relationship between middle school size and student achievement to expand the research base as much of the current literature focuses on elementary and high school size.
4. Use additional independent variables that may impact the relationship between school size and student achievement to determine if other input and output factors affect the relationship. Potential independent variables include pupil-teacher ratio, per pupil expenditure, and percentage of English language learners. Additionally, independent student variables such as gender,

discipline incidences, participation in extracurricular activities, attendance rate, graduation and dropout rates, and GPA could be utilized.

5. Use additional dependent variables to determine if the relationship between school size and student achievement changes based on the measure of student achievement. For example: student scores on ACT, SAT, and Advanced Placement tests.
6. Conduct qualitative research using interviews, observations, and focus groups to determine if different instructional methods impact the relationship between school size and student achievement.

Concluding Remarks.

The study examined the relationship between Missouri elementary, middle, and high school size and student achievement on the MAP assessment. The data were also analyzed to determine the impact of location, ethnicity, poverty, and special education on the relationship. Analysis revealed higher levels of student achievement in elementary schools with enrollments of more than 503 students, middle schools with enrollments of more than 755 students, and high school with enrollments of more than 1041 students. However, other factors such as location, ethnicity, poverty, and special education of the school challenged the assertion that a singular school size maximizes student achievement for all students. Optimal school size cannot be determined with a one-size-fits-all approach. Rather, policy makers, school leaders, local boards of education, and communities must assess the unique characteristics of an individual school in order to determine the appropriate school size that adequately addresses the needs of the school's clientele.

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Appendices

Appendix A: Schools Excluded from the Sample

Schools Excluded from the Sample

District Name	School Name	Exclusion Justification
Sikeston R-6	5th And 6th Grade Center	Grade 8 Not In Middle School Grade Span
Academie Lafayette	Academie Lafayette	Charter School
Kansas City 33	Ace Collegium 6 At Southeast	Grade 8 Not In Middle School Grade Span
Specl. Sch. Dst. St. Louis Co.	Ackerman School	Alternative Educational Facility
Adrian R-III	Adrian Sr. High	Unclassified Grade Span
Allen Village	Allen Village School	Charter School
Cape Girardeau 63	Alma Schrader Elementary	Grade 5 Not In Elementary Grade Span
Alta Vista Charter Sch.	Alta Vista Charter School	Charter School
Columbia 93	Ann Hawkins Gentry Middle	Grade 8 Not In Middle School Grade Span
Appleton City R-II	Appleton City High	Unclassified Grade Span
Arcadia Valley R-II	Arcadia Valley Elementary	Grade 5 Not In Elementary Grade Span
Ava R-I	Ava Elementary	Grade 5 Not In Elementary Grade Span
MI Schls For The Sev Disabled	B W Robinson School	State Special Education School
MO Schls For The Sev Disabled	B W Sheperd School	State Special Education School
B. Banneker Academy	B. Banneker Academy	Charter School
Bakersfield R-IV	Bakersfield High	Unclassified Grade Span
Normandy	Bel-Nor Elementary	Grade 5 Not In Elementary Grade Span
Normandy	Bel-Ridge Elementary	Grade 8 Not In Middle School Grade Span
Belton 124	Belton-Ozanam Southland Cooperative	Alternative Educational Facility
Neosho R-V	Benton Elementary	Grade 5 Not In Elementary Grade Span
St. Louis City	Big Picture Middle & High @ NW	Alternative Educational Facility
Wellston	Bishop Middle	Grade 8 Not In Middle School Grade Span
Blair Oaks R-II	Blair Oaks Elementary	Grade 5 Not In Elementary Grade Span
Cape Girardeau 63	Blanchard Elementary	Grade 5 Not In Elementary Grade Span
Blue Eye R-V	Blue Eye Elementary	Grade 5 Not In Elementary Grade Span
Fort Osage R-I	Blue Hills Elementary	Grade 5 Not In Elementary Grade Span
Lebanon R-III	Boswell Elementary	Grade 8 Not In Middle School Grade Span
Crawford Co. R-I	Bourbon Elementary	Grade 5 Not In Elementary Grade Span
Branson R-IV	Branson Elementary East	Grade 5 Not In Elementary Grade Span
Branson R-IV	Branson Elementary West	Grade 5 Not In Elementary Grade Span
Branson R-IV	Branson Intermediate	Grade 8 Not In Middle School Grade Span
Northwest R-I	Brennan Woods Elementary	Grade 5 Not In Elementary Grade Span
Specl. Sch. Dst. St. Louis Co.	Bridges Program	Alternative Educational Facility
Raymore-Peculiar R-II	Bridle Ridge Intermediate	Grade 8 Not In Middle School Grade Span
Brookfield R-III	Brookfield Elementary	Grade 5 Not In Elementary Grade Span
Brookside Charter Sch.	Brookside Charter School	Charter School
Brookside Charter Sch.	Brookside Frontier Math/Science	Charter School
Fort Osage R-I	Buckner Elementary	Grade 5 Not In Elementary Grade Span
Cabool R-IV	Cabool Elementary	Grade 5 Not In Elementary Grade Span
Belton 124	Cambridge Elementary	Grade 5 Not In Elementary Grade Span
Carl Junction R-I	Carl Junction Intermediate	Grade 8 Not In Middle School Grade Span
Carl Junction R-I	Carl Junction Primary 2-3	Grade 5 Not In Elementary Grade Span
Carl Junction R-I	Carl Junction Satellite	Alternative Educational Facility
Paideia Academy	Carondelet Campus	Charter School
Carrollton R-VII	Carrollton Elementary School	Grade 5 Not In Elementary Grade Span
Webb City R-VII	Carterville Elementary	Grade 5 Not In Elementary Grade Span
Carthage R-IX	Carthage Middle School	Grade 8 Not In Middle School Grade Span
Northwest R-I	Cedar Hill Intermediate	Grade 8 Not In Middle School Grade Span
Northwest R-I	Cedar Springs Elementary	Grade 5 Not In Elementary Grade Span
Center 58	Center Alternative	Alternative Educational Facility
Chillicothe R-II	Central Elementary	Grade 8 Not In Middle School Grade Span
Neosho R-V	Central Elementary	Grade 5 Not In Elementary Grade Span
Union R-XI	Central Elementary	Grade 5 Not In Elementary Grade Span
Wellston	Central Elementary	Grade 5 Not In Elementary Grade Span
Springfield R-XII	Central High	Unclassified Grade Span
Cape Girardeau 63	Central Middle	Grade 8 Not In Middle School Grade Span
Monett R-I	Central Park Elementary	Grade 5 Not In Elementary Grade Span
Nixa R-II	Century Elementary	Grade 5 Not In Elementary Grade Span
City Garden Montessori	City Garden Montessori Charter	Charter School
Elsberry R-II	Clarence Cannon Elementary	Grade 5 Not In Elementary Grade Span
Union R-XI	Clark-Vitt Elementary	Grade 8 Not In Middle School Grade Span
Clearwater R-I	Clearwater Elementary	Grade 5 Not In Elementary Grade Span

District Name	School Name	Exclusion Justification
Fort Osage R-I	Cler-Mont Elementary	Grade 5 Not In Elementary Grade Span
Clever R-V	Clever Elementary	Grade 5 Not In Elementary Grade Span
Clever R-V	Clever Upper Elementary	Grade 8 Not In Middle School Grade Span
Cape Girardeau 63	Clippard Elementary	Grade 5 Not In Elementary Grade Span
Rolla 31	Col. John B. Wyman Elementary	Grade 5 Not In Elementary Grade Span
Paideia Academy	College Hill Campus	Charter School
Carthage R-IX	Columbian Elementary	Grade 5 Not In Elementary Grade Span
Community R-VI	Community High	Unclassified Grade Span
Confluence Academies	Confluence Preparatory Academy	Charter School
Construction Careers Center	Construction Careers Center	Charter School
St. Charles R-VI	Coverdell Elementary	Grade 5 Not In Elementary Grade Span
Kansas City 33	Cr Anderson Alt Hs At Fairview	Alternative Educational Facility
Crane R-III	Crane Elementary	Grade 5 Not In Elementary Grade Span
Raymore-Peculiar R-II	Creekmoor Elementary	Grade 5 Not In Elementary Grade Span
Hickman Mills C-1	Crittenton Treatment Center	Alternative Educational Facility
Crawford Co. R-II	Cuba Elementary	Grade 5 Not In Elementary Grade Span
Marshfield R-I	Daniel Webster Elementary	Grade 5 Not In Elementary Grade Span
Springfield R-XII	David Harrison Elementary	Grade 5 Not In Elementary Grade Span
Hickman Mills C-1	Day Treatment	Alternative Educational Facility
Independence 30	Day Treatment	Alternative Educational Facility
Della Lamb Elementary	Della Lamb Elementary	Charter School
Derrick Thomas Academy	Derrick Thomas Elementary Academy	Charter School
Derrick Thomas Academy	Derrick Thomas Jr. Academy	Charter School
Diamond R-IV	Diamond Elementary	Grade 5 Not In Elementary Grade Span
Don Bosco Education Ctr.	Don Bosco Education Center	Charter School
Platte Co. R-III	Donald D. Siegrist Elementary	Grade 5 Not In Elementary Grade Span
Ethel Hedgeman Lyle Academy	E H Lyle Middle/High	Charter School
Raymore-Peculiar R-II	Eagle Glen Intermediate	Grade 8 Not In Middle School Grade Span
Ozark R-VI	East Elementary	Grade 5 Not In Elementary Grade Span
Marshall	Eastwood Elementary	Grade 5 Not In Elementary Grade Span
Eldon R-I	Eldon Upper Elementary	Grade 8 Not In Middle School Grade Span
St. Louis City	Elias Michael Elementary	Alternative Educational Facility
Clinton Co. R-III	Ellis Elementary	Grade 5 Not In Elementary Grade Span
Fort Osage R-I	Elm Grove Elementary	Grade 5 Not In Elementary Grade Span
Nixa R-II	Espy Elementary	Grade 5 Not In Elementary Grade Span
Ethel Hedgeman Lyle Academy	Ethel Hedgeman Lyle Academy	Charter School
Maryville R-II	Eugene Field Elementary	Grade 5 Not In Elementary Grade Span
Poplar Bluff R-I	Eugene Field Elementary	Grade 5 Not In Elementary Grade Span
Webb City R-VII	Eugene Field Elementary	Grade 5 Not In Elementary Grade Span
St. Louis City	External Location	Facility Closed
Specl. Sch. Dst. St. Louis Co.	External Sites	Alternative Educational Facility
Fair Grove R-X	Fair Grove Elementary	Grade 5 Not In Elementary Grade Span
Carthage R-IX	Fairview Elementary	Grade 5 Not In Elementary Grade Span
Jennings	Fairview Intermediate	Grade 8 Not In Middle School Grade Span
Jennings	Fairview Primary	Grade 5 Not In Elementary Grade Span
Parkway C-2	Fern Ridge High	Alternative Educational Facility
Festus R-VI	Festus Elementary	Grade 5 Not In Elementary Grade Span
Festus R-VI	Festus Intermediate	Grade 8 Not In Middle School Grade Span
Chillicothe R-II	Field Elementary	Grade 5 Not In Elementary Grade Span
Fort Osage R-I	Fire Prairie Middle	Grade 8 Not In Middle School Grade Span
Forsyth R-III	Forsyth Elementary	Grade 5 Not In Elementary Grade Span
Francis Howell R-III	Francis Howell Union High	Alternative Educational Facility
Cape Girardeau 63	Franklin Elementary	Grade 5 Not In Elementary Grade Span
Columbia 93	Frederick Douglass High	Alternative Educational Facility
Frontier School Of Innovation	Frontier School Of Innovation	Charter School
Ft. Zumwalt R-II	Ft. Zumwalt Hope High	Alternative Educational Facility
St. Louis City	Gallaudet School For Deaf Elementary	Alternative Educational Facility
Jennings	Gary Gore Elementary	Grade 8 Not In Middle School Grade Span
MO Schls For The Sev Disabled	Gateway/Hubert Wheeler School	State Special Education School
Genesis School Inc.	Genesis School Inc.	Charter School
St. Charles R-VI	George M. Null Elementary	Grade 5 Not In Elementary Grade Span
Neosho R-V	George Washington Carver Elementary	Grade 5 Not In Elementary Grade Span
Belton 124	Gladden Elementary	Grade 5 Not In Elementary Grade Span
Neosho R-V	Goodman Elementary	Grade 5 Not In Elementary Grade Span
Gordon Parks Elementary	Gordon Parks Elementary	Charter School

