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The effect of school size, socioeconomic status, and grade -level configuration on academic achievement in Louisiana public schools

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THE EFFECT OF SCHOOL SIZE, SOCIOECONOMIC STATUS, AND GRADE-LEVEL CONFIGURATION ON ACADEMIC ACHIEVEMENT IN LOUISIANA PUBLIC SCHOOLS

by

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ABSTRACT

The national emphasis on continually improving education for all students coupled with accountability requires educators and policymakers to identify and implement effective schooling structures and strategies. In this study, the researcher examined the relationship among school size, socioeconomic status of students, the interaction of school size and socioeconomic status (SES), grade-level configuration, and academic achievement in Louisiana. An extensive data set representing 1362 public PK-12 schools was analyzed at the 4^{th}, 8^{th}, and 10^{th} grade levels. The construct of schooling as a production process was used as a theoretical model wherein the education production function was used to describe the relation between school inputs and student outcomes.

To determine the impact of input variables on student achievement, thirty-six hypotheses were tested. Ordinary Least Squares (OLS) procedures were used to assess the relationships among variables. Moreover, to determine the differential impact of school size, SES, and the interaction of school size and SES on academic achievement across grade-level configurations, a variant of the F-test known as the "Chow test" was utilized. Further,

Multivariate Analysis of Variance (MANOVA) was used to determine the effects of school size, SES, and the interaction of school size and SES on academic achievement. Where significant interaction effects were found, a univariate ANOVA was calculated. Post-hoc tests, namely Tukey's HSD, were then conducted on each of the models. The results of this study indicate that there is a relationship among the variables investigated.

The poverty level was found to impact significantly the percentage of students passing the state's high stakes tests across the 4^{th}, 8^{th}, and 10^{th} grade levels. At all grades and across all SES levels within an elementary, middle/junior high, and secondary configuration, the mean percentage of students passing the LEAP 21 increased as enrollment size increased. The level of poverty did not alter the positive impact of school size on academic achievement. The results of this study support the notion that the effectiveness and efficiency of school size may best be represented by a U-shaped curve wherein schools may either be too small or too large to operate at optimal levels.

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DEDICATION

This dissertation is dedicated to my maternal grandmother Margarita Gallardo, who not only taught me Spanish, but who taught me to demand the best from myself and from others.

It is also dedicated to my husband, Marc, and my children, Alex and Katie. They have lovingly sacrificed time and memories with me to allow me to complete the Doctoral program.

TABLE OF CONTENTS

LIST OF TABLES

Table	Title	Page

Table	Title	Page

Table	Title	Page

Table	Title	Page

Table	Title	Page

Table	Title	Page

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Thank you to my husband for ensuring that our family and marriage remained loving and strong throughout this challenging part of our lives together. From this day on...

CHAPTER 1

Introduction

The national emphasis on continually improving education for all students coupled with accountability requires educators and policymakers to identify and implement effective schooling structures and strategies. Research regarding the effectiveness of various school structures assists policymakers and practitioners in the ongoing processes of school improvement and reform. Research-driven school reform is a mechanism which can be used to achieve federal and state mandated educational outcomes (Hill, 1998; Tyak & Cuban, 1995). School size and grade-level configuration are important aspects of school effectiveness because these two parameters establish the basic context for the learning environment (Franklin & Glascock, 1998; Renchler, 2000; Stevenson, 2001). The manner in which schools are structured affects student achievement (Smith & DeYoung, 1998; Wasley & Lear, 2001). It may be that structural variables, such as school size and grade-level configuration, serve as proxy variables for operative processes that are associated with various school structures (Bowen, Bowen, & Richman, 2000; Mertens, Flowers, & Mulhall, 2001). For example, in large schools academic success tends to be stratified along socioeconomic lines which does not seem to hold true in small schools (Bickel, 1999a; 1999b; Bickel & Howley, 2000; Howley, 2000a; 2000b; 2001; Howley & Bickel, 2000; Huang & Howley, 1993; Meier, 1998).

According to Raywid (1998):

> One reason that size appears so pivotal is that smallness permits and invites a number of practices and arrangements that have independently been found desirable. In other words, small schools comfortably accommodate much from the lessons we've learned about school effectiveness. (p. 36-37)

Public education in the United States originated from small one-room schoolhouses containing multiage classes (Walker, Kozma, & Green, 1989). The practice of organizing schools by grade, whereby classes are composed of students at the same level or age, was first introduced in Boston's Quincy Grammar School in 1848 (Callahan, 1962). However, this approach to organizing schooling proliferated rapidly throughout the nation (Franklin & Glascock, 1998). Prior to the last decade of the 19th century, the American public school system was comprised of eight years of elementary school followed by four years of high school. A variety of grade-level configurations have developed as a means to address administrative problems such as desegregation, crowded conditions or declining enrollments (Alexander &

Kealy, 1969; Educational Research Services, 1983; Hough, 1995).

In 1888, Charles Eliot, then president of Harvard, initiated a national movement to increase the number of high school graduates entering college (Toepfer, 1982). With the endorsement of the National Educational Association (1894), a swift change occurred in the grade configuration of American public schools resulting in the emergence and popularization of the junior high school (Toepfer, 1982). Around 1909 in Berkley (CA), Superintendent Frank Forest Bunker established the first middle level education program. His reorganization plan called for a 6-3-3 structural grade pattern in which grades 7, 8, and 9 were housed separately from the elementary and high schools (Popper, 1967).

In the first few decades of the 1900s, junior high schools grew in number until the early 1970s (Hough, 1995). In 1920, 80% of high school graduates had attended a K-8 elementary school followed by a four-year high school. By 1960, 80% of all high school graduates had attended an elementary school, a three-year junior high, and a three-year high school (Alexander & McEwin, 1989). Middle schools became popular in the early 1960s leading to a precipitous decline in the number of junior highs. Middle schools are the only school type to have increased in number during the past two decades, and in 1995 they were the dominant form of middle level education (DeYoung, Howley, & Theobald, 1995). Between 1968 and 1991, middle schools grew by over 400%.

Simultaneously, school enrollments and facilities have grown dramatically larger. "There is a natural predilection in American education toward enormity and it does not serve schools well (Fowler, 1992, p. 16)." Although the U.S. population increased 70% between 1940 and 1990, the total number of elementary and secondary schools declined by 69% (Howley, 1994; Walberg, 1992). During the same period, average school enrollments increased from 127 to 653. Before World War II, 75% of American high schools enrolled fewer than 200 students and only 14% enrolled from 500 to 2,500 students (Gaumnitz & Tompkins, 1949). By 1990, 53% of American high schools were in the 500 to 2,500 enrollment range, enrolling 84% of the nation's students (Digest of Education Statistics, 1990). By 2000, the average size of K-12 schools nationwide was approximately 741 students (Viadero, 2000). Due to extensive consolidations and reorganizations, schools enrolling thousands of students have become common (Irmsher, 1997). In many urban and suburban settings, high school enrollments of 2000 and 3000 students abound (Henderson & Raywid, 1996).

Many researchers trace this phenomenon back to a book written by James Bryant Conant in 1959, in which he concluded that larger schools (over 750 students) could offer more comprehensive instructional programs of greater quality at lower cost per student than smaller schools. According to Conant, in order to be cost effective and to offer a sufficiently large and varied curriculum, a secondary school should have at least 100 students in its graduating class. Conant argued that the number-one problem in education was the small high school and that its elimination Conant's philosophy was consistent with the solution posed to meet another problem of the 1950s and 1960s, desegregation.

Actually, by the early 1900s, school enrollments and facilities had begun to grow dramatically larger (Hampel, 2002). The trend toward school consolidation began around 1918 as a reaction to a perceived academic weakness of rural and small one-room schools should be a top priority. (Nelsen, 1985). Ellwood Cubberley (1922) was one of the first influential educators to promote school consolidation. He argued that (a) pupil-teacher ratios could be increased in consolidated schools, (b) longer terms could be held, (c) transportation could be provided, and (d) schools could be led and supervised by professional educational administrators possessing scientific knowledge. Based on the philosophy of "bigger is better," school consolidations continued at a tremendous rate. For example, while total enrollment in elementary and secondary schools nearly doubled between 1945 and 1980 (from 23 million to 40 million), the number of schools dropped from 185,000 to under 86,000 (Ravitch, 1984). Since World War II, the number of public schools in the United States has declined 70%, while the average size of public schools has increased fivefold (McComb, 2000).

It is often assumed that large schools are less costly to operate and provide a richer curriculum than small schools despite the many studies indicating that neither of these assumptions is necessarily true (Gregory, 1992). The impetus for the increases in school size derived, in part, from the belief that consolidating several small schools into one large school yielded economic and curricular benefits. It was assumed that large schools operated more efficiently than small schools and offered students a wider variety of courses and programs. Arguments based on equity and efficiency were used to justify school and district consolidations. Small schools were believed to be inequitable because it was presumed that they would be unable to offer the comprehensive programs generally available in larger institutions. As such, students attending small schools were considered to be at a disadvantage by being denied the educational and extracurricular opportunities available to their peers attending large schools. Further, small schools were thought to be inefficient, as they could not benefit from the economies of scale available to large educational institutions. Therefore, small schools were considered to be unreasonably burdensome to taxpayers (Haller, 1992).

Structural changes in the public educational system have been driven by the forces of urbanization, industrialization, mechanization of agriculture, advances in transportation and communications, and the depletion of natural resources all of which changed the nation's economic and demographic characteristics (Cole, 1989; Tholkes & Sederberg, 1990). Political, economic, social, and demographic factors appear to drive policy decisions about school size and grade-level configuration (Cotton, 1996a). Additionally, changing enrollments, available facilities and resources, and community preferences often determine the size and grade-level configuration of public schools (Franklin & Glascock, 1998). Typically, each school system develops its own organizational structure in response to educational theory, administrative and resource considerations, and/or population pressures (Educational Research Services, 1983).

Throughout the twentieth century and into the present, schools have been organized with a myriad of configurations. The lack of consistency among various types of schools complicates the issue regarding which type of organizational arrangement provides the best combination in terms of efficiency and effectiveness (Howley & Harmon, 2000a). For example, there exists a multitude of different grade configurations in the Louisiana K-12 public education system. Given that organizational structures are important policy variables, it is desirable to know whether there is some systematic relationship between school size, grade-level configuration, and student achievement.

Purpose of the Study

The purpose of this study was to explore the effect of socioeconomic status, school size, grade-level configuration, and the interaction among these variables on academic achievement for grades 4, 8, and 10 so as to provide empirical information to policymakers and educators in Louisiana. As enrollment size and grade-level configuration are important structural features of any educational organization, this study added to the growing body of quantitative work that investigates the influence of school size and grade-level configuration on student cognitive outcomes. It seems that school size and grade-level configuration may serve as a proxy for one or more factors that are likely to influence the effectiveness of other various inputs and processes such as departmentalization, curriculum, class size, homework policies, testing and assessment, and teaching practices (Bickel & Howley, 2000; Hampel, 2002; Howley, 2001; Howley & Bickel, 2000a; 2000b Wihry, Coladarci, & Meadow, 1992). An extensive body of research has highlighted the negative relationship between poverty and academic outcomes (Bickel & Howley, 2000; Bickel , Howley, Williams, & Glascock, 2000; Coleman, et al, 1966; Howley & Bickel, 2000a; 2000b; Howley, 1995;1996a; 2000a; 2001). This study investigated the relationship among school size, grade-level configuration, and socioeconomic levels within schools to determine if and to what extent the negative impact of poverty on student academic achievement might be modified by altering school organizational structures.

Most grade-level configuration research since the 1960s has focused on middle level grade-configurations (Wihry et al., 1992). Little grade-level configuration research exists related to the elementary school, the high school, or the combination K-12 school (Alspaugh, 1998a; Bickel, 1999a; 1999b). Additionally, very few researchers have addressed whether or not the instructional environments that are likely to be effective at a given grade are more characteristic of some grade-level configurations than others, which was addressed by this study. While grade span research has been predominantly focused on middle level education, the preponderance of research exploring school size effects has been focused on the high school level (Gregory, 2000). Based upon this area of research, policymakers have been urged to downsize secondary level schools so that stronger bonds and more trusting relationships between students and adults can be formed (Carnegie Council on Adolescent Development, 1989; Cotton, 1996b; Daniels, Bizar, & Zemelman, 2001; Duke & Trautvetter, 2001; National Association of Secondary School Principals, 1996; Raywid, 1998;). Nonetheless, little research exists examining the middle school or junior high level in relation to school size, and only about 10% of the research examining school size effects has involved elementary schools (Gregory, 2000). This phenomenon is likely related to the ideal of the neighborhood elementary school, which has capped the size of elementary schools in many communities (Hampel, 2002). Additional research was needed to ascertain the effectiveness of various organizational structures across the elementary, middle, and high school levels (Daniels et al., 2001; Franklin & Glascock, 1998; Gregory, 2000).

Justification for the Study

Designing an effective school is the vision and driving force behind much of the research in the field of education, and many of our current educational endeavors are related to the notion of effectiveness (Johnson, Livingston, Schwartz, & Slate, 2000). Since the early 1980s numerous commissions have written reports, such as *A Nation at Risk* published in 1983, recommending major educational reforms and restructuring. During this same period, programs based on effective schools research multiplied dramatically (Cunningham & Gresso, 1993). By 1989, over half of all school districts in the United States reported using or planning to use programs based on school effectiveness research to improve their schools (General Accounting Office, 1989). The national review of education continued, culminating in 1994 with the Goals 2000: Educate America Act passed by the U.S. Congress, so as to "improve learning and teaching by providing a national framework for education reform; to promote research, consensus building, and systemic changes needed to ensure equitable educational opportunities and high levels of educational achievement for all American students" (Goals 2000: Educate America Act of 1994, H. R. 1804 Sec. 1. et seq., para. 1).

School effects research had its origins in the mid-1960s and early 1970s when a prevalent view in the research community was that schools had little influence on academic achievement that was independent of student background and social context (Brookover, 1979; Jencks et al. 1972; Coleman et al. 1966). Beginning with the 1966 seminal study of the differential effects of school and student-background characteristics conducted by Coleman et al., early research suggested that schools, teachers, and fiscal resources had minimal, if any, effect on student achievement. Concluding that public schools had no differential effects, Coleman's report credited family background as the primary determinant of academic achievement. However, school effectiveness research, which emerged in response to Coleman's controversial findings, suggests that some schools are clearly more successful than others in regards to improving student academic achievement (Brookover, Beady, Flook, Schweitzer, & Wisenbaker, 1979; Daly & Ainley, 2000; Edmonds, 1979; Good & Brophy, 1986; Raudenbush & Willms, 1995). Within this line of inquiry, researchers stress that "schools matter, that schools do have major effects upon children's development and that, to put it simply, schools do make a difference" (Reynolds & Creemers, 1990, p.1).

The national emphasis on making schools more effective and efficient does not seem to have waned. On January 8, 2002, President Bush signed a complex 1,200 page federal education law, which reauthorizes the *Elementary and Secondary Education Act (ESEA) of 1965*. The act also authorizes significant increases in federal funding linked to several major requirements:

- Students in grades three through eight will be tested annually in mathematics and reading, using state-developed tests linked to state standards;
- Schools must raise all students to a level of academic proficiency, as defined by the state, within 12 years;
- All core academic subject area teachers are to be "highly qualified," within four years;
- Schools that do not progress will offer public school choice, or supplemental education services, such as tutoring;
- Schools that do not make adequate progress will face increasing sanctions with reconstitutions after five years; and

- Schools are to close the gap in test scores between rich and poor students and white and minority students. (Public Affairs Research Council of Louisiana, Inc., 2002, p. 2)

In a major, long-term effort to improve schools and to raise student academic achievement, Louisiana is in its third year of implementing a strong, educational accountability program similar to the new federal program. Although Louisiana ranked fourth highest among all states in a recent *Education Week* evaluation of state education standards and accountability, the ESEA goal to have all students at the state's proficient level of academic achievement on the Louisiana Educational Assessment Program for the 21st Century (LEAP 21) tests within 12 years poses quite a challenge to the state as evidenced by the performance of Louisiana's students on the National Assessment of Educational Progress (NAEP). For example, in the sample of fourth and eighth graders tested in mathematics in 2000, less than 15% scored at the proficient level or above (National Center for Education Statistics, 2002). Perhaps, the overall poor performance of these students is related to the fact that of the 756,044 K-12 Louisiana public school students enrolled for the 2001-2002 academic year, 26% were living at or below the poverty level with 58.5% of Louisiana's school age population eligible for free/reduced price lunch (National Center for Education Statistics, 2002). In fact, Louisiana has the third highest percentage of rural students living in poverty in the nation with 49% of Louisiana's public schools located in rural areas and small towns (The Rural School and Community Trust, 2002). As research has identified the negative impact that poverty has on student achievement, it would seem that greater than 50% of Louisiana public school students could be at risk of academic failure (Bickel & Howley, 2000; Bickel , Howley, Williams, & Glascock, 2000; Coleman, et al, 1966; Howley & Bickel, 2000a; 2000b; Howley, 1995;1996a; 2000a; 2001).

Small school size seems to reduce the negative impact on student achievement of risk factors, such as poverty, whereas large school size appears to compound the negative effects (Bickel & Howley, 2000; Bickel et al. 2000; Friedkin & Necochea, 1988; Howley, 1995; 1996a; 2000a; 2000b; 2001; Howley & Bickel, 2000a; 2000b). Howley (2000a) has found that in small schools the strength of the relationship between poverty and academic achievement is approximately half what it is in larger schools. Howley & Bickel (2000b) reported that the well-documented correlation between poverty and low achievement is much stronger, as much as ten times stronger, in larger schools than in smaller ones.