District Name	School Name	Exclusion Justification
Springfield R-XII	Gray Elementary	Grade 5 Not In Elementary Grade Span
MO Schls For The Sev Disabled	Greene Valley School	State Special Education School
St. Louis City	Griscom Detention Center	Alternative Educational Facility
St. Charles R-VI	Harris Elementary	Grade 5 Not In Elementary Grade Span
Harrisonville R-IX	Harrisonville Elementary	Grade 5 Not In Elementary Grade Span
Rolla 31	Harry S. Truman Elementary	Grade 5 Not In Elementary Grade Span
Webb City R-VII	Harry S. Truman Elementary	Grade 5 Not In Elementary Grade Span
Camdenton R-III	Hawthorn Elementary	Grade 5 Not In Elementary Grade Span
Nevada R-V	Heartland R-V School	Alternative Educational Facility
Sedalia 200	Heber Hunt Elementary	Grade 5 Not In Elementary Grade Span
MO Schls For The Sev Disabled	Helen M Davis School	State Special Education School
Gasconade Co. R-I	Hermann Elementary	Grade 5 Not In Elementary Grade Span
Nixa R-II	High Pointe Elementary	Grade 5 Not In Elementary Grade Span
Northwest R-I	High Ridge Elementary	Grade 5 Not In Elementary Grade Span
Belton 124	Hillcrest Elementary	Grade 5 Not In Elementary Grade Span
Lebanon R-III	Hillcrest School	Grade 8 Not In Middle School Grade Span
Hillsboro R-III	Hillsboro Elementary	Grade 5 Not In Elementary Grade Span
Hillsboro R-III	Hillsboro Middle Elementary	Grade 8 Not In Middle School Grade Span
Lee's Summit R-VII	Hilltop School	Alternative Educational Facility
Specl. Sch. Dst. St. Louis Co.	Hiram Neuwoehner	Alternative Educational Facility
Hogan Preparatory Academy	Hogan Preparatory Academy	Charter School
Hollister R-V	Hollister Elementary	Grade 5 Not In Elementary Grade Span
Hollister R-V	Hollister Middle	Grade 8 Not In Middle School Grade Span
Hope Academy	Hope Academy	Charter School
Sedalia 200	Horace Mann Elementary	Grade 5 Not In Elementary Grade Span
Northwest R-I	House Springs Elementary	Grade 5 Not In Elementary Grade Span
Northwest R-I	House Springs Intermediate	Grade 8 Not In Middle School Grade Span
Hume R-VIII	Hume High	Unclassified Grade Span
Hurley R-I	Hurley High	Unclassified Grade Span
Camdenton R-III	Hurricane Deck Elementary	Grade 5 Not In Elementary Grade Span
Imagine Acad. Academic Success	Ia Of Academic Success	Charter School
Imagine Academy Of Careers	Ia Of Careers Elementary	Charter School
Imagine Academy Of Careers	Ia Of Careers Middle	Charter School
Imagine Academy Es And Math	Ia Of Environ. Science/Math	Charter School
Imagine Academy Of Careers	Imagine College Prep. High	Charter School
Independence 30	Independence Academy	Alternative Educational Facility
Fort Osage R-I	Indian Trails Elementary	Grade 5 Not In Elementary Grade Span
North St. Francois Co. R-I	Intermediate School	Grade 8 Not In Middle School Grade Span
Jackson R-II	Jackson Middle	Grade 8 Not In Middle School Grade Span
Windsor C-1	James E. Freer Elementary	Grade 5 Not In Elementary Grade Span
Cape Girardeau 63	Jefferson Elementary	Grade 5 Not In Elementary Grade Span
Farmington R-VII	Jefferson Elementary	Grade 5 Not In Elementary Grade Span
St. Charles R-VI	Jefferson Middle	Grade 8 Not In Middle School Grade Span
Columbia 93	John B. Lange Middle	Grade 8 Not In Middle School Grade Span
Nixa R-II	John Thomas Elementary	Grade 5 Not In Elementary Grade Span
Specl. Sch. Dst. St. Louis Co.	Juvenile Detention Center	Alternative Educational Facility
Kansas City 33	K. C. Job Corps Alternative	Alternative Educational Facility
Kearney R-I	Kearney Middle	Grade 8 Not In Middle School Grade Span
Jennings	Kenneth C. Hanrahan Elementary	Grade 8 Not In Middle School Grade Span
Imagine Ren Acad Env Sci & Ma	Kensington Campus	Charter School
Belton 124	Kentucky Trail Elementary	Grade 5 Not In Elementary Grade Span
Kipp St Louis	Kipp Inspire Academy	Charter School
Kipp: Endeavor Academy	Kipp: Endeavor Academy	Charter School
Kirbyville R-VI	Kirbyville Elementary	Grade 5 Not In Elementary Grade Span
Poplar Bluff R-I	Lake Road Elementary	Grade 5 Not In Elementary Grade Span
MO Schls For The Sev Disabled	Lakeview Woods School	State Special Education School
Lee A. Tolbert Com. Academy	Lee A. Tolbert Com. Academy	Charter School
Sikeston R-6	Lee Hunter Elementary	Grade 5 Not In Elementary Grade Span
Lexington R-V	Leslie Bell Elementary	Grade 5 Not In Elementary Grade Span
Liberty 53	Liberty Middle School	Grade 8 Not In Middle School Grade Span
Lift For Life Academy	Lift For Life Academy	Charter School
Kansas City 33	Lincoln College Prep.	Unclassified Grade Span
St. Charles R-VI	Lincoln Elementary	Grade 5 Not In Elementary Grade Span
Farmington R-VII	Lincoln Intermediate	Grade 8 Not In Middle School Grade Span
Linn Co. R-I	Linn Co. High	Unclassified Grade Span

District Name	School Name	Exclusion Justification
Specl. Sch. Dst. St. Louis Co.	Litzsinger	Alternative Educational Facility
Logan-Rogersville R-VIII	Logan-Rogersville Elementary	Grade 5 Not In Elementary Grade Span
Logan-Rogersville R-VIII	Logan-Rogersville Upper Elementary	Grade 8 Not In Middle School Grade Span
Dallas Co. R-I	Long Lane Elementary	Grade 5 Not In Elementary Grade Span
Dallas Co. R-I	Mallory Elementary	Grade 5 Not In Elementary Grade Span
Malta Bend R-V	Malta Bend High	Unclassified Grade Span
Northwest R-I	Maple Grove Elementary	Grade 5 Not In Elementary Grade Span
MO Schls For The Sev Disabled	Maple Valley School	State Special Education School
Lebanon R-III	Maplecrest Elementary	Grade 5 Not In Elementary Grade Span
Marion C. Early R-V	Marion C. Early High	Unclassified Grade Span
Carthage R-IX	Mark Twain Elementary	Grade 5 Not In Elementary Grade Span
Rolla 31	Mark Twain Elementary	Grade 5 Not In Elementary Grade Span
Webb City R-VII	Mark Twain Elementary	Grade 5 Not In Elementary Grade Span
Warrensburg R-VI	Martin Warren Elementary	Grade 5 Not In Elementary Grade Span
Nixa R-II	Mathews Elementary	Grade 5 Not In Elementary Grade Span
Hayti R-II	Mathis Elementary	Grade 5 Not In Elementary Grade Span
Sikeston R-6	Matthews Elementary	Grade 5 Not In Elementary Grade Span
Springfield R-XII	Mcbride Elementary	Grade 5 Not In Elementary Grade Span
Fort Osage R-I	Mccune School For Boys	Alternative Educational Facility
Harrisonville R-IX	Mceowen Elementary	Grade 8 Not In Middle School Grade Span
Meramec Valley R-III	Meramec Valley Middle	Grade 8 Not In Middle School Grade Span
Neosho R-V	Middle School	Grade 8 Not In Middle School Grade Span
Milan C-2	Milan Elementary	Grade 5 Not In Elementary Grade Span
Belton 124	Mill Creek Upper Elementary	Grade 8 Not In Middle School Grade Span
Jackson R-II	Millersville Attendance Center	Grade 5 Not In Elementary Grade Span
Monett R-I	Monett Intermediate	Grade 8 Not In Middle School Grade Span
Monroe City R-I	Monroe City Elementary	Grade 5 Not In Elementary Grade Span
St. Charles R-VI	Monroe Elementary	Grade 5 Not In Elementary Grade Span
Montrose R-XIV	Montrose High	Alternative Educational Facility
Sikeston R-6	Morehouse Elementary	Grade 5 Not In Elementary Grade Span
Morgan Co. R-I	Morgan Co. R-I Elementary	Grade 5 Not In Elementary Grade Span
Mound City R-II	Mound City Elementary	Grade 5 Not In Elementary Grade Span
Mountain Grove R-III	Mountain Grove Elementary	Grade 5 Not In Elementary Grade Span
MO School For The Blind	MSB Elementary	State Special Education School
MO School For The Blind	MSB High	State Special Education School
Northwest R-I	Murphy Elementary	Grade 5 Not In Elementary Grade Span
MO Schls For The Sev Disabled	New Dawn School	State Special Education School
New Franklin R-I	New Franklin Middle-High	Unclassified Grade Span
Nixa R-Ii	Nicholas A. Inman Elementary	Grade 8 Not In Middle School Grade Span
Norborne R-VIII	Norborne High	Unclassified Grade Span
North St. Francois Co. R-I	North County Parkside Elementary	Grade 5 Not In Elementary Grade Span
Ozark R-Vi	North Elementary	Grade 5 Not In Elementary Grade Span
North Harrison R-Iii	North Harrison High	Unclassified Grade Span
Northwest R-I	North Jefferson Intermediate	Grade 8 Not In Middle School Grade Span
North Nodaway Co. R-VI	North Nodaway Jr.-Sr. High	Unclassified Grade Span
North Pemiscot Co. R-I	North Pemiscot Sr. High	Unclassified Grade Span
North Platte Co. R-I	North Platte Elementary	Grade 5 Not In Elementary Grade Span
North Platte Co. R-I	North Platte Intermediate	Grade 8 Not In Middle School Grade Span
Specl. Sch. Dst. St. Louis Co.	North Technical	Alternative Educational Facility
Northeast Randolph Co. R-IV	Northeast High	Unclassified Grade Span
Specl. Sch. Dst. St. Louis Co.	Northview	Alternative Educational Facility
Jennings	Northview Elementary	Grade 5 Not In Elementary Grade Span
Marshall	Northwest Elementary	Grade 5 Not In Elementary Grade Span
Poplar Bluff R-I	O'neal Elementary	Grade 5 Not In Elementary Grade Span
Poplar Bluff R-I	Oak Grove Elementary	Grade 5 Not In Elementary Grade Span
Camdenton R-III	Oak Ridge Intermediate	Grade 8 Not In Middle School Grade Span
Confluence Academies	Old North	Charter School
Jackson R-II	Orchard Drive Elementary	Grade 5 Not In Elementary Grade Span
Camdenton R-III	Osage Beach Elementary	Grade 5 Not In Elementary Grade Span
Palmyra R-I	Palmyra Elementary	Grade 5 Not In Elementary Grade Span
Park Hill	Park Hill Day School	Alternative Educational Facility
Cameron R-I	Parkview Elementary	Grade 5 Not In Elementary Grade Span
Sedalia 200	Parkview Elementary	Grade 5 Not In Elementary Grade Span
Pathway Academy	Pathway Academic Elementary	Charter School
Pathway Academy	Pathway Academic Middle	Charter School