However, the relationship among school size, socioeconomic status, and student performance is complex. Although it seems that small schools may help impoverished students achieve their academic potential, small schools are not necessarily the best choice for all students under all circumstances (Howley, 1996a). A school size or grade-level configuration that is desirable or possible in one context, such as in an urban, affluent setting, may be undesirable or impossible to implement in a different context, such as in a poor, rural setting. For example, although Becker (1987) reported a significant advantage to locating the sixth grade in an elementary, rather than middle-level grade span, the advantage declined as student socioeconomic status rose. Sixth graders in the upper tail of the socioeconomic status (SES) distribution performed slightly better in non-elementary settings. This examination of the relationship among school size, grade-level configuration, students' socioeconomic status, and student achievement in Louisiana contributed to the line of inquiry that suggests that the effects of school size and grade-level configuration depend on the interaction among these variables. Also, the findings of this study provide information regarding the impact of school organizational structures on student achievement which may be helpful to policymakers and educators engaged in the school restructuring and reform process.

Theoretical Framework

The construct of schooling as a production process was used as a theoretical model for this study (Wihry, Coladarci, & Meadow, 1992). Within this context, the education production function was used to describe the relation between school inputs and student outcomes. In the pursuit of improving the effectiveness of the educational process, educational policymakers and researchers alike seek to identify school inputs that are significant determinants of school outputs (Glasman & Binianinov, 1981).

> "The presumed existence of the education production function lies at the heart of administrative efforts to improve educational productivity" (Monk, 1989, p. 34).

By using educational production functions, educational administrators can improve educational productivity. Based on the assumption that schools have systems' attributes, it is expected that changes in the systems' inputs result in changes in the systems' outputs. This concept provides a useful framework for structuring multivariate analyses of educational outcomes. Using the metaphor of the factory, schools are viewed as producers of achievement (Greenwald, Hedges, & Laine, 1996). Production function models have been used in many empirical studies exploring the between-school determinants of educational outcomes (Monk, 1989; Hanushek, 1986). Within this framework, increments in educational outputs are a function of various inputs to the educational process. An understanding of which inputs can be manipulated to achieve the maximum benefit is helpful to policymakers and educators in implementing school reforms and restructuring (Glasman & Biniamov, 1981).

Inputs may be categorized as either (a) input factors or (b) process factors (Caldas, 1993a). Input factors are defined as the independent variables over which schools have little or no control such as the demographic and socioeconomic characteristics of the student body (Shavelson, McDonnel, Oakes, & Picus, 1987). Process factors are defined as the independent variables over which schools or policymakers do have some control, such as school organizational structures (Shavelson et al., 1987). Very few studies based on a production function model have included grade-level configuration as an input factor. The output is defined as the product of the inputs in the form of educational goods and services. The output is the dependent variable, student achievement, as measured by standardized achievement tests, such as the Louisiana criterion-referenced tests known as LEAP 21. Additionally, this study relied on the premise that differences in pupil achievement are not only related to differences in intelligence and socioeconomic background but also to differences among schools (Brandsma & Doolard, 1999). The effectiveness of the school as an organization has an impact on student achievement such that students' learning is strongly influenced by the educational context in which it occurs (Bosker, 1990; Lee, 2000; Purkey & Smith, 1983).

Research Questions

Research question one: Do the effects of school size, SES, and/or the interaction of school size and SES on academic achievement in Louisiana public schools as measured by the LEAP 21 and the Graduate Exit Examination for the 21st Century (GEE 21) significantly differ across grade-level configurations at the 4th, 8th, and 10th grade levels?

Research question two: Is there a significant relationship among school size, grade-level configuration, SES, the interaction of school size and SES, and student achievement in Louisiana public schools in grades 4, 8, and 10 as measured by the English Language Arts and Mathematics components of the LEAP 21 and the GEE 21?

Research question three: Do the effects of school size and SES levels on student achievement as measured by the English Language Arts and Mathematics components of the LEAP 21 and GEE 21 significantly differ in Louisiana public schools in grades 4, 8, and 10?

Research question four: Does the effect of school size on student achievement in Louisiana public schools in grades 4, 8, and 10 as measured by the English Language Arts and Mathematics components of the LEAP 21 and GEE 21 significantly differentiate across SES levels?

Hypotheses

In order to determine the impact of school size and grade-level configuration in Louisiana public schools on student achievement at grades 4, 8, and 10, the following null hypotheses were tested:

Hypothesis (1a): The effects of school size, SES, and/or the interaction of school size and SES on the academic achievement of 4th graders as measured by the English Language Arts component of the LEAP 21 do not significantly differ across grade-level configurations in Louisiana public schools.

Hypothesis (1b): The effects of school size, SES, and/or the interaction of school size and SES on the academic achievement of 4th graders as measured by the Mathematics component of the LEAP 21 do not significantly differ across grade-level configurations in Louisiana public schools.

Hypothesis (1c): The effects of school size, SES, and/or the interaction of school size and SES on the academic achievement of 8th graders as measured by the English Language Arts component of the LEAP 21 do not significantly differ across grade-level configurations in Louisiana public schools.

Hypothesis (1d): The effects of school size, SES, and the interaction of school size and SES on the academic achievement of 8th graders as measured by the Mathematics component of the LEAP 21 do not significantly differ across grade-level configurations in Louisiana public schools.

Hypothesis (1e): The effects of school size, SES, and/or the interaction of school size and SES on the academic achievement of 10th graders as measured by the English Language Arts component of the GEE 21 do not significantly differ across grade-level configurations in Louisiana public schools

Hypothesis (1f): The effects of school size, SES, and the interaction of school size and SES on the academic achievement of 10th graders as measured by the Mathematics component of the GEE 21 do not significantly differ across grade-level configurations in Louisiana public schools.

Hypothesis (2ai): There is no significant relationship among school size, SES, the interaction effect of school size and SES, and academic achievement as measured by the English Language Arts component of the LEAP 21 for 4th graders in an elementary configuration.

Hypothesis (2aii): There is no significant relationship among school size, SES, the interaction effect of school size and SES, and academic achievement as measured by the English Language Arts component of the LEAP 21 for 4th graders in a middle/junior high configuration.

Hypothesis (2aiii): There is no significant relationship among school size, SES, the interaction effect of school size and SES, and academic achievement as measured by the English Language Arts component of the LEAP 21 for 4th graders in a combination configuration.

Hypothesis (2bi): There is no significant relationship among school size, SES, the interaction effect of school size and SES, and academic achievement as measured by the Mathematics component of the LEAP 21 for 4^{th} graders in an elementary configuration.

Hypothesis (2bii): There is no significant relationship among school size, SES, the interaction effect of school size and SES, and academic achievement as measured by the Mathematics component of the LEAP 21 for 4^{th} graders in a middle/junior high configuration.

Hypothesis (2biii): There is no significant relationship among school size, SES, the interaction effect of school size and SES, and academic achievement as measured by the Mathematics component of the LEAP 21 for 4^{th} graders in a combination configuration.

Hypothesis (2ci): There is no significant relationship among school size, SES, the interaction effect of school size and SES, and academic achievement as measured by the English Language Arts component of the LEAP 21 for 8th graders in an elementary configuration.

Hypothesis (2cii): There is no significant relationship among school size, SES, the interaction effect of school size and SES, and academic achievement as measured by the English Language Arts component of the LEAP 21 for 8th graders in a middle/junior high configuration.

Hypothesis (2ciii): There is no significant relationship among school size, SES, the interaction effect of school size and SES, and academic achievement as measured by the English Language Arts component of the LEAP 21 for 8th graders in a secondary configuration.

Hypothesis (2civ): There is no significant relationship among school size, SES, the interaction effect of school size and SES, and academic achievement as measured by the English Language Arts component of the LEAP 21 for 8th graders in a combination configuration.

Hypothesis (2di): There is no significant relationship among school size, SES, the interaction effect of school size and SES, and academic achievement as measured by the Mathematics component of the LEAP 21 for 8^{th} graders in an elementary configuration.

Hypothesis (2dii): There is no significant relationship among school size, SES, the interaction effect of school size and SES, and academic achievement as measured by the Mathematics component of the LEAP 21 for 8^{th} graders in a middle/junior high configuration.

Hypothesis (2diii): There is no significant relationship among school size, SES, the interaction effect of school size and SES, and academic achievement as measured by the Mathematics component of the LEAP 21 for 8^{th} graders in a secondary configuration.

Hypothesis (2div): There is no significant relationship among school size, SES, the interaction effect of school size and SES, and academic achievement as measured by the Mathematics component of the LEAP 21 for 8th graders in a combination configuration.

Hypothesis (2ei): There is no significant relationship among school size, SES, the interaction effect of school size and SES, and academic achievement as measured by the English Language Arts component of the GEE 21 for 10th graders in a secondary configuration.

Hypothesis (2eii): There is no significant relationship among school size, SES, the interaction effect of school size and SES, and academic achievement as measured by the English Language Arts component of the GEE 21 for 10th graders in a combination configuration.

Hypothesis (2f): There is no significant relationship among school size, SES, the interaction of school size and SES, grade-level configuration, and academic achievement at the 10th grade level as measured by the Mathematics component of the GEE 21.

Hypothesis (3a): The effects of school size and SES levels on academic achievement as measured by the English Language Arts and Mathematics components of the LEAP 21 do not significantly differ for 4th graders in an elementary combination.

Hypothesis (3b): The effects of school size and SES levels on student academic achievement as measured by the English Language Arts and Mathematics components of the

LEAP 21 do not significantly differ for 8th graders in a middle/junior high configuration.

Hypothesis (3c): The effects of school size and SES levels on student academic achievement as measured by the English Language Arts and Mathematics components of the GEE 21 do not significantly differ for 10th graders in a secondary configuration.

Hypothesis (4a): There is no significant relationship between school size and student academic achievement as measured by the English Language Arts and Mathematics components of the LEAP 21 for 4th graders in an elementary configuration in which 50% or less of students participate in the federal free or reduced price lunch program.

Hypothesis (4b): There is no significant relationship between school size and student academic achievement as measured by the English Language Arts and Mathematics components of the LEAP 21 for 4th graders in an elementary configuration in which between 51% and 79% of students participate in the federal free or reduced price lunch program.

Hypothesis (4c): There is no significant relationship between school size and student academic achievement as measured by the English Language Arts and Mathematics components of the LEAP 21 for 4th graders in an elementary configuration in which 80% or more of students participate in the federal free or reduced price lunch program

Hypothesis (4d): There is no significant relationship between school size and student academic achievement as measured by the English Language Arts and Mathematics components of the LEAP 21 for 8th graders in a middle/junior high configuration in which 50% or less of students participate in the federal free or reduced price lunch program.

Hypothesis (4e). There is no significant relationship between school size and student academic achievement as measured by the English Language Arts and Mathematics components of the LEAP 21 for 8th graders in a middle/junior high configuration in which between 51% and 79% of students participate in the federal free or reduced price lunch program.

Hypothesis (4f). There is no significant relationship between school size and student academic achievement as measured by the English Language Arts and Mathematics components of the LEAP 21 for 8th graders in a middle/junior high configuration in which 80% or more of students participate in the federal free or reduced price lunch program.

Hypothesis (4g). There is no significant relationship between school size and student academic achievement as measured by the English Language Arts and Mathematics components of the GEE 21 for 10th graders in a Secondary configuration in which 35% or less of students participate in the federal free or reduced price lunch program. This hypothesis was assessed through the use of Multivariate Analysis of Variance (MANOVA).

Hypothesis (4h): There is no significant relationship between school size and student academic achievement as measured by the English Language Arts and Mathematics components of the GEE 21 for 10^{th} graders in a secondary configuration in which between 36% and 59% of students participate in the federal free or reduced price lunch program.

Hypothesis (4i): There is no significant relationship between school size and student academic achievement as measured by the English Language Arts and Mathematics components of the GEE 21 for 10^{th} graders in a secondary configuration in which 60% or more of students participate in the federal free or reduced price lunch program

Limitations

The unit of analysis in this study was limited to the individual public school in Louisiana, with the exclusion of schools classified as alternative, vocational, magnet, charter, university lab, and special education. These aforementioned types of schools were excluded from this study because many of them offer specialized programs or provide services only to certain populations. The analysis was limited to the data that all schools reported to the Louisiana State Board of Elementary and Secondary Education for inclusion in the mandated Louisiana School

Report Card for 2001-2002. In addition, the researcher assumed that the LEAP 21 and GEE 21 tests had been administered appropriately and that data were reported accurately.

Definition of Terms

The terms used in this study are operationally defined as follows:

Academic Achievement. For the purposes of this study, academic achievement is defined as student performance as measured by the state-developed Mathematics and English Language Arts criterion-referenced tests administered to students in grades 4, 8, and 10. These tests measure student mastery of the state content standards. The Louisiana Educational Assessment Program for the 21st Century (LEAP 21) and the Graduation Exit Examination for the 21st Century (GEE 21) comprise Louisiana's criterion-referenced testing (CRT) program. The LEAP 21 tests for English Language Arts and Mathematics are administered to students at grades 4 and 8. The GEE 21 English Language Arts and Mathematics tests are administered to students at grade 10. By law, these tests must be as rigorous as those of the National Assessment of Educational Progress (NAEP). (Louisiana Department of Education, 2002).

Combination or Unit School. Any school whose grade structure falls within

Consolidation. The practice of combining two or more schools for educational or economic benefits (Nelsen, 1985).

Criterion-referenced test. A criterion-referenced test is a test that usually covers a narrow domain and is utilized for mastery decisions (Thorndike, 1997).

Elementary School. A school comprised of grades PK/K-5/6 (Franklin & Glascock, 1998).

GEE 21. The Graduate Exit Examination for the 21st Century is a criterion-referenced test used to measure how well a student has mastered the state content standards (Louisiana Department of Education, 2002).

Grade-Span Configuration. The set of grade levels housed within a specific school (Franklin & Glaskcock, 1998).

Secondary School. A school comprised of grades 7/8/ 9-12 (Franklin & Glascock, 1998).

Input factors. The factors that affect school achievement over which the school has little or no control (Shavelson et al., 1987).

LEAP 21. The Louisiana Educational Assessment Program for the 21st Century is a criterion-referenced test used to measure how well a student has mastered the state content standards (Louisiana Department of Education, 2002).

Middle/Junior High School. A school comprised of grades 6/7-8/9 (Franklin & Glascock, 1998).

The National Assessment of Educational Progress (NAEP). NAEP is a nationally representative and continuing assessment of American students in the areas of reading, mathematics, science, writing, U. S. history, civics, geography, and the arts. Assessments have been conducted periodically since 1969. Scores are not provided for individual students or schools; instead, results are offered regarding subject-matter achievement, instructional experiences, and school environment for populations of students and subgroups of those populations. The National Assessment of Educational Progress (NAEP), also known as "the Nation's Report Card," is a nationally representative and continuing assessment of American students in the areas of reading, mathematics, science, writing, U. S. history, civics, geography, and the arts (National Center for Education Statistics, 2002).

Output. Output is defined as the product of the inputs in the form of educational goods and services.

Poverty Level. The percentage of students in the school who receive free or reduced lunch (Howley & Bickel, 2000b).

Process or Change factors. The factors over which educational policymakers have control (Shavelson et al., 1987).

Production Function. Any multivariate model of academic achievement describing the maximum level of outcome possible from alternative combinations of inputs (Monk, 1989; Wihry et al., 1992).

School Size. The average number of students per school (Howley & Bickel, 2000b).

Socioeconomic Level. The percentage of students within a school participating in the federal free or reduced price lunch program (Howley & Bickel, 2000b).

CHAPTER 2

Review of Literature

Introduction

Throughout the history of the American public education system school reforms and changes designed to make schools more effective, efficient, and equitable have been initiated at the national, state, and local levels. The public demands that policymakers and educators continually improve schools and student performance. Therefore, American public education is constantly under review and accountable for enhancing school system productivity (Daly & Ainley, 2000). Accountability may be defined as holding schools responsible for their effects on student outcomes. This phenomenon has led to the development of systems for judging and monitoring the quality of students' education and performance of schools (Daly & Ainley, 2000; Tomlinson, Mortimore, & Sammons, 1988). For example, in response to demands for improvement in K-12 public education, the 1997 Louisiana Legislature created the School and District Accountability Commission and charged it with the responsibility of recommending to the Board of Elementary and Secondary Education (BESE) a statewide system of accountability for public education in

Louisiana. The reform initiative was called Reaching for Results. Policymakers and educators in Louisiana have been working since that time to improve student achievement by reforming the public education system. By basing policymaking on empirical research-based evidence, the likelihood that education reforms will result in improved student performance is increased (Reezgit, Guldemond, & Creemers, 1999).

In an effort to improve educational productivity, there has been a predilection in American education toward enormity based on the concept of economies-of-scale, the idea that large organizational units are cost-effective and educationally efficient (Fowler, 1992). Additionally, early school size literature suggested that larger schools and districts could offer a broader range of courses and, thus, a more comprehensive educational program. Based on these arguments, educators and policymakers were urged to consolidate and reorganize schools and districts.

Due to these extensive consolidations and reorganizations, most students now attend comparatively larger schools (Howley, 1989). The average size of K-12 schools nationwide is approximately 741 students (Viadero, 2000). Schools with thousands of students are not uncommon (Irmsher, 1997). As a result, many of the nation's schools have developed bureaucratic features such as impersonality, rules and regulations, technical specialization, and formal hierarchies (Klonsky, 1995).

Many students complain that large schools are like "impersonal, intimidating, inefficient warehouses" (Viadero, 2000, p. 3).