District Name	School Name	Exclusion Justification
Platte Co. R-III	Paxton School	Grade 8 Not In Middle School Grade Span
Raymore-Peculiar R-II	Peculiar Elementary	Grade 5 Not In Elementary Grade Span
Perry Co. 32	Perryville Elementary	Grade 5 Not In Elementary Grade Span
Dunklin R-V	Pevely Elementary	Grade 5 Not In Elementary Grade Span
Plato R-V	Plato High	Unclassified Grade Span
Park Hill	Plaza Middle	Grade 8 Not In Middle School Grade Span
Pleasant Hill R-III	Pleasant Hill Elementary	Grade 5 Not In Elementary Grade Span
Pleasant Hill R-III	Pleasant Hill Intermediate	Grade 8 Not In Middle School Grade Span
Pleasant Hope R-VI	Pleasant Hope Elementary	Grade 5 Not In Elementary Grade Span
Pleasant Hope R-VI	Pleasant Hope Ranch School	Alternative Educational Facility
Carthage R-IX	Pleasant Valley Elementary	Grade 5 Not In Elementary Grade Span
Polo R-VII	Polo Elementary	Grade 5 Not In Elementary Grade Span
Poplar Bluff R-I	Poplar Bluff 5th & 6th Center	Grade 8 Not In Middle School Grade Span
Potosi R-III	Potosi Elementary	Grade 5 Not In Elementary Grade Span
Purdy R-II	Purdy Elementary	Grade 5 Not In Elementary Grade Span
Kansas City 33	R. J. Delano	Alternative Educational Facility
Raymore-Peculiar R-II	Raymore Elementary	Grade 5 Not In Elementary Grade Span
Warren Co. R-III	Rebecca Boone Elementary	Grade 8 Not In Middle School Grade Span
Reeds Spring R-IV	Reeds Spring Elementary	Grade 5 Not In Elementary Grade Span
Reeds Spring R-IV	Reeds Spring Intermediate	Grade 8 Not In Middle School Grade Span
Republic R-III	Republic Elementary II	Grade 5 Not In Elementary Grade Span
Republic R-III	Republic Elementary III	Grade 8 Not In Middle School Grade Span
Rich Hill R-IV	Rich Hill High	Unclassified Grade Span
Warrensburg R-VI	Ridge View Elementary	Grade 5 Not In Elementary Grade Span
Trenton R-IX	Rissler Elementary	Grade 5 Not In Elementary Grade Span
Aurora R-VII	Robinson Elementary	Grade 5 Not In Elementary Grade Span
Aurora R-VIII	Robinson Intermediate	Grade 8 Not In Middle School Grade Span
Rolla 31	Rolla Middle	Grade 8 Not In Middle School Grade Span
Farmington R-VII	Roosevelt Elementary	Grade 5 Not In Elementary Grade Span
Sarcoxie R-II	Sarcoxie High	Unclassified Grade Span
Scott City R-I	Scott City Elementary	Grade 5 Not In Elementary Grade Span
Belton 124	Scott Elementary	Grade 5 Not In Elementary Grade Span
Scuola Vita Nuova	Scuola Vita Nuova Charter	Charter School
Sedalia 200	Sedalia Middle School	Grade 8 Not In Middle School Grade Span
Senath-Hornersville C-8	Senath Elementary	Grade 5 Not In Elementary Grade Span
Marshfield R-I	Shook Elementary	Grade 8 Not In Middle School Grade Span
Raymore-Peculiar R-II	Shull Elementary	Grade 5 Not In Elementary Grade Span
Hickory Co. R-I	Skyline Elementary	Grade 5 Not In Elementary Grade Span
Sedalia 200	Skyline Elementary	Grade 5 Not In Elementary Grade Span
Columbia 93	Smithton Middle	Grade 8 Not In Middle School Grade Span
Confluence Academies	South City	Charter School
Eldon R-I	South Elementary	Grade 5 Not In Elementary Grade Span
Neosho R-V	South Elementary	Grade 5 Not In Elementary Grade Span
Ozark R-VI	South Elementary	Grade 5 Not In Elementary Grade Span
Liberty 53	South Valley Middle	Grade 8 Not In Middle School Grade Span
Sikeston R-6	Southeast Elementary	Grade 5 Not In Elementary Grade Span
Specl. Sch. Dst. St. Louis Co.	Southview	Alternative Educational Facility
Kansas City 33	Southwest Early College Campus	Unclassified Grade Span
Lawson R-XIV	Southwest Elementary	Grade 5 Not In Elementary Grade Span
Southwest R-V	Southwest Elementary	Grade 5 Not In Elementary Grade Span
Hickman Mills C-1	Spofford Treatment Center	Alternative Educational Facility
St. Louis Charter School	St. Louis Charter School	Charter School
MO School For The Deaf	Stark Elementary	State Special Education School
Carthage R-IX	Steadley Elementary	Grade 5 Not In Elementary Grade Span
Steelville R-Iii	Steelville Elementary	Grade 5 Not In Elementary Grade Span
Webster Groves	Steger Sixth Grade Center	Grade 8 Not In Middle School Grade Span
Warrensburg R-VU	Sterling Elementary	Grade 8 Not In Middle School Grade Span
Stockton R-I	Stockton Elementary	Grade 5 Not In Elementary Grade Span
Raymore-Peculiar R-II	Stonegate Elementary	Grade 5 Not In Elementary Grade Span
Strafford R-VI	Strafford Elementary	Grade 5 Not In Elementary Grade Span
Sturgeon R-V	Sturgeon Elementary	Grade 5 Not In Elementary Grade Span
Kansas City 33	Teenage Parents Center	Alternative Educational Facility
Raymore-Peculiar R-II	Timber Creek Elementary	Grade 5 Not In Elementary Grade Span
Lee A. Tolbert Com. Academy	Tolbert Preparatory Academy	Charter School
Potosi R-III	Trojan Intermediate	Grade 8 Not In Middle School Grade Span

District Name	School Name	Exclusion Justification
University Academy	University Academy-Lower	Charter School
University Academy	University Academy-Middle	Charter School
University Academy	University Academy-Upper	Charter School
Ozark R-VI	Upper Elementary	Grade 8 Not In Middle School Grade Span
Urban Com. Leadership Academy	Urban Com. Leadership Academy	Charter School
Van Buren R-I	Van Buren High	Unclassified Grade Span
MO Schls For The Sev Disabled	Verelle Peniston School	State Special Education School
Imagine Ren Acad Env Sci & Ma	Wallace Campus	Charter School
Hayti R-II	Wallace Elementary	Grade 8 Not In Middle School Grade Span
Confluence Academies	Walnut Park	Charter School
Warren Co. R-III	Warrior Ridge Elementary	Grade 5 Not In Elementary Grade Span
Sedalia 200	Washington Elementary	Grade 5 Not In Elementary Grade Span
Farmington R-VII	Washington-Franklin Elementary	Grade 5 Not In Elementary Grade Span
Webb City R-VII	Webb City Middle	Grade 8 Not In Middle School Grade Span
Ozark R-VI	West Elementary	Grade 5 Not In Elementary Grade Span
West Plains R-VII	West Plains Elementary	Grade 5 Not In Elementary Grade Span
MO School For The Deaf	Wheeler High	State Special Education School
MO School For The Deaf	Wheeler Middle	State Special Education School
Willard R-II	Willard Central Elementary	Grade 5 Not In Elementary Grade Span
Willard R-II	Willard East Elementary	Grade 5 Not In Elementary Grade Span
Willard R-II	Willard Intermediate	Grade 8 Not In Middle School Grade Span
Willard R-II	Willard North Elementary	Grade 5 Not In Elementary Grade Span
Willard R-Ii	Willard Orchard Hills Elem	Grade 5 Not In Elementary Grade Span
Willard R-II	Willard South Elementary	Grade 5 Not In Elementary Grade Span
Willow Springs R-IV	Willow Springs Elementary	Grade 5 Not In Elementary Grade Span
Springfield R-XII	Wilson's Creek 5-6 Inter. Center	Grade 8 Not In Middle School Grade Span
Jennings	Woodland Elementary	Grade 5 Not In Elementary Grade Span
Woodland R-IV	Woodland Elementary	Grade 5 Not In Elementary Grade Span

Note. *Grade 5 Not In Elementary Grade Span* and *Grade 8 Not in Middle School Grad Span* reflect schools that were excluded because the school did include the specific grade necessary for inclusion in the sample. *Unclassified Grade Span* refers to a school with a grade span outside of the criteria for elementary, middle, or high school as defined by the 2008 U.S. Department of Education Common Core of Data Glossary. *Charter Schools* are “independent public schools that are free from rules and regulations that apply to traditional public school districts unless specifically identified in charter school law” (Missouri DESE, 2011a, para 1) operating in Kansas City and St. Louis. *State Special Education Schools* comprise schools administered by the Missouri State Board of Education for students at the Missouri School for the Deaf, Missouri School for the Blind, and Missouri Schools for the Severely Disabled (Missouri DESE, 2011b). *Alternative Educational Facilities* refer to schools serving non-traditional student enrollments in programs for career and technical training, behavior modification, credit-recovery, drug treatment and rehabilitation, in-patient treatment and hospitalization, intensive special education, and juvenile offender incarceration.