In this chapter, school effects research related to school size and grade-span configuration will be examined. The first section of this review will be focused on the evolution of the school size literature followed by a section delineating various outcomes related to school size. The review concludes with a discussion of the relationship between grade-span configuration and academic achievement.

A Historical Perspective of School Effects Research

Designing an effective school is the vision and driving force behind much of the research in the field of education and many current educational endeavors are related to the notion of effectiveness (Johnson, Livingston, Schwartz, & Slate, 2000). Defining "effectiveness" is a complex task; nonetheless, "the construct of effectiveness is here to stay because it is the ultimate dependent variable in institutional research. The need to demonstrate that one academic program, structure, reward system, administrative style, curricular design or whatever is better in some way than another makes the notion of effectiveness a central empirical issue" (Cameron & Bilimoria, 1985, p. 101).

A true understanding of school effects research must originate with an historical perspective. On July 2, 1966 the U.S. Office of Education released the largest federally funded educational study conducted in the U.S., up to that time (Stringfield & Herman, 1996). This landmark, two-volume study, *On Equality of Educational Opportunity,* which had been mandated by Title IV of the Civil Rights Act of 1964, was the product of an extensive national survey involving 600,000 children and 4,000 schools. The report evaluated the availability of educational opportunities in the public schools for minority versus non-minority students (Coleman et al., 1966). Often referred to as the Coleman Report, it was the earliest large scale school effects study and it was the best known study based on an education production function model, which over the last few decades has been the dominant paradigm utilized in research efforts to analyze the relationship between educational inputs and outcomes (Hedges, Laine, & Greenwald, 1994; Stringfield & Herman, 1996). The study indicated that the traditional inputs such as (a) reported teacher qualifications, (b) facilities, and (c) expenditures did not explain much of the variance between schools or individuals.

Coleman studied characteristics of schools (including physical facilities, curriculum, and instructional materials), their staffs (including teacher training, experience, abilities, and attitudes), and their students (including socio-economic and racial or ethnic background). Like much other early school effects research, Coleman found virtually no classroom or school-alterable variable systematically related to student achievement (Jencks et al., 1972; Sammons, 1996; Stringfield & Herman, 1996).

However, Coleman found smaller school size associated with higher verbal achievement among twelfth graders. Also, like other large sample input-output analyses, Coleman identified student background as the most powerful determinant of achievement (Uline, Miller, & Tschannen-Moran, 1998). Coleman summarized his study as follows:

> Schools bring little influence to bear on a child's achievement that is independent of his background and general social context;…this very lack of an independent effect means that the inequalities imposed on children by their home, neighborhood, and peer environment are carried along to become the inequalities with which they confront adult life at the end of school. For equality of educational opportunity must imply a strong effect of schools that is independent of the child's immediate environment, and that strong independent effect is not present in American schools. (p. 325)

Echoing Coleman's major findings, Jencks and a group of Harvard colleagues (1972) published an analysis of the interaction between education, income, and social class concluding that "(w)e cannot blame economic inequality on differences between schools, since differences between schools seem to have very little effect on any measurable attribute of those who attend them" (p. 8). Some researchers, such as Austin (1979) and Cohen (1982), believed that the Coleman Report was misunderstood by others, but most researchers interpreted it to conclude that the schools studied had little effect on student academic achievement (Edmonds, 1979). In fact, a major impetus for the development of school effectiveness research is generally recognized to have been a reaction to the deterministic interpretation of these early researchers' findings concerning the potential influence of schools and teachers on students' achievement. Investigators have since conducted numerous studies aimed at identifying schools that appear to be unusually effective in terms of student performance on standardized achievement tests with gradual progress being made on both methodological and substantive fronts (Daly & Ainley, 2000; Good & Brophy, 1986; Raudenbush & Willms, 1995; Stringfield & Herman, 1996). School effects studies of the 1970s (Brookover et al., 1979; Rutter, 1979), using more refined process measures at the school level than the original Coleman study found substantial evidence of differential school effects (Stringfield & Herman, 1996). Researchers suggested that the small, but significant number of low-income, largely minority schools whose academic performance exceeded what was expected of them could be attributed to school effects.

For example, Brookover (1979) analyzed data from 68 Michigan elementary schools and found that there were several school-related factors, which contributed to schools' relative effects on student achievement. Based upon a longitudinal study conducted from 1970 to 1974, which focused on 12 inner city secondary schools, Rutter et al. (1979) identified school processes related to effective outcomes.

From 1973-1977, Edmonds conducted a national research project involving students in grades 3-7 in thousands of schools throughout the United States. Based on this study, Edmonds compiled a highly publicized list of effective schools characteristics ushering in the effective schools movement. Continuing on into the 1980s, a myriad of studies were conducted examining various school inputs such as ethnic composition, proportion of limited-English proficient students, enrollments in categorical programs, and staff characteristics (Uline, 1998). School size and grade-span configuration are additional examples of input variables that have been reported to have an effect on student achievement.

School Size Effects

Although there is an abundance of literature exploring school size effects, the empirical literature is much smaller, particularly in regard to the relationship between school size and student achievement. There are two distinct streams of research related to school size effects. One stream, which is sociological in nature, examines how size influences other organizational properties such as the climate or culture of the school. For example, research suggests that as schools grow larger, they tend to become more bureaucratic which is associated with more specialized instructional programs and more formal and hierarchical human relationships (Lee & Loeb, 2000). The other stream, which is grounded in economic theory, reflects an economy-of-scale argument focusing on the potential for increased savings through reduced redundancy and increased resource strength as schools become larger (Lee & Smith, 1997).

There are four main types of research related to school size: (a) early sociological studies stressing the deficits of rural life, (b) input studies, (c) process studies, and (d) output studies. Each of these represents an historical phase in the development of school size literature. Output measures can be grouped into two categories: (a) economic and academic outcomes or (b) social and affective outcomes (Gregory, 2000).

Between approximately 1900 through the early 1970s school size research focused on input variables such as: (a) resource allocation, (b) capital outlays, (c) curriculum offerings, and (d) teacher characteristics (Gregory, 2000). Generally, increased school size was recommended to (a) improve the curriculum, (b) to enhance teacher specialization, (c) to achieve economies of scale, (d) to modernize facilities, and (e) to provide a variety of superior extra-curricular activities and sports programs. Many schools were consolidated and closed during this era. "Professional faith in the virtues of larger schools persisted, virtually unchallenged, at least through the mid-1960s" (Howley, 1989, p. 3). Public attention shifted to the Civil Rights Movement and concerns for disadvantaged students and minority groups striving to achieve equity in society and in the school system. By the early 1970s, a paradigm shift occurred wherein school effects researchers began to place an emphasis upon measurable output variables, such as student achievement, retention rates, and graduation rates (Gregory, 2000). The Achievement Gap and the Urban Crisis were identified and addressed in the literature and by policymakers. During this period, the effective schools movement began which lead to a developing awareness and understanding of process variables such as teacher expectations, leadership, school climate, and organizational culture. These studies indicated that there was a differential effect of process variables across various school sizes (Edmonds, 1979; Stockard, & Mayberry, 1986).

The School Size Debate

Daresh (1984) summarized the classic pros and cons related to the large school size debate as follows:

> There are those who...argue that large size is a desirable characteristic of schools. In this view, larger schools are good because they are able to provide more diverse instructional offerings to meet the different needs and interests of students. Courses that might be feasible because they are too "exotic" and do not attract many students...can be offered in schools with large enrollments. Even more significant are the opportunities that exist in large schools for student participation in many different extracurricular and athletic activities...Finally, the most frequent argument in favor of large schools is the fact that larger schools are more efficient to operate and are therefore more responsive to community financial interests. There is no question that, due to building maintenance and necessary support staff, it costs considerably more to operate two buildings with 500 students in each than a single large building with 1,000 students.
>
> Those who favor smaller schools note that, while it may be true that some instructional diversity might be sacrificed in smaller schools, instruction in the "basics" will not suffer...with fewer distracting elective courses, schools can focus more attention on

> improving instruction in critical skill areas. Small school advocates also note, while the number of extracurricular activities might be increased in large schools, there is still no guarantee that a higher percentage of students will participate. Small schools still provide ample opportunities for students to become involved and receive recognition as "stars." Finally, the strongest argument generally made in favor of maintaining smaller schools is that they are much more personal places where students are less likely to feel lost in the crowd. (pp. 3-4)

In the following section, the literature addressing the traditional arguments for the consolidation of schools into large organizational structures will be summarized.

Curricular breadth and depth. On October 4, 1957, the Soviet Union launched the world's first artificial satellite, Sputnik I. Sputnik triggered substantial criticism of America's public schools (Guthrie & Reed, 1991). In response, Congress passed the 1958 National Defense Education Act (NDEA) to encourage and improve teaching and learning in the areas of math, science, engineering, and foreign-language. It was believed that small (usually rural) high schools could not offer programs as comprehensive as those offered by larger (usually urban) institutions. Comprehensive meaning offering a range of specialized academic and vocational courses from remedial to advanced levels so as to meet diverse students' needs (Haller, Monk, & Tien, 1993).

James B. Conant's *The American High School Today* (1959) remains the most influential example of these beliefs. Conant's commentary prompted a national effort to create large, comprehensive high schools that could offer an expansive and specialized curriculum. Conant emphasized that advanced course offerings in math, science, and foreign language would be impossible to offer without a high school enrollment of at least 400 students. Unless each grade level had 100 or more students, calculus, physics, French IV, and other rigorous courses could not be scheduled. Large schools would be able to offer a greater range of courses and by providing a more varied curricular program, students would have greater flexibility in choosing courses to fulfill their graduation requirements and future career objectives. However, according to Lee, Smith, & Croninger (1995), "students' academic experiences are compartmentalized, differentiated, and socially stratified in most high schools, since the curriculum is divided into discrete subjects grouped by departments" (p. 130). Within these units, subject matter is organized into course sequences (tracks), access to which is usually determined by students' aspirations and interests, prior performance, or evidence of ability.

A large high school typically offers students a wide range of courses in each department. The multitude of courses tends to vary considerably in their academic content and expectations for performance (Powell, Farrar, & Cohen, 1985). Both vertical (tracks) and horizontal (offerings within tracks) curriculum expansion generate substantial differences in what students in the same school study and learn (Bryk, Lee, & Holland, 1993). Highly differentiated high school curriculums seemed to harm disadvantaged students because more of their courses are low-track offerings that required less academic effort, expectations for their achievement were lower, and the academic content is less challenging (Lee, Smirdon, Alfred-Liro, & Brown 2000). Lee et al. (2000) further found that low-income and minority students were benefitted by attending schools with a narrow curriculum and a strong academic focus. The researchers indicated that because courses were similar in academic content and expectations, students in different classrooms had similar academic experiences.

Based upon an analysis of *High School and Beyond* data collected in 1980 and 1982, Haller, Monk, Spotted Bear, Griffith, and Moss (1990) reported that schools that graduate 100 students, roughly the minimum size recommended by Conant, are probably the equal of much larger institutions. The researchers defined a comprehensive program as one comprised of the following three types of interrelated courses: (a) Base courses-the traditional entry-level classes in a subject taken by students who are progressing normally in their studies, (b) Advanced courses- the classes that provide interested students with an opportunity to learn more about a subject than they could from its base course alone, and (c) Alternative courses- these are classes that do not normally require the base course as a prerequisite. Relatively few schools were found to lack the base course in a subject area, even among the very smallest. The researchers found that as schools become larger, they typically add advanced and alternative courses to their curricula and that in order to provide both advanced and alternative courses a graduating class of at least 200 seems to be required.

In 1983, The National Commission on Excellence in Education recommended that all students seeking a high school diploma be required to complete a core curriculum that should include: (a) four years of English; (b) three years of mathematics; (c) three years of science; (d) three years of social studies; (e) two years of foreign language; and (f) one-half year of computer science. Barker (1985) reported that core curricular offerings in small high school settings, overall, were well aligned with the national goals. Virtually every school-large or small, rural or suburban, offers its state's mandated courses (Haller, Monk, & Tien, 1993).

The findings of a 1983 study of high school course offerings in Illinois found that large high schools frequently (a) had longer and more varied foreign language sequences, (b) offered calculus, (c) offered selected non-required courses such as geography, and (d) offered more opportunities for remedial math and English. Small schools tended to be more stringent in their graduation requirements. Seventy percent of the smallest schools (total enrollment<100 students) required students to take general science or biology, while only 8% of those schools with enrollments over 1,000 required biology and only 23% required general science (Albrecht & Duea, 1983).

The curriculum offered by schools can vary in terms of (a) breadth- the number and variety of subject areas in which courses are offered, (b) depth- the number of sequentially arranged courses offered in a particular subject area, and (c) accessibility- the number of times a course is offered (Monk, 1987). Using data collected in New York State, Monk (1987) examined the relationship between school size and curriculum offerings. Monk concluded that not only is the availability of additional courses not guaranteed by larger size, but the number of students who actually take advantage of whatever extra courses are made available is small. Although course breadth and depth increased with enrollment, most of the difference in breadth between schools with 100 and 1000 pupils was accounted for by increases in the number of foreign languages offered. Monk noted that the incidence of courses available in the larger schools and not available in the smaller schools is rarely high. An additional important finding of this study is that calculus courses were never offered by more than 60% of the districts analyzed, regardless of their enrollment. The findings were similar for advanced placement mathematics, advanced placement chemistry, and advanced placement physics. Monk reported that a relatively small proportion of students in the larger schools enrolled in the advanced and alternative courses that were not available in the smaller schools.

Also, in 1987, Melnick, Shibles, and Gable compared Connecticut's small high schools (total enrollment, fewer than 600 students, or fewer than 150 students per grade) and medium high schools (total enrollment between 601 and 900 students or 150-225 students per grade) with their larger, non-city counterparts (total enrollment greater than 900 students or greater than 225 students per grade) on the basis of standardized achievement scores and high school course offerings. Significant differences were reported with respect to the percentage of small, middle, and large high schools offering courses in the arts, foreign languages, and advanced placement science and social sciences, with small high schools offering fewer courses than middle or large high schools.

In a later study, using data collected for the National Science Foundation as part of a project known as the Longitudinal Study of American Youth (LSAY), Haller, Monk, & Tien (1993) concluded that small and rural high schools are apparently the equals of larger and more urban institutions in imparting higher-order thinking skills to students. The researchers stressed that although large schools offered more advanced courses than did small ones, those offerings appeared to have little influence on average levels of student achievement. It seems that by offering a narrowly focused academic curriculum, even when enrollment is quite small, students can achieve at high levels (Brown, 1993). Roellke (1996) reported that in small schools, where deficiencies have existed, curricular adequacy had often been achieved through various restructuring efforts including: (a) integration of curricula, (b) innovative scheduling, (c) higher education cooperatives, (d) inter-district sharing, as well as (e) the use of instructional technologies.

Lee et al. (2000) qualitatively investigated how enrollment size influences two organizational features of schools: curriculum and social relations. The researchers reported that the small and large public high schools studied seemed to operate based on a choice model while the Catholic high schools under investigation offered a constrained mostly academic curriculum. The public schools were described as consumer-oriented; "They made a valiant effort to offer something for everyone, and they seemed to think that this was their responsibility," (p.157). These schools allowed their clients to dictate course offerings creating a form of the shopping-mall curriculum described by Powell, Farrar, and Cohen (1985) in their book *The Shopping Mall High School: Winners and Losers in the Educational Marketplace*. Furthermore, the specialization typically present in large high schools can lead to stratification and inequities in school outcomes. In small schools, virtually everyone will take the same curriculum, regardless of his or her interests, abilities, or social background (provided that a tracking system is not in place) (Bracey, 1998). Lee and Bryk (1988, 1989) suggested that this results in both higher average achievement and achievement that is more equitably distributed.

Summary of curricular issues related to school size. The relationship between school size and program comprehensiveness is complex. Although large schools do seem to offer more courses than smaller ones, they do not necessarily offer more comprehensive curriculums. Haller, Monk, Spotted Bear, Griffith, and Moss (1990) stressed that the measure of curriculum comprehensiveness should not be based solely on the number of courses offered. Comprehensiveness may vary across subject areas regardless of the size of the school. Additionally, Fowler (1992) found that although large schools may offer greater curricular variety, only a small percentage of students take advantage of the available opportunities in advanced and alternative classes. Finally, increasing school size generally does correlate with curriculum specialization, resulting in differentiation of academic experiences and the social stratification of outcomes (Bryk, Lee, & Holland, 1993; Lee & Bryk, 1988, 1989; Lee, Bryk, & Smith, 1993). Research on high school tracking suggests that extensive differentiation in curricular offerings and students' academic experiences may have debilitating consequences especially for impoverished students (Gamoran, 1989; Lee & Bryk, 1988, 1989; Oakes, 1985).

Economies of scale and efficiency. According to classic economic theory, in a service-production organization, increasing the number of persons served can generate greater efficiency based on the following two criteria: (a) increasing numbers of recipients maximize the efficient delivery of a given service, and (b) supplies and materials needed to deliver services are more economically obtained through larger purchases (Buzacott, 1982). If the cost of supplies is reduced when purchased in larger amounts or if other costs can be sustained at a flat level regardless of the numbers served, then spreading the relatively lower per-person cost over a larger base reduces overall spending on core costs. The rationale for the consolidation of schools and school districts has been based on the expectation that it would result in a reduction in the average cost of the educational services being provided. Equivalently, it was thought that there are significant economies of scale operating in the public education production function (Chakraborty, Biswas, & Lewis, 2000).

Historically, efficiency in the public education system has been a significant issue in the United States (Callahan, 1962). Since the beginning of this century, educational administrators have sought to provide schooling efficiently, a managerial concept borrowed from the private sector (Cotton, 1996). School administrators assumed that adoption of scientific management principles, like their counterparts in the private business sector, would legitimize their professional endeavors (Cotton, 1996). Therefore, arguments based on efficiency models have often been used to justify school consolidations as well as large school sizes. Consolidation was promoted as a "means of getting more and better education per tax dollar" through "more efficient administration" and "sound business practices" (Hickey, 1969, p. 7).

Size economies research, which stems from the disciplines of economics and management science, has often been applied to the problem of school and district consolidation. Research in this area is typically conducted by economists focusing attention on the costs and benefits that might result from operating on an expanded scale (Lee et al., 2000). Theories of production hold that scale or size economies may be available in larger schools, which is to say that it is possible for larger schools to operate with lower per student costs than smaller schools (Monk, 1987). Savings are expected to accrue as core costs are spread over a larger pupil base.

Economies of scale refers to an inverse relationship between average cost and the number of units produced. Scale economies may result from specialization in the use of resources, spreading costs over more output units, and the growth of ancillary facilities (Chakraborty et al., 2000). Beginning more than thirty years ago, researchers emphasized the importance of (a) including both capital and operating costs in economies of scale studies and (b) assuming that output quality remains constant at different levels of enrollment and that economies of scale are efficiencies or reductions in average total costs which are associated with increased units of output as described by the long run average cost curve (LRAC) (Patten, 1971). The LRAC in education has been found to be either (a) a parabolic curve, which means that as the level of output increases, average costs decline to a minimal point and then rise to form a parabola or U-shaped average cost curve; or (b) a hyperbolic curve, where average costs do not increase after the lowest point is reached, so that the scale curve forms a hyperbola or L-shape over all practical levels of enrollment (Tholkes & Sederberg, 1990).

In order to apply the economies of scale principle to education, the function, nature, inputs, and outputs of school organizations and school output capacity must be defined. Schools and districts are defined as organizations whose function is to deliver educational services. School organization inputs, such as personnel, supplies, facilities, equipment, and transportation, are the factors of production necessary to generate these services (Tholkes & Sederberg, 1990). The administrator's production function, wherein each course, co-curricular activity, and support service is treated as an output, traditionally has been used to define school organization outputs (Thomas, 1971). The maximum number of students who can be offered a specified mix of instructional and support services at given levels of class sizes and staffing ratios is termed the school's output capacity. Average costs are defined as the monetary value of the inputs required to offer a particular service divided by the number of service units provided. Scale economies are realized for educational organizations as long as the addition of one more student results in a lower average cost per unit of output. Economies of scale are maximized at the point where the combined average total costs of all outputs per student are at their minimum (Tholkes & Sederberg, 1990).

Researchers have found scale economies in the operation of schools (Butler & Monk, 1985; Callan &

Santerre,1990; Riew, 1986). Callan and Santerre (1990) explored the education production by specifying an empirical model that incorporated 3 important inputs: (a) instruction, (b) administration, and (c) support staff services. Based on a sample that consisted of all 165 school districts in Connecticut, time series cross-section data were pooled over the period 1980-1984, the researchers estimated factor demand and substitution elasticities for these inputs. A significant degree of substitutability was found between instruction, administration, and support staff services. The authors concluded that short-run economies of scale existed in the provision of local public education.

In 1959, Hirsch published a precedent-setting article representing a new methodological direction on economies of scale. He examined scale effects in 27 St. Louis-area school districts by (a) using cross-sectional data, (b) using regression analysis to measure average expenditures as a function of average daily attendance, and (c) by selecting inputs serving as controls for the quality of the education provided. Teacher-pupil ratio, percent of graduates entering college, college hours per teacher, teacher experience, teacher salary, and the total number of high school credit units were used as indicators of educational quality. Hirsch found that per-pupil expenditures did not vary significantly with enrollment, and concluded that no economies of scale were operating contrary to previous studies, which had uniformly found economies of scale.

Since Hirsch's (1959) seminal work was published, several researchers have investigated the interaction between potentially lower school costs and the higher transportation and management costs incurred when students are placed in the minimum-cost per student enrolled size school. Transportation, distribution, higher salaries, and new-construction costs have been found to cancel the savings realized from increased purchasing power and from more efficient use of facilities, equipment, and personnel (Bickel & Howley, 2000; Bickel, Howley, Williams, & Glascock, 2000; Howley, 2000a; Howley & Bickel, 1999; Stiefel, 1991).

In fact, based on a review of more than thirty studies, Fox (1981) concluded that, "per pupil school costs appear to be characterized by a U-shaped average cost curve" (p. 285). A U-shaped cost curve, or parabolic curve, refers to the shape of the long run average cost curve and means that as the level of output increases, average costs decline to a minimum point and then rise to form a parabola or U-shaped scale curve. In other words, schools can be too large to perform effectively or efficiently. Similarly, Valencia (1984) studied 49 districts, 35 of which had promised savings from closing schools. However, only 12 of these calculated the proposed savings. Eight of these 12 districts reported that the school closures had either not produced the expected savings or had resulted in unexpected additional costs.

Most recently, the concepts of cost-effectiveness and relative costs have been investigated by researchers examining the economic efficiency of school operations (Monk, Wahlberg, & Wang, 2001). For example, Thompson (1994) examined the cost-effectiveness of schools of different sizes in Hawaii. Smaller schools were found to have higher costs, but higher achievement in sixth grade math and reading. Thompson's results indicated that although small schools may sometimes be more expensive to operate than larger schools, they may be more cost-effective than the larger schools if the outcomes are better in terms of the cost per unit of outcome. Stiefel, Berne, Iatorola, & Fruchter (2000) found that small regular 9-12 high schools have a budget- per-graduate that is no greater than the budget-per-graduate of other 9-12 high schools, and, in some cases a much cheaper budget-per-graduate. In their first cost-benefit analysis of New York's small schools, Stiefel, Latarola, Fruchter, and Berne (1998) deemed them to be a good value, with "the quite small additional budgets…well worth the improved outputs," (p. 18). These smaller schools were somewhat more expensive on a cost-per-student enrolled basis. However, based on a cost-per-student graduate, the smaller schools were less costly. The graduation rate of the small public high schools was over 90% as compared to the entire school system's graduation rate of approximately 50%.

Summary of economies of scale and efficiency issues. The review of literature suggested that greater school size does not always result in economies of scale particularly when factors such as (a) transportation costs, (b) capital expenditures, (c) student dispersion, (d) quality of education, (e) qualitative differences between large and small schools, (f) community wealth, and (g) program-by-program differences are taken into account (Tholkes & Sederberg, 1990). For example, as schools get larger, their support and administrative staffs usually expand (Chamber, 1981). Monk (1990) found that as school districts increased either in number of schools in the district or the size of the school, supervisory services were being financed at the expense of students' instructional services. Also, the diseconomies of larger consolidated schools may include: (a) diminished school bond or levy support, (b) increased salaries for more specialized staff, (c) higher rates of vandalism, (d) higher insurance costs, and (e) larger physical plants to maintain (Streifel, Foldesy, & Holman, 1991; Valencia, 1984).

School Size and Related Outcomes

In this section, the literature related to the effect of school size on student outcomes will be examined.

Student outcomes are normally divided into two realms: (a) the affective domain and (b) the cognitive domain (Fowler, 1992). For the purposes of this review the school effects studies included will be grouped into these general areas.

Affective and social outcomes. There is a large body of research highlighting the positive effects of small school size on (a) attitudes and satisfaction, (b) attachment to school, (c) attendance, and (d) extracurricular participation (Daniels, Bizar, & Zemelman, 2001; Howley, 1994; Fowler, 1992). Students attending small schools have higher attendance rates than those in large schools and small school size is associated with lower high school drop-out rates (Cotton, 1996a, 1996b; Fowler, 1995; Stockard & Mayberry, 1992; Toenjes, 1989).

Pittman and Haughwout (1987) examined the impact of high school size on dropout rate using 744 schools from the High School and Beyond (HSB) study conducted by the National Center for Education Statistics. Without controlling for socioeconomic status, the researchers analyzed dropout rate, school climate, program diversity, and school size. They concluded that large enrollment tended to result in a poor school climate which seemed to increase the school dropout rate: "For every 400-student increase in the high school student population, there would be approximately a 1% rise in the dropout rate at the school" (Pittman & Haughwout, 1987, p. 343). Fetler

(1989) examined average dropout rates for two consecutive years in conjunction with percentage of students participating in the Aid to Families with Dependent Children (AFDC), total enrollment, achievement, and academic course enrollments for all of California's regular public high schools. The results revealed that both AFDC percentage and total enrollment were positively related to dropout rates. Perhaps, these results are related to those reported by Page based on a 1991 study of adolescent use of alcohol, tobacco, and other psychoactive substances and its relationship to school size:

> Students in large schools were significantly more likely to drink alcohol, get drunk, use smokeless tobacco, and use marijuana or hashish than students in small and medium schools. Students in large schools were significantly more likely to smoke cigarettes than those in small schools (p. 18).

The incidence of violence seems to increase as school size increases Michael Klonsky (2000) reports on the Small Schools Workshop's national listserv. He states that incidents of violence and crime increase dramatically in schools with 1,000 or more students as compared with those of 300 or less. In urban schools with less than 300 students, for example, 3.9% of the schools studied reported serious violent incidents compared with 32.9% of schools over 1,000 students. According to Klonsky, if more large schools are built, then there is an increased chance that a Littleton type incident will occur. Based on a study of high-school violence, Toby (1993) suggests that the first step in ending school violence must be to "break through the anonymous, impersonal atmosphere of jumbo high schools and junior highs by creating smaller communities of learning within larger structures, where teachers and students can come to know each other well" (p. 46). Garbarino (1998), director of the Family Life Development Center at Cornell University suggested the following regarding the scourge of violence among juveniles, "At the adolescent level, if I could do one single thing it would be to ensure that teenagers are not in a high school bigger than 400 to 500 students" (p. 116).

Extracurricular participation. Larsen (1949) conducted one of the earliest studies examining the relationship between school size and student participation in extracurricular activities. Larsen noted that students in large high schools reported to have taken part in far fewer extracurricular activities than did students attending smaller schools. In 1964, Barker and Gump conducted one of the first systematic studies examining school size. Their seminal work, a book entitled *Big School, Small School: High School Size and Student Behavior* was based on a sample of high schools in eastern Kansas ranging in size from 35 to 2,287. In the book, the researchers concluded that small high schools are advantageous in that students were afforded greater opportunities to participate in extracurricular activities and to exercise leadership roles. Their research revealed that both the number and the variety of extracurricular activities in which students participate are significantly higher in small schools than in large ones consistent with undermanning, a behavior setting theory.

Undermanning indicates that as the population of an organization increases, the number of behavior settings increases, but not as quickly as the population which leads to a personnel surplus (Barker & Gump, 1964). According to the theory, large organizations exert low pressure on their members to hold various positions within the organization primarily because there is likely to exist a surplus of organizational members available to do so. Conversely, small organizations exert a high degree of pressure on their members, as there tends to be a shortage of substitutes and alternates available relative to the number of positions to be filled. Thus, each member is more important to the successful operation of a small organization than is each member in a large organization. For example, the largest school studied by Barker and Gump had 65 times as many students as the smallest school but only had 8 times as many behavior settings. Also, the small-school student was more likely to derive greater satisfaction from participating.

In addition, Barker and Gump proposed the inside-outside perpetual paradox, which is the notion that although a large school may appear impressive from an outside view with "its grand exterior dimensions, its long halls, and myriad rooms, and its tides of students," a small school is impressive from an inside view with the "forces at work stimulating and compelling students to more active and responsible contributions to its enterprises" revealed (p. 195). Barker and Gump concluded that small schools are best and that the perceived "power" and "rightness" of a large school is an "illusion" (p. 195).

It seems that when students are part of a small, intimate learning community, they tend to be more actively involved in school activities. School size may affect student outcomes through its effects on the structure of opportunities associated with the social environment of the school (Garbarino, 1995). According to Goodlad (1984), small schools were better able to solve their problems, were more intellectually oriented, and had more caring teachers and greater parent and student satisfaction. The size of the school is part of the physical environment that influences social interactions (Bryk & Driscoll, 1988; Barker & Gump, 1964):

> There can be little doubt that the school environment and the activities that take place within it are major dimensions of a youth's life and play a critical role in his or her socialization. To the extent that the school environment changes, one would expect

corresponding changes in socialization experience. (Blyth, Simmons, and Bush, 1978, p. 150.)

Lindsay (1982), replicating the work of Barker and Gump (1964), explored school size effects. Using a representative national sample of 14,668 students in 328 elementary schools from the National Longitudinal Study of 1972 and controlling for SES and student ability, Lindsay reported higher extracurricular participation and higher student satisfaction and attendance, particularly for girls, in schools with an elementary grade level (e.g., sixth grade) of 100 or fewer students. With minor exception, the negative effect of larger school size was the same in urban and rural areas. Based on a study of 9,000 Washington juniors and seniors randomly selected from 55 schools that ranged in size from 17 to 1,205 enrolled juniors and seniors, Morgan and Alwin (1980) concluded that "school size has consistently strong [and negative] effects on rates of participation in [extracurricular] activities" (p. 251). Grabe (1981) reported similar results based on a study of roughly 1,600 students.

Based on a study of 34 randomly selected high schools (grades 9-12) in Illinois ranging in size from fewer than 100 students to roughly 500 students, Rogers (1987) reported that "(a)s the high school size increased, a smaller percentage of the student body participated in [extracurricular] activities" (p. 10). Using a more objective measure of participation than employed in similar previous studies, Schoggen and Schoggen (1988) determined the amount of participation by seniors in the voluntary, extracurricular activities of their high schools in relation to the high school's size. The voluntary participation of 10,412 seniors in 27 public high schools, ranging in size from 21 to 622 students per senior class, in central New York state was measured through the tabulation of names printed near photographs of activity groups published in school yearbooks. Schoggen and Schoggen's finding that school size was significantly related to the mean number of participations and to the percentage of students who participated in none of the school's voluntary activities supported the findings of earlier research that relied upon student self-report as the measure of participation.

Although large schools may offer more activities, students enrolled in small schools seem to be more likely to participate in school-sponsored activities than their large school counterparts (Coladarci & Cobb, 1996). A large school may have a better varsity football team because there are more students from which talent can be drawn. But small schools generally have a higher percentage of students participating in athletics. Several studies provide consistent evidence that the amount of participation by most students in the voluntary, extracurricular activities of the school is negatively related to size of high school; the larger the school, the lower the average level of student participation and the fewer experiences of average students in leadership and other responsible positions (Grabe, 1981; Morgan & Alwin, 1980).

Summary of school size effects: extracurricular participation. The review of literature exploring the relationship between school size and extracurricular participation indicates that the level of student participation in all school-sponsored activities tends to be higher in small schools. Students in small schools seem to be involved in a greater number and variety of activities, assume a greater number of positions of responsibility, have a greater sense of belonging and are less likely to be alienated than their counterparts in larger schools. As suggested by Undermanning Theory, it seems that in small schools the participation of all students is needed for clubs, teams, and student government to have an adequate number of members (Schoggen & Schoggen, 1988).

Achievement outcomes. Academic outcomes and accountability are tied together as evidenced by school report cards designed to report academic achievement to the public. These report cards have become common in many states, such as Louisiana. These public education report cards are based on state developed tests to determine students' mastery of basic skills (French & Bobbett, 1993). It seems that if a school is to be considered effective, student learning should be evidenced by successful performance on skills-based tests (Sutton & Soderstrom, 1999). Louisiana's process of school improvement involves a cycle from mission and goal identification to outcome evaluation in terms of student achievement.

Beginning in the late 1960s, reseachers began to examine the relationship between school characteristics, such as size, and student academic achievement. Many of these early studies reported a negative relationship between academic achievement and school size, controlling for socioeconomic differences (Jenks et al., 1972; Summers & Wolfe, 1975; Stemnock, 1974). Wendling and Cohen (1981) analyzed data collected from 1,021 New York State elementary schools to determine the relationship school size and student achievement. Third-grade reading and mathematics achievement was found to be negatively related to school size, when controlling for student socioeconomic status (SES). High-achieving elementary schools had a mean size of 447 students, whereas low-achieving elementary schools had a mean size of 776 students. Eberts, Kehoe, and Stone (1984) examined 287 elementary schools ranging in size from 200 students to 800 students. Based on an analysis of a subsample of the data from the Sustaining Effects Study, the researchers found that smaller elementary schools had higher achievement, even when controlling for student, teacher, principal, and school-climate characteristics. Miller, Ellsworth, and Howell (1986) conducted a study involving 73 elementary schools in the Kansas Unified School District #259. Reading achievement levels were reported to be higher in the smaller schools. Unlike small schools, in large schools, academic success seemed to be stratified along socioeconomic lines.

Until 1988, when Friedkin and Necochea published their groundbreaking work, few studies explored the interaction among school size, poverty, and student achievement (Howley & Bickel, 2000b). Friedkin and Necochea (1988) are often cited as the first researchers to conduct an empirical analysis of the possible interaction effect of school size and SES of the student population. The researchers analyzed data gathered by the state of California's Department of Education (California Assessment Program) as part of its census of the schools and school districts in the state during the 1983-84 academic year. The data included measures of the number, SES, and academic achievement of pupils in four grades: third, sixth, eighth, and twelfth. The researchers hypothesized that the effects of size on performance may be either positive or negative depending on the SES of the pupil population.

The researchers found that socioeconomic status systematically influences the effects of school and district size on aggregate student achievement. Large schools and districts (in California) benefit affluent students moderately, whereas small schools and districts benefit impoverished students to an even greater extent than the large schools benefit the affluent. The opposite relationship is true as well: Large schools compound the negative effects of being impoverished, whereas small schools reduce the advantages that affluence normally brings. Small schools, on this basis, might not serve students from affluent communities particularly well, at least on average.