Appendix B: IRB Application

BAKER UNIVERSITY

Date: February 8, 2011

SCHOOL OF EDUCATION
GRADUATE DEPARTMENT

IRB PROTOCOL NUMBER ______________
(IRB USE ONLY)

IRB REQUEST
Proposal for Research
Submitted to the Baker University Institutional Review Board

I. Research Investigator(s) (Students must list faculty sponsor first)

Department(s) **School of Education Graduate Department**

Name	Signature	
1. Dr. Susan Rogers	[signature]	Major Advisor
2. Ms. Margaret Waterman	[signature]	Research Analyst
3.		University Committee Member
4.		External Committee Member

Principal Investigator: Corey D. Vorthmann [signature]
Phone: 816-244-9453
Email: corey.vorthmann@gmail.com
Mailing address: 2802 Meadow Ridge Drive, St. Joseph, MO 64054

Faculty sponsor: Dr. Susan Rogers
Phone: 913-344-1226
Email: susan.rogers@bakeru.edu
Expected Category of Review: __X__ Exempt ____Expedited ____Full

II: Protocol Title
The Relationship Between School Size and Student Achievement in Missouri

Summary
The following summary must accompany the proposal. Be specific about exactly what participants will experience, and about the protections that have been included to safeguard participants from harm. Careful attention to the following may help facilitate the review process:

In a sentence or two, please describe the background and purpose of the research.
The purpose of this study is to examine the extent to which a relationship exists between the size of public schools in Missouri and student achievement as measured by the Missouri Assessment Program (MAP) test. A second purpose of the study is to determine if the relationship is affected by student ethnicity, poverty, and special education status in addition to the geographic location and pupil-teacher ratio of the school.

Briefly describe each condition or manipulation to be included within the study.
There are no conditions or manipulation included in the study.

What measures or observations will be taken in the study? If any questionnaire or other instruments are used, provide a brief description and attach a copy.
Student achievement will be measured using 2010 MAP test data available to the public on the Missouri Department of Elementary and Secondary Education website.

Will the subjects encounter the risk of psychological, social, physical, or legal risk? If so, please describe the nature of the risk and any measures designed to mitigate that risk.
The subjects will not encounter the risk of psychological, social, physical, or legal risk in this study.

Will any stress to subjects be involved? If so, please describe.
Subjects involved in this study will not experience any stress.

Will the subjects be deceived or misled in any way? If so, include an outline or script of the debriefing.
Subjects will not be deceived or misled in this study.

Will there be a request for information that subjects might consider to be personal or sensitive? If so, please include a description.
The data used in this study is examined at the building level and is not personal or sensitive.

Will the subjects be presented with materials that might be considered to be offensive, threatening, or degrading? If so, please describe.
Subjects will not be presented with materials that might be considered offensive, threatening, or degrading.

Approximately how much time will be demanded of each subject?
No time will be demanded of the subjects. The researcher is employing archival data that has been collected by the Missouri Department of Elementary and Secondary Education.

Who will be the subjects in this study? How will they be solicited or contacted? Provide an outline or script of the information which will be provided to subjects prior to their volunteering to participate. Include a copy of any written solicitation as well as an outline of any oral solicitation.
The subjects in this study were all public school buildings in the state of Missouri. There will not be any additional solicitation.

What steps will be taken to ensure that each subject's participation is voluntary? What if any inducements will be offered to the subjects for their participation?
All public school districts in Missouri must provide demographic and student achievement data to the Missouri Department of Elementary and Secondary Education. No additional participation will be necessary for this study.

How will you ensure that the subjects give their consent prior to participating? Will a written consent form be used? If so, include the form. If not, explain why not.
Subjects will not be contacted for this study. All data is public information made available by the Missouri Department of Elementary and Secondary Education.

Will any aspect of the data be made a part of any permanent record that can be identified with the subject? If so, please explain the necessity.
No data will be made a part of any permanent record from this study.

Will the fact that a subject did or did not participate in a specific experiment or study be made part of any permanent record available to a supervisor, teacher or employer? If so, explain.
Archived data will be used for this study. No data will be made part of any permanent record as a result of this study.

What steps will be taken to ensure the confidentiality of the data?
All data given to the researcher will remain confidential and only reviewed by the researcher and the researcher's committee.

If there are any risks involved in the study, are there any offsetting benefits that might accrue to either the subjects or society?
There are no risks involved in this research study.

Will any data from files or archival data be used? If so, please describe.
Yes, all data used in the research study is archival data made available by the Missouri Department of Elementary and Secondary Education.

Appendix C: IRB Approval

2-24-2011

Mr. Cory Vorthmann
School of Education Graduate Department
Baker University

1858
BAKER
UNIVERSITY
Own Confidence

RE: IRB: BU-2011-04: The Relationship Between School Size and Student Achievement in Missouri

Dear Mr. Vorthmann:

The Baker University Institutional Review Board (IRB) has reviewed your research project application (BU-2011-04) and approved this project under the Exempt category. As described, the project complies with all the requirements and policies established by Baker University for protection of human subjects in research. Unless renewed, approval lapses one year after approval date.

1. A Project Status Report must be filed with the IRB annually for continuation.
2. Any significant change in the research protocol must be reviewed and approved by the IRB prior to altering the project.
3. Any change in the investigator(s) named in the original application must be reviewed and approved by the IRB prior to altering the project.
4. Any injury to a subject because of the research procedure must be reported to the IRB immediately.
5. When signed consent forms are required:
    a. the primary investigator must retain the forms until filed,
    b. consent forms must be filed with the OIR with the annual report,
    c. the subject must be given a copy of the form at the time of consent.
6. If this is a funded project, a copy of this letter must be with the grant file.

The Office of Institutional Research (OIR) must be notified when this project is completed or terminated. As noted above, you must provide an annual status report to receive approval for maintaining your project. If your project receives funding which requests an annual update, you must file your annual report at least one month prior to the annual update.

Thanks for your cooperation. If you have questions, please contact me.

Sincerely,

William R. Miller, Ph.D.
Chair, Baker University Institutional Review Board

CC: Susan Rogers, Ph.D., Faculty Supervisor.

P.O. Box 65
Baldwin City, KS 66006
785.594.6451 | 785.594.2522 fax
www.bakerU.edu

Appendix D: Tukey HSD Post Hoc Analyses for H9 through H40

Table D1

MAP Grade 5 Communication Arts Post Hoc Analysis of Elementary School Size and Location

			VS	VS	VS	VS	SM	SM	SM	SM	M	M	M	M	L	L	L	L	VL	VL	VL	VL
			C	S	T	R	C	S	T	R	C	S	T	R	C	S	T	R	C	S	T	R
			39.12	63.30	48.00	48.14	35.97	47.18	49.02	47.78	42.05	55.21	53.37	49.35	45.06	54.93	49.32	54.36	58.44	63.59	51.34	49.27
VS	C	39.12																				
	S	63.30	-24.18																			
	T	48.00	-8.89	15.29																		
	R	48.14	-9.02	15.16	-0.13																	
SM	C	35.97	3.14	27.32	12.03	12.16																
	S	47.18	-8.06	16.12	0.83	0.96	-11.20															
	T	49.02	-9.91	14.27	-1.02	-0.89	-13.05	-1.85														
	R	47.78	-8.66	15.52	0.23	0.36	-11.80	-0.60	1.25													
M	C	42.05	-2.93	21.25	5.96	6.09	-6.07	5.13	6.98	5.73												
	S	55.21	-16.09	8.09	-7.20	-7.07	-19.24	-8.03	-6.19	-7.43	-13.16											
	T	53.37	-14.26	9.92	-5.37	-5.24	-17.40	-6.20	-4.35	-5.60	-11.33	1.83										
	R	49.35	-10.24	13.94	-1.35	-1.22	-13.38	-2.18	-0.33	-1.58	-7.31	5.85	4.02									
L	C	45.06	-5.95	18.23	2.94	3.07	-9.09	2.11	3.96	2.71	-3.02	10.15	8.31	4.29								
	S	54.93	-15.81	8.37	-6.93	-6.79	-18.96	-7.75	-5.91	-7.15	-12.88	0.28	-1.56	-5.58	-9.87							
	T	49.32	-10.20	13.98	-1.31	-1.18	-13.35	-2.14	-0.30	-1.54	-7.27	5.89	4.06	0.04	-4.26	5.61						
	R	54.36	-15.24	8.94	-6.35	-6.22	-18.38	-7.18	-5.34	-6.58	-12.31	0.85	-0.98	-5.00	-9.30	0.57	-5.04					
VL	C	58.44	-19.32	4.86	-10.43	-10.30	-22.46	-11.26	-9.42	-10.66	-16.39	-3.23	-5.06	-9.08	-13.38	-3.51	-9.12	-4.08				
	S	63.59	-24.47	-0.29	-15.58	-15.45	-27.61	-16.41	-14.56	-15.81	-21.54	-8.38	-10.21	-14.23	-18.52	-8.66	-14.27	-9.23	-5.15			
	T	51.34	-12.22	11.96	-3.33	-3.20	-15.37	-4.16	-2.32	-3.56	-9.29	3.87	2.04	-1.98	-6.28	3.59	-2.02	3.02	7.10	12.25		
	R	49.27	-10.16	14.03	-1.27	-1.13	-13.30	-2.09	-0.25	-1.49	-7.22	5.94	4.10	0.08	-4.21	5.66	0.05	5.09	9.17	14.32	2.07	

Note. Tukey's HSD = 16.40. Abbreviations are as follows: Very Small (VS), Small (SM), Medium (M), Large (L), Very Large (VL), City (C), Suburb (S), Town (T), and Rural (R).