Friedkin and Necochea's (1988) work was replicated by researchers. Similar studies were conducted by researchers using data from the states of Alaska, Georgia, Montana, Ohio, Texas, and West Virginia (Bickel, 1999a, 1999b; Bickel & Howley, 2000; Bickel, Howley, Williams, & Glascock, 2000; Howley, 1989a, 1989b, 1994, 1995, 1996a, 1999, 2000a, 2000b, 2001; Howley & Bickel, 2000a, 2000b; Huang & Howley, 1993). These states represent considerable variety salient to the structure and operation of schooling in the United States—rural and urban mix, ethnic mix, magnitude of influence of State Education Agency, district organization types, school and district size, and funding inequity (Howley & Bickel, 1999). The reseachers reported that the usual relationship between SES and performance seems to be disrupted in small schools and districts. Simple zero- order correlational analysis was used to measure the magnitude of relationship between SES and achievement in smaller versus larger units (schools or districts divided at the median in these separate data sets). At all grade levels, in all five states, for both schools and districts, for a variety of alternative measures of SES, and for quite different sorts of achievement tests (i.e., both criterion-referenced and norm-referenced), the amount of variance in achievement associated with SES is substantially reduced in smaller units. In most cases, the magnitude of the relationship among the smaller units is about half what it is among the larger units (Bickel, 1999a, 1999b; Bickel & Howley, 2000; Bickel, Howley, Williams, & Glascock, 2000; Howley, 1989a, 1989b, 1994, 1995, 1996a, 1999, 2000a, 2000b, 2001; Howley & Bickel, 2000a, 2000b; Huang & Howley, 1993).

Fowler and Walberg (1991) investigated school size effects in 293 New Jersey public secondary schools by examining 18 school outcomes, including the average scores on (a) state-developed tests, (b) student retention, (c) suspensions, (d) postschool employment, and (e) college attendance. They further investigated 23 additional school characteristics to include: (a) district socioeconomic status and percentages of students from low-income families, (b) school size and number of schools within each district, and (c) teacher characteristics encompassing salaries, degree status, and years of experience. The researchers determined that next to socioeconomic status and the percentage of students from low-income families, school size was the best predictor of student achievement on state tests. Students in smaller schools, regardless of socioeconomic status, tended to perform better on the state tests.

Caldas (1993a) examined the effects of input and process factors, including school size, on public school achievement in Louisiana using a sample that included 1,301 schools identified as either elementary, middle/junior high, high, or combination. Academic achievement was represented by a transformed composite index that included the results of the state's criterion-referenced test and the norm-referenced test administered in the spring of 1990. Using stepwise regression analysis, Caldas reported a small but significant school size effect at the elementary level. Walberg & Walberg (1994) examined the relationship among (a) school size, (b) district size, (c) percentage of schooling costs paid by the state, (d) percentage paid locally, and (e) student achievement. Smaller schools were found to exhibit higher achievement levels than larger schools at both the elementary and secondary levels. Also in 1994, Lee and Smith analyzed standardized test scores based on data obtained from the National Education Longitudinal Study of 1988, or NELS, to determine the gains made by students in the first two years of high school. They reported that small communal schools were found to increase teacher collaboration and team teaching while giving teachers more input into decisions affecting their work. Rather than academically tracking students into homogenous groups, students were likely to be heterogeneously grouped according to diverse talents and interests. The researchers also concluded that the typical large-school emphasis on specialization increased the number of possibly conflicting goals held by various organizational members. "Large size and fragmented human contact complicate the management of such schools, which elevates the importance of formal rules to regulate behavior. The environment in comprehensive high schools is therefore less human" (p. 2). In addition, students who attended small high schools consistently posted higher gains in math, reading, history, and science. Moreover, these gains were more equitably distributed among students from different socioeconomic backgrounds.

In 1995, Lee and Smith again used data based on a sample of 11,794 sophomores in 830 high schools from the first two waves of the National Educational Longitudinal Study of 1988, to assess the impact on 10th-grade students of attending high schools whose practices were consistent with the school restructuring movement. Lee and Smith report that student gains in achievement and engagement were significantly higher in schools with restructuring practices and lower in schools without reforms. The researchers found that higher and more socially equitable engagement and achievement were consistently associated with smaller high schools. Using the production function approach and data from Baltimore (Maryland) public elementary schools, Lamdin (1995) reports that school size has a negligible effect on student academic performance.

Lee and Loeb (2000) explored whether teachers and students are influenced by the size of the inner-city elementary school to which they belong. Using hierarchical linear modeling (HLM), the researchers analyzed survey and standardized test data from almost 5,000 teachers and 23,000 sixth and eighth-grade students in 264 K-8 Chicago schools to assess teacher attitudes and student 1-year gains in mathematics achievement scores. The results indicated that teachers have a more positive attitude about their responsibility for student learning and students achieve at higher levels in small schools. Further, the researchers reported that schools enrolling fewer than 400 students were characterized by more positive teacher attitudes and higher student achievement.

Gardner, Ritblatt, Shulamit, and Beatty (2000) conducted a study examining academic achievement, parental school involvement, absenteeism, and dropout rate as a function of high school size. Data from 60 public high schools in California, which had a student population of between 200-600, were compared with data collected from 67 public high schools with enrollments of greater than 2000 students. The students attending schools with an enrollment of greater than 2000 scored higher on the total SAT, verbal SAT, and math SAT than their counterparts attending the smaller schools with enrollment between 200-600 students. However, the small size schools had less absenteeism, a lower dropout rate, and a higher level of parental school involvement.

Summary of school size effects: academic achievement. Coladarci (1983), a former dean of Stanford University's Cubberly School of Education, noted:

> (R)esearch on the effects of institution size on pupil progress produced only a literature of disagreement....Revised and reinterpreted, this literature confesses a clear and near-unanimous finding: the smaller unit definitely is superior in pupil achievement....Other than home, there is no place like the small school. (pp. 79, 82)

Although the literature suggests that there is a general consensus among educational researchers regarding the negative impact of large school size on academic performance, the literature also indicates that the relationship between school size and academic achievement is unlikely to be linear. Very small and very large schools may have a negative effect on student achievement and studies suggest that the well-known adverse consequences of poverty are tied to school size in substantively important ways. In brief, as size increases, the mean achievement of a school or district with less-advantaged students declines. The greater the concentration of less-advantaged students attending a school, the steeper the decline.

When researchers control for the effect of SES variables on student achievement, they tend to identify a positive effect of small-scale schooling (Eberts et al., 1984; Giesbrecht, 1978; Walberg & Fowler, 1987). However, like older studies, recent studies that do not control for the effect of SES variables on student achievement tend to find no difference in the achievement of students attending small and large size schools (Howley, 1989a, 1989b; Howley & Bickel, 2000a, 2000b; Melnick et al., 1987). These results highlight the importance of including influential SES variables in studies of the effects of school size on student achievement (Bickel, 1999a, 1999b; Bickel & Howley, 2000; Bickel, Howley, Williams, & Glascock, 2000; Howley, 1989a, 1989b, 1994, 1995, 1996a, 1999, 2000a, 2000b, 2001; Howley & Bickel, 2000a, 2000b; Huang & Howley, 1993). Findings in this area of research indicate that small schools may mitigate the effects of poverty thereby providing an achievement advantage for impoverished students while more affluent students may perform better in larger settings. Given the high percentage of Louisiana's children living in poverty, it would seem that the proposed study is needed to provide additional quantitative information regarding the interaction effects of school size, students' socioeconomic background, and academic achievement.

Optimum School Size

Strong evidence has been presented in this review of the literature suggesting that school outcomes are better in smaller schools and that they are more equitably distributed. However, exactly how small a school should be continues to be the subject of intense debate. Optimal school size is usually defined using two potentially conflicting criteria: (a) how organizational size affects group members (a sociological criterion) and (b) the best school size for optimum economic efficiency (an economic criterion). Based upon a review of 30 research studies on school size and its relationship to other factors, Williams (1990) states that "on average, the research indicates that an effective size for an elementary school is in the range of 300-400 students and that 400-800 students is appropriate for a secondary school" (pp. 7-8). The Cross City Campaign for Urban School Reform set the limits at 350 students for elementary schools and 500 students for secondary schools (Fine & Somerville, 1998). A joint policy statement issued by the Carnegie Foundation and the National Association of Secondary School Principals recommended that high schools operate with enrollments of 600 or less (Irmsher, 1997).

Upon reviewing the literature related to school size, Howley (1994) suggests that studies involving outcomes, such as achievement, attendance or dropout rates, recommend a smaller school size than those involving inputs, such as teacher salaries, instructional materials, and specialized staffing. Having also reviewed the literature related to school size, Raywid (1999) notes that studies in which the dependent variable involves the construct of community tend to recommend smaller size schools than those in which the dependent variable involves a measure of an outcome. Therefore, researchers and policy analysts focusing on community will generally recommend small schools universally; those focusing on outcomes suggest that small schools are most appropriate for the impoverished portion of the population while those focusing on inputs tend to favor schools larger for all than those recommended by other researchers (Howley & Bickel, 2000b; Sergiovanni, 1994). Ironically, Conant's (1959) idea of a large high school, one with 300 (grades 10-12) or 400 (grades 9-12), would be considered a small school today (Cotton, 1996a).

In 1985, the Illinois State Board of Education published the results of a ten-year study of K-12 schools. At the secondary level, the lowest student achievement on three separate standardized tests occurred in schools with fewer than 495 students; the highest achievement was found in schools with 495 to 1,280 students. Elementary schools with more than 450 students were reported to have the lowest academic achievement while schools with fewer than

265 students were reported to have the highest achievement scores.

Using three waves of data from National Educational Longitudinal Study of 1988 and hierarchical linear modeling (HLM) methods, Lee and Smith investigated how students' achievement in two subjects (reading and mathematics) over the high school years is influenced by the size of the high school the students attend. They determined growth in achievement for schools that ranged in size from around 100 to around 2,800 students. Lee and Smith (1997a) reported a curvilinear relationship between student achievement and high school size. Achievement seemed to decline when high schools enrolled fewer than 600 students or greater than 900 students. The greatest negative effects were found where enrollment exceeded 2,100 students. Additionally, the adverse effects of large school size were greater for poor and minority students. They concluded that high school students perform best when enrollment is between 600 and 900 students. They reported that learning is more equitable in very small schools, with equity defined as by the relationship between learning and student socioeconomic status. Additionally, the effect school size had on student achievement differed according to the proportion of low SES students. The researchers emphasized that enrollment size seemed to have a stronger effect on learning in schools with high concentrations of low SES students.

Heath (1994) suggested a range of 200-350 students at the elementary level and 400-500 students for a high school. He argued that when these recommended enrollments are exceeded, students and teachers alike have fewer opportunities for sustained relationships, resulting in an impersonal and bureaucratic climate:

> Students see their friends less frequently, have less contact with adults other than their teachers, participate much less frequently in extracurricular activities, including athletic teams, have much less opportunity to hold leadership positions, are more aggressive and disorderly, and cheat more frequently. Parents no longer visit the school as frequently or know their children's teachers as well. (p. 81)

Grade-Level Configuration

Despite two major waves of grade span reorganization during the twentieth century-the junior high and middle school movements-little empirical evidence exists bearing on the relationship between grade organization and academic achievement (Franklin & Glascock, 1998; Wihry et al., 1992). In the nineteenth century, American public education was organized into a two-tiered system. Most systems had six years of elementary followed by six years of secondary education to better facilitate the movement of children into the labor force (Hough, 1995). With the passage of child labor laws early in the twentieth century, many more students had to be prepared to complete secondary education, which lead to the development of the junior high school concept (Hough, 1995). Junior high schools were closely aligned with and patterned after high schools. By the mid-1960s, many districts had transformed junior high schools into middle schools (Hough, 1995).

The traditional elementary school and middle school configurations predominate in U.S. public schools with 56% or 25,480 schools, configured to transition students into either middle schools or junior high schools by the end of the fifth grade (National Center for Education Statistics, 1997). Another 34% or 15,576 schools, are configured to transition students by the end of the sixth grade. Only about 10% or 4,500 schools, combine the elementary with the middle level grades, through the eighth grade. Although middle schools were supposed to have been created to address the needs of young adolescents, many systems adopted the middle school grade span format but not its philosophical commitment and program reform (Hough, 1995).

Moore (1984) compared the reading achievement of seventh and eighth graders attending a K-8 school structure with those attending a junior high school. The two groups were more or less homogeneous with respect to the ethnicity and socioeconomic status of the students. The seventh and eighth grade students in the K-8 schools scored significantly higher in reading achievement than the seventh and eighth grade junior high students. Becker (1987) conducted a study to determine the extent to which different middle grade configurations affect academic learning for students with different abilities and socioeconomic status. In this study based on the school experiences of 8,000 Pennsylvania sixth graders, Becker found a variety of organizational structures in place, from highly tracked, highly departmentalized to self-contained, heterogeneous elementary school classrooms. Becker reported that students from low socioeconomic backgrounds seem to benefit by having instruction provided by a limited number of teachers in an elementary setting.

Hough (1989) examined middle-level school programs and organizations identifying significant differences in programs, policies, and practices among junior high, middle, and elemiddle schools. In a follow-up to that study, Hough collected data from 771 school principals, counselors, and English/language arts teachers. His findings indicated that K-8 schools made significantly greater use of such middle-level policies and practices as interdisciplinary teaching teams, peer tutoring, cross-age tutoring, flexible scheduling, and exploratory programs that did middle schools (6-8 or 7-8) or junior high schools (7-9). Hough (1991) found that middle schools with 6-8 grade spans and K-8 schools were more likely to implement child-centered programs, practices, and policies, than schools with 7-9 or 7-12 grade spans.

Hough (1995) indicated that those middle schools aligned closely with elementary programs be labeled "elemiddle" schools. Hough argues that elemiddle schools, which include both primary and middle grades, may more easily facilitate the child-oriented programs conducive to young adolescent learning. These schools are characterized by their focus on students between the ages of 10 and 14, usually enrolled in grades 5 through 8. Generally, the elemiddle grade configuration is contained in K-8 schools, but also can be found in schools having 4-8, 5-8, and PK-8 grade configurations.

Using data from the Maine Educational Assessment and a series of production functions, Wihry et al. (1992) examined the relationship between grade span and the academic achievement of eighth graders. The results revealed that eighth-graders in elementary settings (K-8, K-9, and 3-8) outperformed eighth-graders in schools with more traditional grade configurations. Eighth-graders in junior/senior settings (6-12, 7-12, and 8-12) performed less well than eighth-graders in all other grade spans.

Very recently, Franklin and Glascock (1998) studied the relationship between grade configuration and student behavior (attendance/suspension) and academic achievement for grades 6, 7, 10, and 11. Elementary (grades K-6/7), middle/junior high (grades 6/7-8/9), secondary (grades 7/8/9-12), and unit (K-12) schools were included in the grade-level data analysis. The grade 6 sample included 76 elementary, 68 middle, and 73 unit schools. The grade sample included 77 elementary, 73 middle, and 76 unit schools. The sample for grades 10 and 11 included two groups of 73 each; unit (K-12) and secondary (grades 9-12). From the population of all Louisiana schools during the 1993-1994 school year, sample schools were randomly selected within each grade configuration. The researchers found that the unit school appears to have positive effects on the academic performance of students in grades six and ten, whereas middle and secondary schools have detrimental effects on the same grade levels.

Alspaugh (1999) has conducted several research studies investigating the effects of grade span on student achievement concluding that students usually experience achievement loss during each transition year that occurs from elementary school to middle or junior high school, and from middle or junior high school to high school. Typically, students regain the achievement loss in the year following the transition year.

In another study, Alspaugh (1995), using data obtained from a sample of 45 high schools-15 with students in grades 10-12, 15 with students in grades 9-12, and 15 with students in grades 7-12, studied the effect of transition year, student gender and grade span on high school dropout rates. He concluded that students who made the transition to high school at grade 7 dropped out significantly less often than did students making the transition at either the ninth or tenth grade level. Students transitioning at grade 10 had the highest dropout rates, which Alspaugh attributes to the achievement loss experienced by many students during a transition year observed in previous research.

Summary of Grade-Level Configuration Research

Although grade-level configuration seems to influence school outcomes, empirical research on the topic has been sparse. Most of the related literature is qualitative or anecdotal with emphasis placed on delineating the perceived benefits and drawbacks of various grade-level configurations. Also, the research is usually focused on the middle grades with very little research focused on the empirical relationship between grade-level configuration and academic achievement, while controlling for other factors such as school size. Given the dearth of empirical research regarding grade-level configuration, it would seem that the proposed study examining the relationship between grade-level configuration and academic achievement across the elementary and secondary levels is warranted. There seems to be some evidence to suggest that grade-level configuration affects student achievement in Louisiana. The Spring 2002 issue of *Reaching for Results* published by the Louisiana State Department of Education highlights the following information on the front page:

> In what Gov. Mike Foster termed a "historic" move, Louisiana's 1,153 public K-8 and "combination" schools showed considerable growth during the first two-year

> cycle of the state's School Accountability System. Ninety-three percent or 1,069 of the K-8 and combination schools improved and nearly 70 % or 803 schools met or exceeded their two-year Growth Targets. (p. 3)

The noteworthy improved performance of Louisiana's K-8 and combination schools suggests that organizational structures influence academic performance.

By expanding upon the work of Franklin and Glascock (1998), the proposed study will contribute valuable information to policymakers and educators regarding the relative effectiveness of the various grade-level configurations in Louisiana.