Table D2

MAP Grade 5 Mathematics Post Hoc Analysis of Elementary School Size and Location

			VS	VS	VS	VS	SM	SM	SM	SM	M	M	M	M	L	L	L	L	VL	VL	VL	VL
			C	S	T	R	C	S	T	R	C	S	T	R	C	S	T	R	C	S	T	R
			35.78	51.83	49.35	51.17	36.79	46.69	49.10	51.24	44.95	54.44	53.71	49.26	48.05	55.66	48.82	51.76	60.53	63.96	52.13	51.30
VS	C	35.78																				
	S	51.83	-16.05																			
	T	49.35	-13.57	2.48																		
	R	51.17	-15.39	0.66	-1.82																	
SM	C	36.79	-1.01	15.04	12.56	14.38																
	S	46.69	-10.91	5.14	2.66	4.48	-9.90															
	T	49.10	-13.32	2.73	0.25	2.07	-12.31	-2.41														
	R	51.24	-15.46	0.59	-1.89	-0.07	-14.45	-4.55	-2.14													
M	C	44.95	-9.17	6.88	4.40	6.22	-8.16	1.74	4.15	6.29												
	S	54.44	-18.66	-2.61	-5.09	-3.27	-17.65	-7.75	-5.34	-3.20	-9.49											
	T	53.71	-17.93	-1.88	-4.36	-2.54	-16.92	-7.02	-4.61	-2.47	-8.76	0.73										
	R	49.26	-13.47	2.57	0.09	1.91	-12.46	-2.56	-0.15	1.98	-4.31	5.19	4.46									
L	C	48.05	-12.27	3.78	1.30	3.12	-11.26	-1.36	1.05	3.19	-3.10	6.39	5.66	1.21								
	S	55.66	-19.88	-3.83	-6.31	-4.49	-18.87	-8.97	-6.56	-4.42	-10.71	-1.22	-1.95	-6.40	-7.61							
	T	48.82	-13.04	3.00	0.53	2.34	-12.03	-2.13	0.28	2.41	-3.87	5.62	4.89	0.43	-0.78	6.84						
	R	51.76	-15.98	0.07	-2.41	-0.59	-14.97	-5.07	-2.66	-0.52	-6.81	2.68	1.95	-2.50	-3.71	3.90	-2.93					
VL	C	60.53	-24.75	-8.70	-11.18	-9.37	-23.74	-13.84	-11.43	-9.30	-15.58	-6.09	-6.82	-11.28	-12.48	-4.87	-11.71	-8.78				
	S	63.96	-28.18	-12.13	-14.61	-12.79	-27.17	-17.27	-14.86	-12.72	-19.01	-9.52	-10.25	-14.70	-15.91	-8.30	-15.13	-12.20	-3.42			
	T	52.13	-16.35	-0.30	-2.78	-0.96	-15.34	-5.44	-3.03	-0.89	-7.18	2.31	1.58	-2.87	-4.08	3.53	-3.31	-0.37	8.40	11.83		
	R	51.30	-15.51	0.53	-1.95	-0.13	-14.50	-4.60	-2.19	-0.06	-6.35	3.15	2.42	-2.04	-3.25	4.36	-2.47	0.46	9.24	12.66	0.83	

Note. Tukey's HSD = 18.17. Abbreviations are as follows: Very Small (VS), Small (SM), Medium (M), Large (L), Very Large (VL), City (C), Suburb (S), Town (T), and Rural (R).

Table D3

MAP Grade 8 Communication Arts Post Hoc Analysis of Middle School Size and Location

			VS	VS	VS	SM	SM	SM	SM	M	M	M	M	L	L	L	L	VL	VL	VL
			S	T	R	C	S	T	R	C	S	T	R	C	S	T	R	C	S	T
			63.36	46.44	53.35	28.81	28.95	47.78	51.61	44.29	47.28	51.78	54.98	54.78	54.05	52.49	51.55	57.31	60.98	52.20
VS	S	63.36																		
	T	46.44	16.92																	
	R	53.35	10.01	-6.91																
SM	C	28.81	34.55	17.63	24.54															
	S	28.95	34.42	17.49	24.40	-0.13														
	T	47.78	15.58	-1.34	5.57	-18.97	-18.84													
	R	51.61	11.75	-5.17	1.74	-22.80	-22.66	-3.83												
M	C	44.29	19.07	2.15	9.06	-15.48	-15.34	3.49	7.32											
	S	47.28	16.08	-0.84	6.07	-18.47	-18.34	0.50	4.32	-2.99										
	T	51.78	11.58	-5.34	1.57	-22.97	-22.83	-4.00	-0.17	-7.49	-4.49									
	R	54.98	8.38	-8.55	-1.64	-26.17	-26.04	-7.20	-3.38	-10.70	-7.70	-3.21								
L	C	54.78	8.58	-8.35	-1.44	-25.97	-25.84	-7.00	-3.18	-10.50	-7.50	-3.01	0.20							
	S	54.05	9.32	-7.61	-0.70	-25.23	-25.10	-6.26	-2.44	-9.76	-6.76	-2.27	0.94	0.74						
	T	52.49	10.88	-6.05	0.86	-23.68	-23.54	-4.71	-0.88	-8.20	-5.20	-0.71	2.50	2.30	1.56					
	R	51.55	11.82	-5.11	1.80	-22.73	-22.60	-3.76	0.06	-7.26	-4.26	0.23	3.44	3.24	2.50	0.94				
VL	C	57.31	6.05	-10.87	-3.96	-28.50	-28.36	-9.53	-5.70	-13.02	-10.03	-5.53	-2.33	-2.53	-3.26	-4.82	-5.76			
	S	60.98	2.39	-14.54	-7.63	-32.16	-32.03	-13.20	-9.37	-16.69	-13.69	-9.20	-5.99	-6.19	-6.93	-8.49	-9.43	-3.67		
	T	52.20	11.17	-5.76	1.15	-23.38	-23.25	-4.42	-0.59	-7.91	-4.91	-0.42	2.79	2.59	1.85	0.29	-0.65	5.11	8.78	

Note. Tukey's HSD = 18.01. Abbreviations are as follows: Very Small (VS), Small (SM), Medium (M), Large (L), Very Large (VL), City (C), Suburb (S), Town (T), and Rural (R).

Table D4

MAP Grade 8 Communication Arts Post Hoc Analysis of Middle School Size and Poverty

			VS	VS	VS	SM	SM	SM	M	M	M	L	L	L	VL	VL	VL
			LP	MP	HP	LP	MP	HP	LP	MP	HP	LP	MP	HP	LP	MP	HP
			64.62	52.09	47.72	61.96	50.01	30.08	62.87	51.40	39.58	66.56	51.92	32.78	65.20	52.12	35.70
VS	LP	64.62															
	MP	52.09	12.53														
	HP	47.72	16.90	4.37													
SM	LP	61.96	2.66	-9.87	-14.24												
	MP	50.01	14.61	2.08	-2.29	11.95											
	HP	30.08	34.54	22.01	17.64	31.88	19.93										
M	LP	62.87	1.75	-10.78	-15.15	-0.91	-12.86	-32.79									
	MP	51.40	13.22	0.69	-3.67	10.56	-1.39	-21.32	11.47								
	HP	39.58	25.04	12.51	8.14	22.38	10.43	-9.50	23.29	11.82							
L	LP	66.56	-1.94	-14.47	-18.84	-4.60	-16.55	-36.49	-3.70	-15.17	-26.99						
	MP	51.92	12.70	0.17	-4.20	10.04	-1.91	-21.85	10.94	-0.53	-12.35	14.64					
	HP	32.78	31.84	19.31	14.94	29.18	17.23	-2.71	30.09	18.61	6.80	33.78	19.14				
VL	LP	65.20	-0.58	-13.11	-17.48	-3.24	-15.19	-35.12	-2.33	-13.80	-25.62	1.36	-13.28	-32.42			
	MP	52.12	12.50	-0.03	-4.40	9.84	-2.11	-22.05	10.74	-0.73	-12.55	14.44	-0.20	-19.34	13.08		
	HP	35.70	28.93	16.40	12.03	26.27	14.32	-5.62	27.17	15.70	3.88	30.87	16.23	-2.91	29.51	16.43	

Note. Tukey's HSD = 14.65. Abbreviations are as follows: Very Small (VS), Small (SM), Medium (M), Large (L), Very Large (VL), Low Poverty (LP), Moderate Poverty (MP), and High Poverty (HP).

Table D5

MAP Grade 8 Communication Arts Post Hoc Analysis of Middle School Size and Special Education

			VS	VS	VS	SM	SM	SM	M	M	M	L	L	L	VL	VL	VL
			LSE	MSE	HSE	LSE	MSE	HSE	LSE	MSE	HSE	LSE	MSE	HSE	LSE	MSE	HSE
			57.44	51.72	50.78	58.59	46.22	31.86	54.73	50.62	43.07	62.73	51.27	60.48	63.35	58.51	65.73
VS	LSE	57.44															
	MSE	51.72	5.72														
	HSE	50.78	6.66	0.93													
SM	LSE	58.59	-1.15	-6.87	-7.81												
	MSE	46.22	11.22	5.50	4.56	12.37											
	HSE	31.86	25.58	19.86	18.92	26.73	14.36										
M	LSE	54.73	2.71	-3.01	-3.95	3.86	-8.51	-22.87									
	MSE	50.62	6.82	1.10	0.16	7.97	-4.40	-18.76	4.11								
	HSE	43.07	14.38	8.65	7.72	15.52	3.16	-11.20	11.67	7.56							
L	LSE	62.73	-5.29	-11.01	-11.95	-4.14	-16.51	-30.87	-8.00	-12.11	-19.67						
	MSE	51.27	6.18	0.45	-0.48	7.32	-5.05	-19.40	3.47	-0.64	-8.20	11.47					
	HSE	60.48	-3.04	-8.76	-9.70	-1.89	-14.26	-28.62	-5.75	-9.86	-17.41	2.25	-9.21				
VL	LSE	63.35	-5.91	-11.63	-12.57	-4.76	-17.13	-31.49	-8.62	-12.73	-20.28	-0.62	-12.08	-2.87			
	MSE	58.51	-1.07	-6.79	-7.72	0.08	-12.29	-26.65	-3.78	-7.89	-15.44	4.22	-7.24	1.97	4.84		
	HSE	65.73	-8.29	-14.01	-14.95	-7.14	-19.51	-33.87	-11.00	-15.11	-22.67	-3.00	-14.47	-5.25	-2.38	-7.22	

Note. Tukey’s HSD = 17.75. Abbreviations are as follows: Very Small (VS), Small (SM), Medium (M), Large (L), Very Large (VL), Low Special Education (LSE), Moderate special education (MSE), and High Special Education (HSE).