A Summary of the Review of Related Literature

In 1970, Meeker and Weiler conducted an extensive review of school size research for the Ford Foundation. At least for urban settings, Meeker and Weiler recommended a high school size of 2,600 students. However, Meeker and Weiler seem to be the last researchers to endorse very large high schools (Gregory, 2000). It is now understood that schools can be too large to perform effectively or efficiently (Howley & Harmon, 2000a). According to Lee and Smith (1996), the financial savings projected by proponents of school consolidation have not materialized. Rather than the expected economies of scale, they discovered that diseconomies of scale resulted from creating large schools. In order to handle the increased bureaucratic demands of a large school, more layers of support and administrative staff are required. In fact, school expenditures (per pupil or overall) seem to exhibit a U-shaped association with size meaning that operating schools that are either too large or too small leads to diseconomies of scale (Bickel, 1999b; Bickel & Howley, 2000; Bickel, Fox, 1980; Howley et al., 2000; Howley, 1995, 2000a; Howley & Bickel, 2000a, 2000b; Huang & Howley, 1993;). Stiefel et al. (2000) found that calculating costs to taxpayers by graduate, rather than by student, small schools were less expensive than large ones because of their lower dropout and higher graduation rate.

Many current educational reform models stress that the large, factory model of schooling is not effective for optimal learning, especially for disadvantaged students (Bickel & Howley, 2000; Stiefel, Berne, Iatarola, & Fuchter, 2000; Lee and Smith, 1997). Barker (1986) stated that changing large schools into smaller entities seems to be a key component of the school improvement process. Small-scale schooling is increasingly recommended by school reform literature as an essential element of school restructuring (Rawid, 1999). Current research suggests that instructional reform is contingent upon small school size (Roellke, 1996; Vulliamy & Webb, 1995).

Within the past decade a growing body of empirical research has held that size is negatively associated with most measures of educational productivity. These conclusions encompass (a) measured achievement levels, (b) dropout rates, (c) grade retention rates, and (d) college enrollment rates (Mik & Flynn, 1996; Fowler, 1995; Stevens & Peltier, 1995; Walberg & Walberg, 1994). Researchers report that in comparison to small schools, large size schools have (a) poorer attendance, (b) less student enthusiasm for involvement in school activities, (c) lower student grade averages and standardized-test scores, (d) higher dropout rates and (e) more problems with violence, security, and drug abuse (Klonsky, 1995; Raywid, 1995).

According to Irmsher (1997), large schools tend to function like bureaucracies while small schools generally function like communities. The comprehensive review of research on effective secondary schools conducted by Lee, Bryk, and Smith (1993) suggests that smaller enrollments facilitate (a) group cohesion, (b) the frequency of communication between individuals, and (c) the general management of the school. Further, larger schools are generally subdivided into departments and other units, which tend to form subcultures that threaten the school organization's mission. Beginning with the seminal work of Weber (1947), sociological theory suggests that as organizations get larger human interactions and social ties become more formal (Lee et al., 2000). As organizations get larger, connections between individuals become less personal. Bureaucratic structures are generated by organizational growth. Bureaucratic structures seem to inhibit communal organization as they rely on affectively neutral social relationships to facilitate the administration of standardized rules and procedures (Bryk & Driscoll, 1988; Bryk, Lee, & Holland, 1993).

Small schools seem to offer benefits in several areas: (a) stronger sense of community, (b) greater student morale, (c) more individualized instruction and attention is available to students, (d) fewer discipline problems, (e) minimum bureaucracy, (f) greater flexibility, (g) increased shared decision making, (h) closer personal relationships between students, parents, teachers, administrators, and other stakeholders, (i) increased learning time (j) high rates of student participation in school activities and (k) more rapid progress toward graduation (Barker & Gump, 1964; Beckner, 1983; Daniels et al., 2001; Dunn, 1977; Lindsay, 1984; McComb, 2000; McMullan, Sipe, & Wolf, 1994; Meier, 1995, 1996a, 1996b; Monk; 1987, 1993; Pittman & Haughwout, 1987). Summarizing the literature on school size, Visher, Emanuel, and Haimson (1999) concluded:

> Investigations of the effects of school size on a range of outcomes have been one of the longest and best-established traditions in the field of education research. Researchers and educators have studied this issue extensively, using data ranging from large

> nationally representative surveys to small qualitative studies of schools of varying sizes. Rigorous statistical analysis has been applied in attempting to isolate the effect of school size from other variables….The majority has found that size matters for outcomes such as academic achievement, graduation and dropout rates, and successful school-to-work transitions. With few exceptions, most studies have shown that small environments lead to improved outcomes. (p. 23)

Meier (1996) has identified several reasons that schools with an enrollment between 300 and 400 students seem to be linked to favorable outcomes. For example, less bureaucracy leads to enhanced communication among students, teachers, parents, and administrators and a more individualized curriculum. According to Meier, students tend to feel that they are part of the school community. Safety seemed to increase perhaps because strangers are easily spotted and teachers can respond quickly to rudeness or frustration. Further, Meier stresses that parental involvement is high as parents are more likely to form alliances with teachers who know their child well.

A research team from Bank Street College of Education conducted a study examining Chicago's efforts to promote small schools. They identified four primary reasons small schools should be created (Wasley et al., 2000, p. 2):

> Why create small schools? Above all, in order to address four specific problems: to create small, intimate learning communities where students, are well known and can be pushed and encouraged by adults who care about them; to reduce the isolation that too often seeds alienation and violence; to reduce the devastating discrepancies in the achievement gap that plague poorer children, too often, children of color; and to encourage teachers to use their intelligence and their experience to help students succeed.

Louisiana's Public Education Accountability System is structured to encourage fundamental changes in classroom teaching by helping schools and communities focus on improved student achievement. Perhaps, small scale-schooling could lead to improved student performance in Louisiana without extensive staff development budgets, without widespread dissemination of innovative materials and methods, and without vast systemic aspirations for reform that implicate everything from teacher education to American culture itself (Bickel & Howley, 2000). It may be that school size and grade-level configuration, key input variables, affect process variables, such as school climate, not addressed by this study. Nonetheless, as a result of the many academic studies published touting the benefits of small-scale schooling, a smaller is better movement has emerged in education (Johnson, 2002).

However, Bickel & Howley (2000) warn against replacing the conventional wisdom that bigger is better with another, equally suspect nostrum that small is always best. Clearly, recent research findings indicate that small is not always best. The optimum size for a school is likely to vary from place to place. Although small schools may mitigate the effects of poverty thereby providing an achievement advantage for impoverished students, more affluent students may perform better in larger settings (Bickel, 1999a, 1999b; Bickel & Howley, 2000; Friedkin & Necochea, 1988; Lee & Smith, 1997). In fact, the demographic characteristics of the community in which the school is located are likely indicators of size-relevant variability (Howley, 1995, 1996; Irmsher, 1997; Plecki, 1991).

CHAPTER 3

Methodology

Introduction

The purpose of this study was to explore the effects of school size, SES, the interaction of school size and SES, and grade-level configuration on the academic achievement of students in grades 4, 8, and 10. This chapter presents the methodology for the study and includes a description of the population, the variables and hypotheses investigated, the data collection procedures and the data analysis techniques utilized.

This research study was designed to contribute to current understanding of optimal organizational structures, specifically school size and grade-level configuration, for 4^{th}, 8^{th}, and 10^{th} grade students. Also, the effects of school size and grade-level configuration were considered along with students' socioeconomic status (SES), which has been found to be associated with school-related outcomes in the literature. The relationship between SES and academic achievement has been well established (Coleman et al., 1966; Jencks et al., 1972; K. White, 1982). *Ceteris paribus*, indices of SES correlate positively and meaningfully with a variety of achievement measures.

Numerous studies have shown a negative relationship between poverty and academic achievement. For example, in a dissertation entitled *The relationship between specific school variables and Louisiana school performance*, White (2000) examined the relationship between school performance and school size, class size, teacher certification, and socioeconomic status of students. White (2000) reported that the socioeconomic status of a school's student population may account for as much as 65% of the variance among School Performance Scores. Moreover, many studies suggest that the negative relationship between poverty and academic achievement may be related to school size. As school size increases, the mean achievement of schools with low SES student populations declines more steeply than schools with higher SES student populations. (Bickel, 1999a; 1999b; Bickel & Howley, 2000; Howley, 2000a; 2000b; 2001; Howley & Bickel, 2000; Huang & Howley, 1993).

The following research questions guided this study. (1) Do the effects of school size, SES, and/or the interaction of school size and SES on academic achievement in Louisiana public schools as measured by the LEAP 21 and the GEE 21 significantly differ across grade-level configurations at the 4^{th}, 8^{th}, and 10^{th} grade levels? (2) Is there a significant relationship among school size, grade-level configuration, SES, the interaction of school size and SES, and student achievement in Louisiana public schools in grades 4, 8, and 10 as measured by the English Language Arts and Mathematics components of the LEAP 21 and the GEE 21? (3) Do the effects of school size and SES levels on student achievement as measured by the English Language Arts and Mathematics components of the LEAP 21 and GEE 21 significantly differ in Louisiana public schools in grades 4, 8, and 10? and (4) Does the effect of school size on student achievement in Louisiana public schools in grades 4, 8, and 10 as measured by the LEAP 21 and GEE 21 significantly differentiate across SES levels?

Research Design

Given that the purpose of this study was to identify the relationship among socioeconomic status, school size, grade-level configuration and student achievement in grades 4, 8, and 10, a correlational research design, in which the researcher collected data to determine whether, and to what degree, a relationship existed between two or more quantifiable variables seemed appropriate (Gay, 1992). The correlational method is best suited to relationship studies in which a number of variables believed to be related to a major, complex variable, such as achievement, are under investigation.

In this study, the researcher employed multivariate regression analysis to test the hypotheses about the relationship among school size, grade-level configuration, SES, and student academic achievement. Multiple regression analysis is a statistical method utilized to study the effects of one or more independent variables on a dependent variable incorporating the principles of correlation and regression (Kerlinger, 1992; Salvatore, 1982). "The method has been used in hundreds of studies probably because of its flexibility, power, and general applicability to many different kinds of research problems" (Kerlinger, 1992, p. 138). Additionally, the relationship among school size, SES, and student academic achievement was assessed through the use of Multivariate Analysis of Variance (MANOVA). This form of analysis allowed the researcher to "assess the relative magnitude of variation resulting from different sources and ascertain whether a particular part of the variation is greater than expectation under the null hypothesis" (Ferguson & Takane, 1989, p. 250). Analysis at the 4^{th}, 8^{th}, and 10^{th} grade levels permitted a comparison of the relationship among school size, SES, and academic achievement across various types of grade-level configurations and pupil populations at different stages of maturity and academic development.

Sample Selection

The unit of analysis in this study was the individual public school in Louisiana, which was appropriate as schools are assigned a School Performance Score based on the aggregate performance of the students in attendance.

The population included all public schools which can be classified as elementary, middle/junior high, secondary, or combination. "A population can be defined as the totality of all possible observations on measurements or outcomes, (Kmenta, 1986, p. 3)." Given that this sample included all of the 1362 public schools in Louisiana that reported information for the 2001-2002 Louisiana School Report Card, the sample and target population were approximately equal. Therefore, based upon large-sample distribution theory, it is probable that the sample mean approximated the population mean (Green, 1990).

The data set provided by the Louisiana State Department of Education consisted of 4th, 8th, and 10th grade students' raw LEAP 21 scores representing all of the state's 1362 public schools. The data set for this study included the following information.

	Elementary	Middle/Junior	Secondary	Combination	Alternative
Total	701	227	228	73	132
4th	694	27		62	
8th	52	190	103	74	
10th			226	71	

The one hundred and thirty two schools identified as alternative were excluded from this study. Alternative schools included those classified as alternative, university laboratory, special education, vocational, magnet, charter, and Montessori.

Description of Variables

The theoretical framework utilized for this study was based upon the construct of schooling as a production process. Therefore, the education production function was used to describe the relation between school inputs and student outcomes. Schools are defined as producers of student achievement, wherein educational outputs are viewed as a function of various inputs to the educational process (Greenwald, Hedges, & Laine, 1996). Within this model, the researcher assumed that changes in the systems' inputs result in changes in the systems' outputs, which provides a useful framework for structuring multivariate analyses of educational outcomes (Wihry et al., 1992).

Inputs may be categorized as either (a) input factors or (b) process factors (Caldas, 1993a). Input factors are defined as the independent variables over which schools have little or no control such as the demographic and socioeconomic characteristics of the student body (Shavelson et al., 1987). Process factors are defined as the independent variables over which schools or policymakers do have some control, such as school structure (Shavelson et al., 1987). Outputs, such as student achievement in English language arts and mathematics, are the dependent variables and are defined as the product of the inputs in the form of educational goods and services. The variables included in this study were operationally defined as follows;

Independent variables. For the purpose of this study, the following socioeconomic (input factors) and school structure variables (process factors), representing inputs were included.

(a) The *Socioeconomic Status* (SES) variables will be defined as the percentage of students participating in the federal free or reduced price lunch program during the fall of 2001 which was calculated by dividing the number of students participating in October 2001 by the school's enrollment in October 2001, and multiplying by 100.

(b) The *School Structure* variables included in the empirical model were School Size (SIZE) and Grade-Level Configuration (LEVEL). School size (SIZE) was represented by the total number of students enrolled at each school. The number and type of public elementary and secondary schools included in this study did not include alternative schools, district-approved charter schools, magnet schools, or vocational schools. Schools were categorized by grade-level configuration (LEVEL) as follows.

Elementary (E): Any school whose grade structure falls within the PK-8 range, which excludes grades 9-12, and which does not fit the definition for middle/junior high school.

Middle/Junior High (MJ): Any school whose grade structure falls within the range 4-9; includes grades 7 or 8; and excludes grades PK-3 and 10-12.

Secondary (S): Any school whose grade structure falls within the range 6-12 and includes grades in the 10-12 range; or any school that includes only grade 9.

Combination (C): Any school whose grade structure falls within the range PK-12 and is not described by any of the above definitions. These schools generally contain some grades in the K-6 range and some grades in the 9-12 range. Examples include grade structures such as K-12; K-3, 9-12, and 4-6. (Louisiana Department of Education, 2002).

(c) The *Size-by-Socioeconomic Status Interaction Effect* variable (SSI) included in the empirical model were represented by the product of school size (SIZE) and socioeconomic status (SES).

Dependent variables. Data from the English Language Arts and Mathematics criterion-referenced tests, referred to as the Louisiana Educational Assessment Program for the 21st Century (LEAP 21) and the Graduate Exit Examination for the 21st Century (GEE 21), were used to form the dependent variables. According to Popham (1993), criterion-referenced testing devices should be employed whenever possible by educational evaluators because such tests simply yield more meaningfully interpretable data than norm-referenced testing devices and hence are of more utility to decision makers (Popham, 1993). For the purposes of this study, the *Academic Achievement* variables representing outputs were represented by the percentage of students passing the English Language Arts (ELA) and the Mathematics (MATH) LEAP 21 and GEE 21. The percentages were converted to their decimal equivalents for inclusion in the model. These tests were used because the English Language Arts and Mathematics LEAP 21 and the GEE 21 carry high stakes for students. The LEAP 21 is used for promotion and remediation decisions, the GEE 21 for eligibility for a standard high school diploma. (Louisiana Department of Education, 2002). The "high stakes" nature of these tests suggests that students will endeavor to maximize their performance.

Students received one of the following five achievement levels with *Approaching Basic* or above achievement levels representing passing scores.

Advanced: A student at this level had demonstrated superior performance beyond the proficient level of mastery.

Proficient: A student at this level had demonstrated competency over challenging subject matter and is well-prepared for the next level of schooling.

Basic: A student at this level has demonstrated only the fundamental knowledge and skills needed for the next level of schooling.

Approaching Basic: A student at this level has only partially demonstrated the fundamental knowledge and skills needed for the next level of schooling.

Unsatisfactory: A student at this level has not demonstrated the fundamental knowledge and skills needed for the next level of schooling. (Louisiana Department of Education, 2002).

Instrumentation

In May 1997, the State Board of Elementary and Secondary Education approved content standards in English language arts, mathematics, science, social studies, foreign language, and the arts. The Department of Education developed criterion-referenced tests to align with the content standards in four of the six content areas: English language arts, mathematics, science, and social studies. These tests are directly aligned with state's content standards and by law these tests must be as rigorous as those of the National Assessment of Educational Progress (NAEP). These tests are administered to students in grades 4, 8, 10, and 11 throughout the state, and are used to evaluate the academic performance of students and, by implication, the effectiveness of schools and school districts in promoting measured academic achievement.

Data Recognition Corp (DRC) from the State of Louisiana was awarded a contract in May of 1998 that included services for scoring, reporting, and research for the 1999-2001 LEAP 21 operational administration. Test development and research services were subcontracted to CTB/McGraw-Hill. These services included item and test form development, while research services included item analyses, scaling, and equating tasks for the operational forms. According to the Louisiana Department of Education's LEAP 21 Operational Technical Report, all high stake's tests were validated as appropriate measures of students' mastery of the State's content standards. Test reliability coefficients of greater than .80 were considered very good, and above .85, excellent. Detailed validity and reliability information for each subject area test by grade level is available upon request in the form of Technical Reports from the Louisiana Department of Education. This information includes, but is not limited to item development and form construction, number correct statistics, item-level analyses, rater agreement, form calibration studies, item fit, form equating, content validity analysis, standards intercorrelations, population studies, and standard setting methods.

Data Collection

Data for this study were supplied by the Louisiana Department of Education. All data representing the input and output factor variables were collected during the 2001-2002 academic year. Thus, this analysis was limited to those data that all schools reported to the Louisiana

Department of Education that could be aggregated by school level.

Data Analysis

In order to determine the impact of socioeconomic status, school size, the interaction of socioeconomic status and school size, and grade-level configuration on student achievement, the data were analyzed at the .05 level of significance as follows.

Research question one: Do the effects of school size, SES, and/or the interaction of school size and SES on academic achievement in Louisiana public schools as measured by the LEAP 21 and the GEE 21 significantly differ across grade-level configurations at the 4^{th}, 8^{th}, and 10^{th} grade levels?

Null Hypothesis (1a): The effects of school size, SES, and/or the interaction of school size and SES on the academic achievement of 4^{th} graders as measured by the English Language Arts component of the LEAP 21 do not significantly differ across grade-level configurations in Louisiana public schools.

Null Hypothesis (1b): The effects of school size, SES, and/or the interaction of school size and SES on the academic achievement of 4^{th} graders as measured by the Mathematics component of the LEAP 21 do not significantly differ across grade-level configurations in Louisiana public schools.

Null Hypothesis (1c): The effects of school size, SES, and/or the interaction of school size and SES on the academic achievement of 8th graders as measured by the English Language Arts component of the LEAP 21 do not significantly differ across grade-level configurations in Louisiana public schools.

Null Hypothesis (1d): The effects of school size, SES, and the interaction of school size and SES on the academic achievement of 8th graders as measured by the Mathematics component of the LEAP 21 do not significantly differ across grade-level configurations in Louisiana public schools.

Null Hypothesis (1e): The effects of school size, SES, and/or the interaction of school size and SES on the academic achievement of 10th graders as measured by the English Language Arts component of the GEE 21 do not significantly differ across grade-level configurations in Louisiana public schools.

Null Hypothesis (1f): The effects of school size, SES, and the interaction of school size and SES on the academic achievement of 10th graders as measured by the Mathematics component of the GEE 21 do not significantly differ across grade-level configurations in Louisiana public schools.

Research question two: Is there a significant relationship among school size, grade-level configuration, SES, the interaction of school size and SES, and student achievement in Louisiana public schools in grades 4, 8, and 10 as measured by the English Language Arts and Mathematics components of the LEAP 21 and the GEE 21?

Null Hypothesis (2ai): There is no significant relationship among school size, SES, the interaction effect of school size and SES, and academic achievement as measured by the English Language Arts component of the LEAP 21 for 4^{th} graders in an elementary configuration.

Null Hypothesis (2aii): There is no significant relationship among school size, SES, the interaction effect of school size and SES, and academic achievement as measured by the English Language Arts component of the LEAP 21 for 4^{th} graders in a middle/junior high configuration.

Null Hypothesis (2aiii): There is no significant relationship among school size, SES, the interaction effect of school size and SES, and academic achievement as measured by the English Language Arts component of the LEAP 21 for 4^{th} graders in a combination configuration.

Null Hypothesis (2bi): There is no significant relationship among school size, SES, the interaction effect of school size and SES, and academic achievement as measured by the Mathematics component of the LEAP 21 for 4^{th} graders in an elementary configuration.

Null Hypothesis (2bii): There is no significant relationship among school size, SES, the interaction effect of school size and SES, and academic achievement as measured by the Mathematics component of the LEAP 21 for 4^{th} graders in a middle/junior high configuration.

Null Hypothesis (2biii): There is no significant relationship among school size, SES, the interaction effect of school size and SES, and academic achievement as measured by the Mathematics component of the LEAP 21 for 4^{th} graders in a combination configuration.

Null Hypothesis (2ci): There is no significant relationship among school size, SES, the interaction effect of school size and SES, and academic achievement as measured by the English Language Arts component of the LEAP 21 for 8th graders in an elementary configuration.

Null Hypothesis (2cii): There is no significant relationship among school size, SES, the interaction effect of school size and SES, and academic achievement as measured by the English Language Arts component of the LEAP 21 for 8th graders in a middle/junior high configuration.

Null Hypothesis (2ciii): There is no significant relationship among school size, SES, the interaction effect of school size and SES, and academic achievement as measured by the English Language Arts component of the LEAP 21 for 8th graders in a secondary configuration.

Null Hypothesis (2civ): There is no significant relationship among school size, SES, the interaction effect of school size and SES, and academic achievement as measured by the English Language Arts component of the LEAP 21 for 8th graders in a combination configuration.

Null Hypothesis (2di): There is no significant relationship among school size, SES, the interaction effect of school size and SES, and academic achievement as measured by the Mathematics component of the LEAP 21 for 8th graders in an elementary configuration.

Null Hypothesis (2dii): There is no significant relationship among school size, SES, the interaction effect of school size and SES, and academic achievement as measured by the Mathematics component of the LEAP 21 for 8th graders in a middle/junior high configuration.

Null Hypothesis (2diii): There is no significant relationship among school size, SES, the interaction effect of school size and SES, and academic achievement as measured by the Mathematics component of the LEAP 21 for 8th graders in a secondary configuration.

Null Hypothesis (2div): There is no significant relationship among school size, SES, the interaction effect of school size and SES, and academic achievement as measured by the Mathematics component of the LEAP 21 for 8th graders in a combination configuration.

Null Hypothesis (2ei): There is no significant relationship among school size, SES, the interaction effect of school size and SES, and academic achievement as measured by the English Language Arts component of the GEE 21 for 10th graders in a secondary configuration.

Null Hypothesis (2eii): There is no significant relationship among school size, SES, the interaction effect of school size and SES, and academic achievement as measured by the English Language Arts component of the GEE 21 for 10th graders in a combination configuration.

Null Hypothesis (2f): There is no significant relationship among school size, SES, the interaction of school size and SES, grade-level configuration, and academic achievement at the 10^{th} grade level as measured by the Mathematics component of the GEE 21.

Research question three: Do the effects of school size and SES levels on student achievement as measured by the English Language Arts and Mathematics components of the LEAP 21 and GEE 21 significantly differ in Louisiana public schools in grades 4, 8, and 10?

Null Hypothesis (3a): The effects of school size and SES levels on academic achievement as measured by the English Language Arts and Mathematics components of the LEAP 21 do not significantly differ for 4^{th} graders in an elementary combination.

Null Hypothesis (3b): The effects of school size and SES levels on student academic achievement as measured by the English Language Arts and Mathematics components of the LEAP 21 do not significantly differ for 8^{th} graders in a middle/junior high configuration.

Null Hypothesis (3c): The effects of school size and SES levels on student academic achievement as measured by the English Language Arts and Mathematics components of the GEE 21 do not significantly differ for 10th graders in a secondary configuration.

Research question four: Does the effect of school size on student achievement in Louisiana public schools in grades 4, 8, and 10 as measured by the LEAP 21 and GEE 21 significantly differentiate across SES levels?

Null Hypothesis (4a): There is no significant relationship between school size and student academic achievement as measured by the English Language Arts and Mathematics components of the LEAP 21 for 4th graders in an elementary configuration in which 50% or less of students participate in the federal free and reduced price lunch program.

Null Hypothesis (4b): There is no significant relationship between school size and student academic achievement as measured by the English Language Arts and Mathematics components of the LEAP 21 for 4th graders in an elementary configuration in which between 51% and 79% of students participate in the federal free and reduced price lunch program.

Null Hypothesis (4c): There is no significant relationship between school size and student academic achievement as measured by the English Language Arts and Mathematics components of the LEAP 21 for 4th graders in an elementary configuration in which 80% or more of students participate in the federal free and reduced price lunch program

Null Hypothesis (4d): There is no significant relationship between school size and student academic achievement as measured by the English Language Arts and Mathematics components of the LEAP 21 for 8^{th} graders in a middle/junior high configuration in which 50% or less of students participate in the federal free and reduced price lunch program.

Null Hypothesis (4e): There is no significant relationship between school size and student academic achievement as measured by the English Language Arts and Mathematics components of the LEAP 21 for 8^{th} graders in a middle/junior high configuration in which between 51% and 79% of students participate in the federal free and reduced price lunch program.

Null Hypothesis (4f): There is no significant relationship between school size and student academic achievement as measured by the English Language Arts and Mathematics components of the LEAP 21 for 8^{th} graders in a middle/junior high configuration in which 80% or more of students participate in the federal free and reduced price lunch program.

Null Hypothesis (4g): There is no significant relationship between school size and student academic achievement as measured by the English Language Arts and Mathematics components of the GEE 21 for 10^{th} graders in a secondary configuration in which 35% or less of students participate in the federal free and reduced price lunch program. This hypothesis was assessed through the use of Multivariate Analysis of Variance (MANOVA).

Null Hypothesis (4h): There is no significant relationship between school size and student academic achievement as measured by the English Language Arts and Mathematics components of the GEE 21 for 10^{th} graders in a secondary configuration in which between 36% and 59% of students participate in the federal free and reduced price lunch program.

Null Hypothesis (4i): There is no significant relationship between school size and student academic achievement as measured by the English Language Arts and Mathematics components of the GEE 21 for 10^{th} graders in a secondary configuration in which 60% or more of students participate in the federal free and reduced price lunch program

Multiple regression analysis was used to test the hypotheses about the relationship among the dependent variables (Ys), student achievement in English language arts and mathematics, and the independent variables (Xs), SES, school size, and the product of SES and school size. All variables were interval or ratio scaled, normally distributed around the prediction line, and related to each other linearly (Cronk, 1999). The regression equation may be written as:

$Y = b_0 + b_1X_{1i} + b_2X_{2i} + \ldots + b_zX_{zi}$ (where z is the number of Independent Variables).

Since the points were unlikely to fall precisely on the line, the exact linear relationship was modified to include a random distribution, error, or stochastic term, u_i: $Y = b_0 + b_1X_{1i} + b_2X_{2i} + \ldots + b_zX_{zi} + u_i$.

The error term was assumed to be (a) normally distributed, with (b) zero expected value or zero mean, and (c) constant variance, and it was further assumed (d) that the error terms were uncorrelated or unrelated to each other and (e) that the explanatory variable assumed fixed values in repeated sampling (so that X_i and u_i are uncorrelated), and last (f) that there was no exact linear relationship between the Xs (Salvatore, 1982).

More specifically, Ordinary Least Squares (OLS) procedures were used to calculate the regression coefficients for each of the independent variables. These coefficients indicated how much change in the dependent variable was associated with an increase of one unit in the associated independent variables when the others were controlled (Glasman & Biniaminov, 1981). The ordinary least-squares method is a technique for fitting the "best" straight line to the sample of XY observations, which involves minimizing the sum of the squared (vertical) deviations of points from the line:

$$\text{Min} \sum (Y_i - \hat{Y}_i)^2$$

where Y_i refers to the actual observations, and $\hat{Y}_i$ refers to the corresponding fitted values, so that $Y_i - \hat{Y}_i = e_i$, the residual (Salvatore, 1982).

According to Salvatore (1982), ordinary least-squares (OLS) estimators are best linear estimators (BLUE). Best unbiased or efficient means smallest variance. Thus, OLS estimators are the best among all unbiased linear estimators. This is known as the Gauss-Markov theorem and represents the most important justification for using OLS. Estimator b_1 measures the change in Y for a unit change in X_1 while holding X_2 constant. b_2 is analogously defined. Estimators b_1 and b_2 are called partial regression coefficients. b_0, b_1, and b_2 are BLUE.

Moreover, hypotheses were tested to determine the differential impact of school size, SES, and the interaction of school size and SES on academic achievement as measured by the English Language Arts and Mathematics components of the LEAP 21 and GEE 21 across grade-level configurations at the 4^{th}, 8^{th}, and 10^{th} grade levels. The F-test known as the "Chow test" was used to test the hypothesis that the slope coefficients were homogeneous across grade-level configurations (Kmenta, 1986). First, the separate regressions for each grade-level configuration were calculated. Next, the separate regressions for each grade-level configuration were collapsed into one regression equation. So as to assess the effects of each grade-level configuration relative to the others, separate dummy variables were introduced for each grade-level configuration (with exception of the reference grade-level configuration) (Pindyck & Rubinfield, 1981). Dummy variables can be used to capture changes (shifts) in the intercept, changes in slope, and changes in both intercept and slope (Salvatore, 1982). In this model, dummy variables were used to capture changes in the intercept, b_0. The combined regression equation was calculated. The equality of the separate regression equation coefficients and the combined regression equation coefficients was determined by calculating the F-statistic and comparing it to the critical value. If the calculated F-statistic exceeded the critical value then the hypothesis was rejected. The linear regression models used can be written as:

Model A: (ELA) (4^{th} grade Elementary Configuration) =

$b_0 + b_1(SIZE)_{1i} + b_2(SES)_{2i} + b_3(SSI)_{3i} + u_i$

Model B: (MATH) (4^{th} grade Elementary configuration) =

$b_0 + b_1(SIZE)_{1i} + b_2(SES)_{2i} + b_3(SSI)_{3i} + u_i$.

Model C: (ELA) (4^{th} grade Middle/Junior High configuration)

$= b_0 + b_1(SIZE)_{1i} + b_2(SES)_{2i} + b_3(SSI)_{3i} + u_i$

Model D: (MATH) (4^{th} grade Middle/Junior High

configuration) $= b_0 + b_1(SIZE)_{1i} + b_2(SES)_{2i} + b_3(SSI)_{3i} + u_i$.

Model E: (ELA) (4^{th} grade Secondary configuration) =

$b_0 + b_1(SIZE)_{1i} + b_2(SES)_{2i} + b_3(SSI)_{3i} + u_i$

Model F: (MATH) (4th grade Middle/Junior High configuration) $= b_0 + b_1(SIZE)_{1i} + b_2(SES)_{2i} + b_3(SSI)_{3i} + u_i$.

Model G: (ELA) (4th grade all configurations) $= b_0 + b_1(SIZE)_{1i} + b_2(SES)_{2i} + b_3(SSI)_{3i} + b_4(M/JH)_{4i} + b_5(C)_{5i} + u_i$

Model H: (MATH) (4th grade all configurations) $= b_0 + b_1(SIZE)_{1i} + b_2(SES)_{2i} + b_3(SSI)_{3i} + b_4(M/JH)_{4i} + b_5(C)_{5i} + u_i$

Model I: (ELA) (8th grade Middle/Junior High configuration) $= b_0 + b_1(SIZE)_{1i} + b_2(SES)_{2i} + b_3(SSI)_{3i} + u_i$

Model J: (MATH) (8th grade Middle/Junior High configuration) $= b_0 + b_1(SIZE)_{1i} + b_2(SES)_{2i} + b_3(SSI)_{3i} + u_i$

Model K: (ELA) (8th grade Elementary configuration) $= b_0 + b_1(SIZE)_{1i} + b_2(SES)_{2i} + b_3(SSI)_{3i} + u_i$

Model L: (MATH) (8th grade Elementary configuration) $= b_0 + b_1(SIZE)_{1i} + b_2(SES)_{2i} + b_3(SSI)_{3i} + u_i$

Model M: (ELA) (8th grade Secondary configuration) $= b_0 + b_1(SIZE)_{1i} + b_2(SES)_{2i} + b_3(SSI)_{3i} + u_i$

Model N: (MATH) (8th grade Secondary configuration) $= b_0 + b_1(SIZE)_{1i} + b_2(SES)_{2i} + b_3(SSI)_{3i} + u_i$

Model O: (ELA) (8th grade Combination configuration) $= b_0 + b_1(SIZE)_{1i} + b_2(SES)_{2i} + b_3(SSI)_{3i} + u_i$

Model P: (MATH) (8th grade Combination configuration) $= b_0 + b_1(SIZE)_{1i} + b_2(SES)_{2i} + b_3(SSI)_{3i} + u_i$

Model Q: (ELA) (8^{th} grade all configurations) = b_0 + $b_1(SIZE)_{1i} + b_2(SES)_{2i} + b_3(SSI)_{3i} + b_4(E)_{4i} + b_5(S)_{5i} + b_6(C)_{6i} + u_i$

Model R: (MATH) (8^{th} grade all configurations) = b_0 + $b_1(SIZE)_{1i} + b_2(SES)_{2i} + b_3(SSI)_{3i} + b_4(E)_{4i} + b_5(S)_{5i} + b_6(C)_{6i} + u_i$

Model S: (ELA) (10^{th} grade Secondary configuration) = b_0 + $b_1(SIZE)_{1i} + b_2(SES)_{2i} + b_3(SSI)_{3i} + u_i$

Model T: (MATH) (10^{th} grade Secondary configuration) = b_0 + $b_1(SIZE)_{1i} + b_2(SES)_{2i} + b_3(SSI)_{3i} + u_i$

Model U: (ELA) (10^{th} grade Combination configuration) = b_0 + $b_1(SIZE)_{1i} + b_2(SES)_{2i} + b_3(SSI)_{3i} + u_i$

Model V: (MATH) (10^{th} grade Combination configuration) = b_0 + $b_1(SIZE)_{1i} + b_2(SES)_{2i} + b_3(SSI)_{3i} + u_i$

Model W: (ELA) (10^{th} grade all configurations) = b_0 + $b_1(SIZE)_{1i} + b_2(SES)_{2i} + b_3(SSI)_{3i} + b_4(C)_{4i} + u_i$.

Model X: (MATH) (10^{th} grade all configurations) = b_0 + $b_1(SIZE)_{1i} + b_2(SES)_{2i} + b_3(SSI)_{3i} + b_4(C)_{4i} + u_i$.