Table D6

MAP Grade 8 Mathematics Post Hoc Analysis of Middle School Size and Special Education

			VS	VS	VS	SM	SM	SM	M	M	M	L	L	L	VL	VL	VL
			LSE	MSE	HSE	LSE	MSE	HSE	LSE	MSE	HSE	LSE	MSE	HSE	LSE	MSE	HSE
			51.02	50.53	49.74	59.84	47.39	33.45	55.00	49.55	41.32	63.20	49.58	58.88	66.30	57.38	62.90
VS	LSE	51.02															
	MSE	50.53	0.49														
	HSE	49.74	1.28	0.79													
SM	LSE	59.84	-8.82	-9.31	-10.10												
	MSE	47.39	3.63	3.14	2.35	12.45											
	HSE	33.45	17.58	17.08	16.29	26.39	13.94										
M	LSE	55.00	-3.98	-4.47	-5.26	4.84	-7.61	-21.55									
	MSE	49.55	1.48	0.98	0.19	10.29	-2.16	-16.10	5.45								
	HSE	41.32	9.70	9.21	8.42	18.52	6.07	-7.88	13.68	8.22							
L	LSE	63.20	-12.18	-12.67	-13.46	-3.36	-15.81	-29.75	-8.20	-13.65	-21.88						
	MSE	49.58	1.45	0.95	0.16	10.27	-2.19	-16.13	5.43	-0.03	-8.25	13.63					
	HSE	58.88	-7.86	-8.35	-9.14	0.96	-11.49	-25.43	-3.88	-9.33	-17.56	4.32	-9.31				
VL	LSE	66.30	-15.28	-15.77	-16.56	-6.46	-18.91	-32.85	-11.30	-16.75	-24.98	-3.10	-16.73	-7.42			
	MSE	57.38	-6.35	-6.85	-7.64	2.46	-9.99	-23.93	-2.38	-7.83	-16.05	5.82	-7.80	1.50	8.92		
	HSE	62.90	-11.88	-12.37	-13.16	-3.06	-15.51	-29.45	-7.90	-13.35	-21.58	0.30	-13.33	-4.02	3.40	-5.52	

Note. Tukey's HSD = 20.29. Abbreviations are as follows: Very Small (VS), Small (SM), Medium (M), Large (L), Very Large (VL), Low Special Education (LSE), Moderate Special Education (MSE), and High Special Education (HSE).

Table D7

MAP English II Post Hoc Analysis of High School Size and Location

			VS	VS	SM	SM	SM	M	M	M	M	L	L	L	L	VL	VL	VL	VL
			C	R	S	T	R	C	S	T	R	C	S	T	R	C	S	T	R
			74.20	70.07	60.77	71.18	74.73	69.45	71.42	70.84	73.13	52.77	68.67	72.36	78.40	74.57	77.58	73.48	74.42
VS	C	74.20																	
	R	70.07	4.13																
SM	S	60.77	13.43	9.30															
	T	71.18	3.03	-1.11	-10.41														
	R	74.73	-0.53	-4.66	-13.96	-3.55													
M	C	69.45	4.75	0.62	-8.68	1.73	5.28												
	S	71.42	2.78	-1.35	-10.65	-0.25	3.31	-1.97											
	T	70.84	3.36	-0.77	-10.07	0.34	3.89	-1.39	0.58										
	R	73.13	1.07	-3.06	-12.36	-1.96	1.60	-3.68	-1.71	-2.29									
L	C	52.77	21.43	17.30	8.00	18.41	21.96	16.68	18.65	18.07	20.36								
	S	68.67	5.53	1.40	-7.90	2.51	6.06	0.78	2.75	2.17	4.46	-15.90							
	T	72.36	1.84	-2.29	-11.59	-1.18	2.37	-2.91	-0.94	-1.52	0.77	-19.59	-3.69						
	R	78.40	-4.20	-8.33	-17.63	-7.23	-3.67	-8.95	-6.98	-7.56	-5.27	-25.63	-9.73	-6.04					
VL	C	74.57	-0.37	-4.50	-13.80	-3.39	0.16	-5.12	-3.15	-3.73	-1.44	-21.80	-5.90	-2.21	3.83				
	S	77.58	-3.38	-7.51	-16.81	-6.40	-2.85	-8.13	-6.16	-6.74	-4.45	-24.81	-8.91	-5.22	0.82	-3.01			
	T	73.48	0.72	-3.41	-12.71	-2.30	1.25	-4.03	-2.06	-2.64	-0.35	-20.71	-4.81	-1.12	4.92	1.09	4.10		
	R	74.42	-0.22	-4.35	-13.65	-3.25	0.31	-4.97	-3.00	-3.58	-1.29	-21.65	-5.75	-2.06	3.98	0.15	3.16	-0.94	

Note. Tukey's HSD = 18.66. Abbreviations are as follows: Very Small (VS), Small (SM), Medium (M), Large (L), Very Large (VL), City (C), Suburb (S), Town (T), and Rural (R).

Table D8

MAP English II Post Hoc Analysis of High School Size and Ethnicity

			VS	VS	VS	SM	SM	SM	M	M	M	L	L	L	VL	VL
			LM	MM	HM	LM	MM	HM	LM	MM	HM	LM	MM	HM	MM	HM
			70.93	67.41	66.90	77.00	74.27	64.94	72.70	73.18	67.59	83.53	73.63	51.98	79.82	69.42
VS	LM	70.93														
	MM	67.41	3.52													
	HM	66.90	4.03	0.51												
SM	LM	77.00	-6.07	-9.59	-10.10											
	MM	74.27	-3.34	-6.86	-7.37	2.73										
	HM	64.94	5.98	2.46	1.96	12.05	9.33									
M	LM	72.70	-1.77	-5.29	-5.80	4.30	1.57	-7.75								
	MM	73.18	-2.26	-5.77	-6.28	3.81	1.09	-8.24	-0.49							
	HM	67.59	3.34	-0.18	-0.69	9.41	6.68	-2.64	5.11	5.60						
L	LM	83.53	-12.61	-16.13	-16.63	-6.54	-9.26	-18.59	-10.84	-10.35	-15.95					
	MM	73.63	-2.71	-6.22	-6.73	3.36	0.64	-8.69	-0.94	-0.45	-6.05	9.90				
	HM	51.98	18.95	15.43	14.92	25.02	22.29	12.97	20.72	21.21	15.61	31.56	21.66			
VL	MM	79.82	-8.90	-12.41	-12.92	-2.83	-5.55	-14.88	-7.13	-6.64	-12.24	3.71	-6.19	-27.85		
	HM	69.42	1.51	-2.01	-2.52	7.58	4.85	-4.47	3.28	3.76	-1.83	14.11	4.21	-17.44	10.40	

Note. Tukey's HSD = 14.19. Abbreviations are as follows: Very Small (VS), Small (SM), Medium (M), Large (L), Very Large (VL), Low Minority (LM), Moderate Minority (MM), and High Minority (HM).

Table D9

MAP English II Post Hoc Analysis of High School Size and Poverty

			VS	VS	VS	SM	SM	SM	M	M	M	L	L	L	VL	VL	VL
			LP	MP	HP	LP	MP	HP	LP	MP	HP	LP	MP	HP	LP	MP	HP
			77.90	69.75	61.85	76.92	74.58	68.76	79.24	71.12	65.10	78.22	66.24	50.40	82.63	68.46	52.47
VS	LP	77.90															
	MP	69.75	8.15														
	HP	61.85	16.05	7.90													
SM	LP	76.92	0.98	-7.17	-15.07												
	MP	74.58	3.32	-4.83	-12.73	2.35											
	HP	68.76	9.14	0.99	-6.91	8.16	5.82										
M	LP	79.24	-1.34	-9.49	-17.39	-2.32	-4.66	-10.48									
	MP	71.12	6.78	-1.37	-9.27	5.81	3.46	-2.36	8.13								
	HP	65.10	12.80	4.65	-3.25	11.82	9.48	3.66	14.14	6.02							
L	LP	78.22	-0.32	-8.47	-16.37	-1.30	-3.64	-9.46	1.02	-7.10	-13.12						
	MP	66.24	11.66	3.51	-4.39	10.68	8.33	2.52	13.00	4.87	-1.14	11.97					
	HP	50.40	27.50	19.35	11.45	26.52	24.18	18.36	28.84	20.72	14.70	27.82	15.84				
VL	LP	82.63	-4.72	-12.88	-20.78	-5.70	-8.05	-13.86	-3.38	-11.51	-17.53	-4.41	-16.38	-32.23			
	MP	68.46	9.44	1.29	-6.61	8.47	6.12	0.31	10.79	2.66	-3.36	9.76	-2.21	-18.06	14.17		
	HP	52.47	25.43	17.28	9.38	24.46	22.11	16.29	26.78	18.65	12.63	25.75	13.78	-2.07	30.16	15.99	

Note. Tukey's HSD = 13.08. Abbreviations are as follows: Very Small (VS), Small (SM), Medium (M), Large (L), Very Large (VL), Low Poverty (LP), Moderate Poverty (MP), and High Poverty (HP).

Table D10

MAP English II Post Hoc Analysis of High School Size and Special Education

			VS	VS	VS	SM	SM	SM	M	M	M	L	L	L	VL	VL	VL
			LSE	MSE	HSE	LSE	MSE	HSE	LSE	MSE	HSE	LSE	MSE	HSE	LSE	MSE	HSE
			72.61	69.89	68.20	70.25	74.98	75.61	77.48	71.93	61.44	74.48	70.59	46.77	79.59	74.93	84.70
VS	LSE	72.61															
	MSE	69.89	2.72														
	HSE	68.20	4.40	1.68													
SM	LSE	70.25	2.36	-0.36	-2.05												
	MSE	74.98	-2.38	-5.10	-6.78	-4.73											
	HSE	75.61	-3.01	-5.72	-7.41	-5.36	-0.63										
M	LSE	77.48	-4.87	-7.59	-9.27	-7.22	-2.49	-1.86									
	MSE	71.93	0.67	-2.05	-3.73	-1.68	3.05	3.68	5.54								
	HSE	61.44	11.16	8.44	6.76	8.81	13.54	14.17	16.03	10.49							
L	LSE	74.48	-1.87	-4.59	-6.27	-4.23	0.51	1.13	3.00	-2.54	-13.03						
	MSE	70.59	2.02	-0.70	-2.38	-0.34	4.40	5.03	6.89	1.35	-9.14	3.89					
	HSE	46.77	25.83	23.11	21.43	23.48	28.21	28.84	30.70	25.16	14.67	27.70	23.81				
VL	LSE	79.59	-6.99	-9.71	-11.39	-9.34	-4.61	-3.98	-2.12	-7.66	-18.15	-5.12	-9.01	-32.82			
	MSE	74.93	-2.32	-5.04	-6.72	-4.68	0.06	0.68	2.55	-2.99	-13.49	-0.45	-4.34	-28.16	4.67		
	HSE	84.70	-12.09	-14.81	-16.50	-14.45	-9.72	-9.09	-7.22	-12.77	-23.26	-10.22	-14.11	-37.93	-5.11	-9.77	

Note. Tukey's HSD = 15.09. Abbreviations are as follows: Very Small (VS), Small (SM), Medium (M), Large (L), Very Large (VL), Low Special Education (LSE), Moderate Special Education (MSE), and High Special Education (HSE).

Table D11

MAP Algebra I Post Hoc Analysis of High School Size and Poverty

			VS	VS	VS	SM	SM	SM	M	M	M	L	L	L	VL	VL	VL
			LP	MP	HP	LP	MP	HP	LP	MP	HP	LP	MP	HP	LP	MP	HP
			62.26	49.43	50.49	55.43	54.93	49.63	57.60	50.63	50.71	53.95	46.11	22.62	55.21	40.64	13.50
VS	LP	62.26															
	MP	49.43	12.83														
	HP	50.49	11.77	-1.06													
SM	LP	55.43	6.83	-6.00	-4.94												
	MP	54.93	7.33	-5.50	-4.44	0.51											
	HP	49.63	12.63	-0.20	0.86	5.80	5.30										
M	LP	57.60	4.66	-8.17	-7.11	-2.17	-2.67	-7.97									
	MP	50.63	11.63	-1.20	-0.14	4.80	4.29	-1.00	6.97								
	HP	50.71	11.55	-1.28	-0.22	4.72	4.22	-1.08	6.89	-0.08							
L	LP	53.95	8.30	-4.52	-3.46	1.48	0.97	-4.32	3.65	-3.32	-3.24						
	MP	46.11	16.15	3.32	4.38	9.32	8.82	3.52	11.49	4.52	4.60	7.84					
	HP	22.62	39.64	26.81	27.87	32.81	32.31	27.01	34.98	28.01	28.09	31.33	23.49				
VL	LP	55.21	7.04	-5.78	-4.72	0.22	-0.29	-5.58	2.39	-4.58	-4.50	-1.26	-9.10	-32.59			
	MP	40.64	21.62	8.79	9.85	14.80	14.29	8.99	16.96	10.00	10.07	13.32	5.47	-18.02	14.58		
	HP	13.50	48.76	35.93	36.99	41.93	41.43	36.13	44.10	37.13	37.21	40.45	32.61	9.12	41.71	27.14	

Note. Tukey's HSD = 22.91. Abbreviations are as follows: Very Small (VS), Small (SM), Medium (M), Large (L), Very Large (VL), Low Poverty (LP), Moderate Poverty (MP), and High Poverty (HP).

Table D12

MAP Algebra I Post Hoc Analysis of High School Size and Special Education

			VS	VS	VS	SM	SM	SM	M	M	M	L	L	L	VL	VL	VL
			LSE	MSE	HSE	LSE	MSE	HSE	LSE	MSE	HSE	LSE	MSE	HSE	LSE	MSE	HSE
			52.79	50.67	51.37	46.63	56.15	60.71	54.30	51.88	43.96	57.94	46.59	20.94	51.64	46.09	63.35
VS	LSE	52.79															
	MSE	50.67	2.13														
	HSE	51.37	1.43	-0.70													
SM	LSE	46.63	6.16	4.03	4.73												
	MSE	56.15	-3.36	-5.49	-4.79	-9.52											
	HSE	60.71	-7.92	-10.04	-9.35	-14.08	-4.56										
M	LSE	54.30	-1.50	-3.63	-2.93	-7.66	1.86	6.42									
	MSE	51.88	0.92	-1.21	-0.51	-5.25	4.28	8.83	2.42								
	HSE	43.96	8.84	6.71	7.41	2.68	12.20	16.75	10.34	7.92							
L	LSE	57.94	-5.14	-7.27	-6.57	-11.30	-1.78	2.77	-3.64	-6.06	-13.98						
	MSE	46.59	6.21	4.08	4.78	0.05	9.57	14.13	7.71	5.29	-2.63	11.35					
	HSE	20.94	31.86	29.73	30.43	25.70	35.22	39.77	33.36	30.94	23.02	37.00	25.65				
VL	LSE	51.64	1.15	-0.98	-0.28	-5.01	4.51	9.07	2.65	0.23	-7.69	6.29	-5.06	-30.71			
	MSE	46.09	6.70	4.57	5.27	0.54	10.06	14.62	8.20	5.79	-2.14	11.84	0.49	-25.16	5.55		
	HSE	63.35	-10.56	-12.68	-11.98	-16.72	-7.20	-2.64	-9.05	-11.47	-19.39	-5.41	-16.76	-42.41	-11.71	-17.26	

Note. Tukey's HSD = 25.16. Abbreviations are as follows: Very Small (VS), Small (SM), Medium (M), Large (L), Very Large (VL), Low Special Education (LSE), Moderate Special Education (MSE), and High Special Education (HSE).

Table D13

MAP Biology Post Hoc Analysis of High School Size and Location

			VS	VS	SM	SM	SM	M	M	M	M	L	L	L	L	VL	VL	VL	VL
			C	R	S	T	R	C	S	T	R	C	S	T	R	C	S	T	R
			32.65	44.43	49.20	52.00	55.27	38.05	56.98	52.78	58.27	23.38	53.25	57.02	62.47	59.65	61.51	58.54	67.42
VS	C	32.65																	
	R	44.43	-11.78																
SM	S	49.20	-16.55	-4.77															
	T	52.00	-19.35	-7.57	-2.80														
	R	55.27	-22.62	-10.84	-6.07	-3.27													
M	C	38.05	-5.40	6.38	11.15	13.95	17.22												
	S	56.98	-24.33	-12.55	-7.78	-4.98	-1.71	-18.93											
	T	52.78	-20.13	-8.36	-3.58	-0.78	2.48	-14.73	4.20										
	R	58.27	-25.62	-13.85	-9.07	-6.27	-3.01	-20.22	-1.29	-5.49									
L	C	23.38	9.27	21.05	25.82	28.62	31.89	14.67	33.60	29.41	34.89								
	S	53.25	-20.60	-8.83	-4.05	-1.25	2.01	-15.20	3.73	-0.47	5.02	-29.88							
	T	57.02	-24.37	-12.59	-7.82	-5.02	-1.75	-18.97	-0.04	-4.23	1.26	-33.64	-3.76						
	R	62.47	-29.82	-18.05	-13.27	-10.47	-7.21	-24.42	-5.49	-9.69	-4.20	-39.09	-9.22	-5.46					
VL	C	59.65	-27.00	-15.23	-10.45	-7.65	-4.39	-21.60	-2.67	-6.87	-1.38	-36.27	-6.40	-2.64	2.82				
	S	61.51	-28.86	-17.08	-12.31	-9.51	-6.24	-23.46	-4.53	-8.73	-3.24	-38.13	-8.26	-4.49	0.96	-1.86			
	T	58.54	-25.89	-14.11	-9.34	-6.54	-3.27	-20.49	-1.56	-5.75	-0.26	-35.16	-5.28	-1.52	3.94	1.12	2.97		
	R	67.42	-34.77	-22.99	-18.22	-15.42	-12.15	-29.37	-10.44	-14.64	-9.15	-44.04	-14.17	-10.40	-4.95	-7.77	-5.91	-8.88	

Note. Tukey's HSD = 25.68. Abbreviations are as follows: Very Small (VS), Small (SM), Medium (M), Large (L), Very Large (VL), City (C), Suburb (S), Town (T), and Rural (R).

Table D14

MAP Biology Post Hoc Analysis of High School Size and Ethnicity

			VS	VS	VS	SM	SM	SM	M	M	M	L	L	L	VL	VL
			LM	MM	HM	LM	MM	HM	LM	MM	HM	LM	MM	HM	MM	HM
			47.58	41.77	36.40	58.36	54.27	40.09	54.08	59.49	46.01	68.43	58.62	24.62	66.51	50.85
VS	LM	47.58														
	MM	41.77	5.81													
	HM	36.40	11.18	5.37												
SM	LM	58.36	-10.78	-16.58	-21.96											
	MM	54.27	-6.69	-12.50	-17.87	4.09										
	HM	40.09	7.49	1.68	-3.69	18.27	14.18									
M	LM	54.08	-6.50	-12.30	-17.68	4.28	0.19	-13.99								
	MM	59.49	-11.92	-17.72	-23.09	-1.14	-5.22	-19.41	-5.42							
	HM	46.01	1.57	-4.23	-9.61	12.35	8.26	-5.92	8.07	13.49						
L	LM	68.43	-20.86	-26.66	-32.03	-10.08	-14.16	-28.34	-14.36	-8.94	-22.43					
	MM	58.62	-11.04	-16.84	-22.22	-0.26	-4.35	-18.53	-4.54	0.88	-12.61	9.82				
	HM	24.62	22.96	17.15	11.78	33.74	29.65	15.47	29.46	34.88	21.39	43.81	34.00			
VL	MM	66.51	-18.93	-24.74	-30.11	-8.15	-12.24	-26.42	-12.43	-7.02	-20.50	1.92	-7.89	-41.89		
	HM	50.85	-3.27	-9.07	-14.45	7.51	3.42	-10.76	3.23	8.65	-4.84	17.59	7.77	-26.23	15.66	

Note. Tukey's HSD = 19.40. Abbreviations are as follows: Very Small (VS), Small (SM), Medium (M), Large (L), Very Large (VL), Low Minority (LM), Moderate Minority (MM), and High Minority (HM).

Table D15

MAP Biology Post Hoc Analysis of High School Size and Poverty

			VS	VS	VS	SM	SM	SM	M	M	M	L	L	L	VL	VL	VL
			LP	MP	HP	LP	MP	HP	LP	MP	HP	LP	MP	HP	LP	MP	HP
			56.06	43.01	42.50	60.24	55.05	46.01	61.72	55.37	46.99	60.77	49.83	17.50	68.99	53.03	18.73
VS	LP	56.06															
	MP	43.01	13.04														
	HP	42.50	13.56	0.51													
SM	LP	60.24	-4.18	-17.22	-17.74												
	MP	55.05	1.00	-12.04	-12.55	5.18											
	HP	46.01	10.05	-2.99	-3.51	14.23	9.05										
M	LP	61.72	-5.67	-18.71	-19.22	-1.49	-6.67	-15.72									
	MP	55.37	0.69	-12.36	-12.87	4.86	-0.32	-9.36	6.35								
	HP	46.99	9.07	-3.98	-4.49	13.25	8.06	-0.98	14.73	8.38							
L	LP	60.77	-4.72	-17.76	-18.27	-0.54	-5.72	-14.77	0.95	-5.40	-13.78						
	MP	49.83	6.23	-6.82	-7.33	10.40	5.22	-3.82	11.89	5.54	-2.84	10.94					
	HP	17.50	38.56	25.51	25.00	42.74	37.55	28.51	44.22	37.87	29.49	43.27	32.33				
VL	LP	68.99	-12.93	-25.97	-26.49	-8.75	-13.93	-22.98	-7.26	-13.62	-22.00	-8.21	-19.16	-51.49			
	MP	53.03	3.03	-10.01	-10.53	7.21	2.03	-7.02	8.70	2.34	-6.04	7.75	-3.20	-35.53	15.96		
	HP	18.73	37.33	24.28	23.77	41.50	36.32	27.27	42.99	36.64	28.26	42.04	31.10	-1.23	50.25	34.29	

Note. Tukey's HSD = 18.59. Abbreviations are as follows: Very Small (VS), Small (SM), Medium (M), Large (L), Very Large (VL), Low Poverty (LP), Moderate Poverty (MP), and High Poverty (HP).

Table D16

MAP Biology Post Hoc Analysis of High School Size and Special Education

			VS	VS	VS	SM	SM	SM	M	M	M	L	L	L	VL	VL	VL
			LSE	MSE	HSE	LSE	MSE	HSE	LSE	MSE	HSE	LSE	MSE	HSE	LSE	MSE	HSE
			44.29	44.93	43.26	50.30	56.24	55.02	60.44	56.10	40.77	59.70	51.38	22.59	67.03	59.14	69.35
VS	LSE	44.29															
	MSE	44.93	-0.63														
	HSE	43.26	1.04	1.67													
SM	LSE	50.30	-6.00	-5.37	-7.04												
	MSE	56.24	-11.94	-11.31	-12.98	-5.94											
	HSE	55.02	-10.73	-10.10	-11.76	-4.73	1.21										
M	LSE	60.44	-16.14	-15.51	-17.18	-10.14	-4.20	-5.41									
	MSE	56.10	-11.80	-11.17	-12.84	-5.80	0.14	-1.08	4.34								
	HSE	40.77	3.52	4.16	2.49	9.52	15.47	14.25	19.66	15.33							
L	LSE	59.70	-15.41	-14.77	-16.44	-9.40	-3.46	-4.68	0.74	-3.60	-18.93						
	MSE	51.38	-7.08	-6.45	-8.12	-1.08	4.86	3.65	9.06	4.72	-10.60	8.32					
	HSE	22.59	21.70	22.34	20.67	27.70	33.65	32.43	37.84	33.51	18.18	37.11	28.79				
VL	LSE	67.03	-22.73	-22.10	-23.77	-16.73	-10.79	-12.01	-6.59	-10.93	-26.26	-7.33	-15.65	-44.44			
	MSE	59.14	-14.84	-14.21	-15.88	-8.84	-2.90	-4.12	1.30	-3.04	-18.37	0.56	-7.76	-36.55	7.89		
	HSE	69.35	-25.06	-24.42	-26.09	-19.05	-13.11	-14.33	-8.91	-13.25	-28.58	-9.65	-17.97	-46.76	-2.32	-10.21	

Note. Tukey's HSD = 21.51. Abbreviations are as follows: Very Small (VS), Small (SM), Medium (M), Large (L), Very Large (VL), Low Special Education (LSE), Moderate Special Education (MSE), and High Special Education (HSE).

Table D17

MAP Government Post Hoc Analysis of High School Size and Poverty

			VS	VS	VS	SM	SM	SM	M	M	M	L	L	L	VL	VL	VL
			LP	MP	HP	LP	MP	HP	LP	MP	HP	LP	MP	HP	LP	MP	HP
			45.82	40.80	32.85	48.00	44.64	27.80	54.13	42.44	34.40	52.30	39.62	12.53	63.27	42.48	18.73
VS	LP	45.82															
	MP	40.80	5.02														
	HP	32.85	12.97	7.95													
SM	LP	48.00	-2.18	-7.20	-15.15												
	MP	44.64	1.18	-3.84	-11.79	3.36											
	HP	27.80	18.02	13.00	5.05	20.20	16.84										
M	LP	54.13	-8.31	-13.33	-21.28	-6.13	-9.49	-26.33									
	MP	42.44	3.38	-1.64	-9.59	5.56	2.20	-14.64	11.69								
	HP	34.40	11.42	6.40	-1.55	13.60	10.24	-6.60	19.73	8.04							
L	LP	52.30	-6.48	-11.50	-19.45	-4.30	-7.66	-24.50	1.83	-9.86	-17.90						
	MP	39.62	6.19	1.17	-6.77	8.38	5.01	-11.82	14.51	2.82	-5.22	12.68					
	HP	12.53	33.29	28.27	20.32	35.47	32.11	15.27	41.60	29.91	21.87	39.77	27.09				
VL	LP	63.27	-17.45	-22.48	-30.42	-15.27	-18.63	-35.47	-9.14	-20.83	-28.87	-10.97	-23.65	-50.74			
	MP	42.48	3.34	-1.68	-9.63	5.52	2.16	-14.68	11.65	-0.04	-8.08	9.82	-2.86	-29.95	20.79		
	HP	17.20	28.62	23.60	15.65	30.80	27.44	10.60	36.93	25.24	17.20	35.10	22.42	-4.67	46.07	25.28	

Note. Tukey's HSD = 17.67. Abbreviations are as follows: Very Small (VS), Small (SM), Medium (M), Large (L), Very Large (VL), Low Poverty (LP), Moderate Poverty (MP), and High Poverty (HP).

Table D18

MAP Government Post Hoc Analysis of High School Size and Special Education

			VS	VS	VS	SM	SM	SM	M	M	M	L	L	L	VL	VL	VL
			LSE	MSE	HSE	LSE	MSE	HSE	LSE	MSE	HSE	LSE	MSE	HSE	LSE	MSE	HSE
			43.21	41.90	34.08	38.93	44.48	39.01	48.33	43.89	30.67	48.48	41.36	22.14	60.31	51.21	70.30
VS	LSE	43.21															
	MSE	41.90	1.31														
	HSE	34.08	9.12	7.81													
SM	LSE	38.93	4.28	2.97	-4.85												
	MSE	44.48	-1.28	-2.58	-10.40	-5.55											
	HSE	39.01	4.19	2.88	-4.93	-0.08	5.47										
M	LSE	48.33	-5.12	-6.43	-14.25	-9.40	-3.85	-9.32									
	MSE	43.89	-0.68	-1.99	-9.80	-4.96	0.59	-4.87	4.44								
	HSE	30.67	12.54	11.23	3.42	8.26	13.81	8.35	17.66	13.22							
L	LSE	48.48	-5.28	-6.59	-14.40	-9.55	-4.00	-9.47	-0.15	-4.60	-17.82						
	MSE	41.36	1.85	0.54	-7.28	-2.43	3.12	-2.34	6.97	2.53	-10.69	7.13					
	HSE	22.14	21.07	19.76	11.95	16.79	22.34	16.88	26.19	21.75	8.53	26.35	19.22				
VL	LSE	60.31	-17.10	-18.41	-26.22	-21.38	-15.82	-21.29	-11.98	-16.42	-29.64	-11.82	-18.95	-38.17			
	MSE	51.21	-8.00	-9.31	-17.13	-12.28	-6.73	-12.20	-2.88	-7.32	-20.54	-2.72	-9.85	-29.07	9.10		
	HSE	70.30	-27.09	-28.40	-36.22	-31.37	-25.82	-31.29	-21.97	-26.41	-39.63	-21.82	-28.94	-48.16	-9.99	-19.09	

Note. Tukey's HSD = 21.54. Abbreviations are as follows: Very Small (VS), Small (SM), Medium (M), Large (L), Very Large (VL), Low Special Education (LSE), Moderate Special Education (MSE), and High Special Education (HSE).

Appendix E: Urban-Centric Locale Codes

Urban-Centric Locale Codes

For purposes of the study, school location was defined as a geographic descriptor determined by utilizing the following urban-centric locale codes assigned to each school using the 2005-2006 National Center for Education Statistics Common Core of Data Public Elementary/Secondary School Locale Code files.

11. City, Large: Territory inside an urbanized area and inside a principal city with population of 250,000 or more.
12. City, Midsize: Territory inside an urbanized area and inside a principal city with population less than 250,000 and greater than or equal to 100,000.
13. City, Small: Territory inside an urbanized area and inside a principal city with population less than 100,000.
21. Suburb, Large: Territory outside a principal city and inside an urbanized area with population of 250,000 or more.
22. Suburb, Midsize: Territory outside a principal city and inside an urbanized area with population less than 250,000 and greater than or equal to 100,000.
23. Suburb, Small: Territory outside a principal city and inside an urbanized area with population less than 100,000.
31. Town, Fringe: Territory inside an urban cluster that is less than or equal to 10 miles from an urbanized area.
32. Town, Distant: Territory inside an urban cluster that is more than 10 miles and less than or equal to 35 miles from an urbanized area.

33. Town, Remote: Territory inside an urban cluster that is more than 35 miles of an urbanized area.

41. Rural, Fringe: Census-defined rural territory that is less than or equal to 5 miles from an urbanized area, as well as rural territory that is less than or equal to 2.5 miles from an urban cluster.

42. Rural, Distant: Census-defined rural territory that is more than 5 miles but less than or equal to 25 miles from an urbanized area, as well as rural territory that is more than 2.5 miles but less than or equal to 10 miles from an urban cluster.

43. Rural, Remote: Census-defined rural territory that is more than 25 miles from an urbanized area and is also more than 10 miles from an urban cluster (U.S. Department of Education, 2008a, p. 3-4).