The statistical significance of the parameter estimates of the multiple regressions were tested by determining the variance of the estimates. The coefficient of multiple determination, R^2, which is defined as the proportion of the total variation in Y explained by the multiple regression of Y on X_1, X_2,...and X_z was computed, analyzed, and is reported in chapter 4. The overall significance of the regressions was tested with the ratio of the explained to the unexplained variance. This follows an F distribution with k - 1 and n - k degrees of freedom, where n was the number of observations and k was the number of parameters estimated. If the calculated F ratio exceeded the tabular value of F at the .05 level of significance and the specified degrees of freedom, the hypotheses was accepted that the regression parameters were not equal to zero and that R^2 was significantly different from zero.

Research questions three and four were assessed through the use of Multivariate Analysis of Variance (MANOVA). MANOVA's are tests involving more than one dependent variable. Cronk (1999) states that "while it is possible to conduct several univariate tests (one for each dependent variable), this causes Type I error inflation" (p. 80). The dependent variables were the percentage of students that had passed the English Language Arts and Mathematics components of the LEAP 21. SES (poverty level) was defined as the percentage of students participating in the free or reduced price lunch program. The SES levels were divided into three ranges and schools were identified as small, medium, or large according to size as measured by total enrollment.

To address research question three, the effects of school size, SES, and the interaction of school size and SES on academic achievement as measured by the English Language Art and Mathematics components of the LEAP 21 and the GEE 21 were assessed. To address research question four, SES was held constant. Where significant interaction effects were found, a univariate ANOVA was calculated. According to Cronk (1999), "analysis of variance (ANOVA) is a procedure that determines the proportion of variability attributed to each of several components" and "it is one of the most useful and adaptable techniques available" (p. 62). This form of analysis allows the researcher to "assess the relative magnitude of variation resulting from different sources and ascertain whether a particular part of the variation is greater than expectation under the null hypothesis" (Ferguson & Takane, 1989, p.250). Post-hoc tests were then conducted to determine which groups were significantly different. Tukey's HSD was used to determine the nature of the difference among groups. The groups analyzed were delineated as follows:

Group 1: (4th grade elementary configuration SES Level 1) small school size

Group 2: (4th grade elementary configuration SES Level 1) medium school size

Group 3: (4th grade elementary configuration SES Level 1) large school size

Group 4: (4th grade elementary configuration SES Level 2) small school size

Group 5: (4th grade elementary configuration SES Level 2) medium school size

Group 6: (4^{th} grade elementary configuration SES Level 2) large school size

Group 7: (4^{th} grade elementary configuration SES Level 3) small school size

Group 8: (4^{th} grade elementary configuration SES Level 3) medium school size

Group 9: (4^{th} grade elementary configuration SES Level 3) large school size

Group 10: (8^{th} grade middle/junior high configuration SES Level 1) small school size

Group 11: (8^{th} grade middle/junior high configuration SES Level 1) medium school size

Group 12: (8^{th} grade middle/junior high configuration SES Level 1) large school size

Group 13: (8^{th} grade middle/junior high configuration SES Level 2) small school size

Group 14: (8^{th} grade middle/junior high configuration SES Level 2) medium school size

Group 15: (8^{th} grade middle/junior high configuration SES Level 2) large school size

Group 16: (8^{th} grade middle/junior high configuration SES Level 3) small school size

Group 17: (8^{th} grade middle/junior high configuration SES Level 3) medium school size

Group 18: (8^{th} grade middle/junior high configuration SES Level 3) large school size

Group 19: (10th grade secondary configuration SES Level 1) small school size

Group 20: (10th grade secondary configuration SES Level 1) medium school size

Group 21: (10th grade secondary configuration SES Level 1) large school size

Group 22: (10th grade secondary configuration SES Level 2) small school size

Group 23: (10th grade secondary configuration SES Level 2) medium school size

Group 24: (10th grade secondary configuration SES Level 2) large school size

Group 25: (10th grade secondary configuration SES Level 3) small school size

Group 26: (10th grade secondary configuration SES Level 3) medium school size

Group 27: (10th grade secondary configuration SES Level 3) large school size

Limitations

The analysis was limited to the data that all schools reported to the Louisiana State Board of Elementary and Secondary Education for inclusion in the mandated Louisiana School Report Card for 2001-2002. The unit of analysis in this study was limited to the individual public school in Louisiana, with the exclusion of schools classified as alternative, university laboratory, special education, vocational, magnet, charter, and Montessori.

These aforementioned types of schools were excluded from this study because many of them offer specialized programs or provide services only to certain populations. In addition, the researcher assumed that the LEAP 21 and GEE 21 tests had been administered appropriately and that data were reported accurately.

CHAPTER 4

Analysis of Data

Introduction

The purpose of this study was to examine the effect of school size, grade-level configuration, and socioeconomic status on academic achievement as measured by performance on the state-mandated English language arts and mathematics exams for Louisiana public school students in grades 4, 8, and 10. Additionally, the interaction among these variables was investigated. The review of literature indicated that a strong negative relationship exists between socioeconomic status and cognitive outcomes. However, current school size research indicates that small school size mitigates the effect of poverty on academic achievement. Also, it seems there may be a relationship between SES and grade-level configuration whereby a school's poverty level as measured by the percentage of students participating in the federal free or reduced price lunch program may suggest the most appropriate grade-span for that particular school population. In this chapter an analysis of the data which were used to answer the research questions posed in this study is presented.

Population

The original data set provided by the Louisiana State Department of Education consisted of students' raw LEAP 21 scores representing all of the state's 1,362 public schools. The data set for this study included:

	Elementary	Middle/Junior	Secondary	Combination	Alternative
Total	701	227	228	73	132
4th	694	27		62	
8th	52	190	103	74	
10th			226	71	

The one hundred and thirty two schools identified as alternative were excluded from this study. Alternative schools included those classified as alternative, vocational, magnet, charter, and Montessori.

Hypothesis Testing

Research question one. Research question one focused on the differential effects of school size, SES, and the interaction of school size and SES on academic achievement in Louisiana public schools as measured by the LEAP 21 and the GEE 21 across grade-level configurations at the 4th, 8th, and 10th grade levels. Six sub-hypotheses were tested to determine the differential impact of school size, SES, and the interaction of school size and SES on academic achievement as measured by the English Language Arts and Mathematics components of the LEAP 21 and GEE 21 across grade-level configurations at the 4th, 8th, and 10th grade levels. The F-test known as the "Chow test" was used to test the hypothesis that the slope coefficients were homogeneous across grade-level configurations (Kmenta, 1986). First, the separate regressions for each grade-level configuration were calculated. Next, the separate regressions for each grade-level configuration were collapsed into one regression equation. So as to assess the effects of each grade-level configuration relative to the others, separate dummy variables were introduced for each grade-level configuration (with exception of the reference grade-level configuration). The combined regression equation was calculated. The equality of the separate regression equation coefficients and the combined regression equation coefficients were determined by calculating the F-statistic and comparing it to the critical value. If the calculated F-statistic exceeded the critical value then the hypothesis was rejected. The degrees of freedom were the same in the numerator because the restrictions across each of the equations were the same. There were three independent variables included in each model. Therefore, there were three degrees of freedom for the numerator across all of the Chow tests. The critical value for an F distribution with three degrees of freedom in the numerator and 120 degrees of freedom in the denominator is 2.68. With three degrees of freedom in the numerator and infinite degrees of freedom in the denominator, the critical value is 2.6. The F tests determined the joint significance of the independent variables in explaining the variation in the dependent variable. To investigate further the significance of each of the independent variables, t-statistics were calculated.

H_{1a}. Null Hypothesis (1a) stated that the effects of school size, SES, and the interaction of school size and SES on the academic achievement of 4th graders as measured by the English Language Arts component of the LEAP 21 do not significantly differ across grade-level configurations in Louisiana public schools. Seven hundred and eighty three schools were included in the analysis at the 4th grade level. In this sub-hypothesis, school size, grade-level configuration, SES, and the product of school size and SES were the independent, or predictor variables. The percentage of students that passed the English Language Arts component of the LEAP 21 was the dependent variable. The mean percentage of 4th graders passing the exam was 76.44%. The calculated F-statistic of 4.51 exceeded the critical value of 2.6, with the result that the hypothesis was rejected. These results suggest that the effects of school size, SES, and the interaction of school size and SES on academic achievement as measured by the percentage of students passing the English Language Arts component of the LEAP 21 differentiate across grade-level configurations at the 4th grade level.

H_{1b}. Null Hypothesis (1b) stated that the effects of school size, SES, and the interaction of school size and SES on the academic achievement of 4^{th} graders as measured by the Mathematics component of the LEAP 21 do not significantly differ across grade-level configurations in Louisiana public schools. Seven hundred and eighty three schools were included in the analysis at the 4^{th} grade level. Table 1 reports the number and percentage of grade-level configurations at the 4^{th} grade level In this sub-hypothesis, school size, grade-level configuration, SES, and the product of school size and SES were the independent, or predictor variables. The percentage of students that passed the Mathematics component of the LEAP 21 was the dependent variable. The mean percentage of 4^{th} graders passing the exam was 74.12%. The calculated F-statistic of 3.53 exceeded the critical value of 2.6, with the result that the hypothesis was rejected as shown in Table 2. These results suggest that the effects of school size, SES, and the interaction of school size and SES on academic achievement as measured by the percentage of students passing the Mathematics component of the LEAP 21 differentiate across grade-level configurations at the 4^{th} grade level.

Table 1.

Number and Percentage of Grade-Level Configurations at the 4th Grade Level

Configuration Type	Total Number of Schools	Percentage of Schools
Elementary	694	88.63
Middle/Junior High	27	3.45
Combination	62	7.92

Table 2.

F-Test Statistics 4th Grade Level

	F-Value	Critical Value
English Language Arts	4.51	2.6
Mathematics	3.53	2.6

H_{1c}. Null Hypothesis (1c) stated that the effects of school size, SES, and the interaction of school size and SES on the academic achievement of 8th graders as measured by the English Language Arts component of the LEAP 21 do not significantly differ across grade-level configurations in Louisiana public schools. Four hundred and nineteen schools were included in the analysis at the 8th grade level. In this sub-hypothesis, school size, grade-level configuration, SES, and the product of school size and SES were the independent, or predictor variables. The percentage of students that passed the English Language Arts component of the LEAP 21 was the dependent variable.

The mean percentage of 8th graders passing the exam was 80.47%. The calculated F-statistic of 3.33 exceeded the critical value of 2.6, with the result that the hypothesis was rejected. These results suggest that the effects of school size, SES, and the interaction of school size and SES on academic achievement as measured by the percentage of students passing the English Language Arts component of the LEAP 21 differentiate across grade-level configurations at the 8th grade level.

H_{1d}. Null Hypothesis (1d) stated that the effects of school size, SES, and the interaction of school size and SES on the academic achievement of 8th graders as measured by the Mathematics component of the LEAP 21 do not significantly differ across grade-level configurations in Louisiana public schools. Four hundred and nineteen schools were included in the analysis at the 8th grade level. Table 3 reports the number and percentage of grade-level configurations at the 8h grade level In this sub-hypothesis, school size, grade-level configuration, SES, and the product of school size and SES were the independent, or predictor variables. The percentage of students that passed the Mathematics component of the LEAP 21 was the dependent variable. The mean percentage of 8th graders passing the exam was 78.43%. The calculated F-statistic of 4.32 exceeded the critical value of 2.6, with the result that the hypothesis was rejected as shown in Table 4. These results suggest that the effects of school size, SES, and the interaction of school size and SES on academic achievement as measured by the percentage of students passing the Mathematics component of the LEAP 21 differentiate across grade-level configurations at the 8th grade level.

Table 3.

Number and Percentage of Grade-Level Configurations at the 8th Grade Level

Configuration Type	Total Number of Schools	Percentage of Schools
Elementary	52	12.41
Middle/Junior High	190	45.35
Secondary	103	24.58
Combination	74	17.66

Table 4.

F-Test Statistics 8th Grade Level

	F-Value	Critical Value
English Language Arts	3.33	2.6
Mathematics	4.32	2.6

H_{1e}. Null Hypothesis (1e) stated that the effects of school size, SES, and the interaction of school size and SES on the academic achievement of 10th graders as measured by the English Language Arts component of the GEE 21 do not significantly differ across grade-level configurations in Louisiana public schools. Two hundred and ninety seven schools were included in the analysis at the 10^{th} grade level. In this sub-hypothesis, school size, grade-level configuration, SES, and the product of school size and SES were the independent, or predictor variables. The percentage of students that passed the English Language Arts component of the GEE 21 was the dependent variable. The mean percentage of 10^{th} graders passing the exam was 82.13%. The calculated F-statistic of 3.36 exceeded the critical value of 2.6, with the result that the hypothesis was rejected. These results suggest that the effects of school size, SES, and the interaction of school size and SES on academic achievement as measured by the percentage of students passing the English Language Arts component of the GEE 21 differentiate across grade-level configurations at the 10^{th} grade level.

H_{1f}. Null Hypothesis (1f) stated that the effects of school size, SES, and the interaction of school size and SES on the academic achievement of 10^{th} graders as measured by the Mathematics component of the GEE 21 do not significantly differ across grade-level configurations in Louisiana public schools. Two hundred and ninety-seven schools were included in the analysis at the 10^{th} grade level. The number and percentage of grade-level configurations at the 10^{th} grade level is reported in Table 5. In this sub-hypothesis, school size, grade-level configuration, SES, and the product of school size and SES were the independent, or predictor variables. The percentage of students that passed the Mathematics component of the GEE 21 was the dependent variable. The mean percentage of 10th graders passing the exam was 80.14%. The calculated F-statistic of .84 did not exceed the critical value of 2.6, with the result that the hypothesis failed to be rejected as shown in Table 6. These results suggest that the effects of school size, SES, and the interaction of school size and SES on academic achievement as measured by the percentage of students passing the Mathematics component of the GEE 21 do not differentiate across grade-level configurations at the 10th grade level.

Table 5.

Number and Percentage of Grade-Level Configurations at the 10th Grade Level

Configuration Type	Total Number of Schools	Percentage of Schools
Secondary	226	76.09
Combination	71	23.91

Table 6.

F-Test Statistics 10th Grade Level

	F-Value	Critical Value
English Language Arts	3.36	2.6
Mathematics	.84	2.6

Research question two. Research question two explored the relationship among school size, grade-level configuration, SES, the interaction of school size and SES, and student achievement in Louisiana public schools in grades 4, 8, and 10 as measured by the English Language Arts and mathematics components of the LEAP 21 and the GEE 21. Sub-hypotheses investigated the relationship among these variables by grade level and by exam component.

H_{1a}. Null Hypothesis (1a) stated that there is no significant relationship among school size, SES, the interaction of school size and SES, and academic achievement at the 4^{th} grade level as measured by the English Language Arts component of the LEAP. An F-test was used to test the hypothesis that the slope coefficients were homogeneous across grade-level configurations. The calculated F-statistic of 4.51 exceeded the critical value of 2.6, with the result that the hypothesis was rejected. These results suggest that the effects of school size, SES, and the interaction of school size and SES on academic achievement as measured by the percentage of students passing the English Language Arts component of the LEAP 21 differentiate across grade-level configurations at the 4th grade level. Therefore, separate multiple linear regressions were calculated to test the relationship among school size, SES, the interaction effect of school size and SES, and academic achievement as measured by the English Language Arts component of the LEAP 21.

H_{2ai}. Null Hypothesis (2ai) stated that there is no significant relationship among school size, SES, the interaction effect of school size and SES, and academic achievement as measured by the English Language Arts component of the LEAP 21 for 4th graders in an elementary configuration. Descriptive statistics for 4th graders in an elementary configuration is reported in Table 7. The multiple linear regression calculated to test the relationship among school size, SES, the interaction effect of school size and SES, and academic achievement as measured by the English Language Arts component of the LEAP 21 for 4th graders in an elementary configuration was found to be significant $F\ (3,\ 690) = 24.891$, $p < .05$, with an adjusted R^2 of .094 as shown in Table 8. Therefore, the hypothesis was rejected. SES (poverty level) was found to be a significant determiner of academic achievement for 4th graders in an elementary configuration as measured by the English Language Arts component of the LEAP 21. The percentage of students participating in the free or reduced lunch program seems to have a significant impact on the student achievement of 4th graders in an elementary configuration as measured by the English Language Arts component of the LEAP 21. However, neither school size nor the product of school size and SES were found to be significant. Table 9 reports the coefficients and t-statistics for 4th graders in an elementary configuration.

Table 7.

Descriptive Statistics for 4th Grade ELA LEAP 21 in an Elementary Configuration

	Mean	Std. Deviation
4th ELA: %Passing	77.40	20.52
SIZE X SES	455.48	192.54
SES (Poverty Level)	70.23	21.48
SIZE X SES	30985.59	14915.60

Table 8.

Multiple Regression Analysis for Variables Predicting 4th Grade ELA LEAP 21 Percentage Rates in an Elementary Configuration

N=694

MODEL	SS	df	MS	F
Regression	28497.495	3	9499.165	24.891*
Residual	263329.150	690	381.636	
Total	291826.640	693		

*$p < .05$

Table 9.

Coefficients for Variables 4th Grade ELA LEAP 21 Percentage Rates in an Elementary Configuration
N=694

	Beta	SE of Mean	t-stat
Constant	85.730	6.614	12.962*
SIZE	9.178E-03	.012	.787
SES	-.271	.090	-3.005*
SIZE X SES	2.113E-04	.000	1.255

*$p < .05$

H_{2aii}. Null Hypothesis (2aii) stated that there is no significant relationship among school size, SES, the interaction effect of school size and SES, and academic achievement as measured by the English Language Arts component of the LEAP 21 for 4th graders in a middle/junior high configuration. Descriptive statistics are reported in Table 10. The multiple linear regression calculated to test the relationship among school size, SES, and the interaction effect of school size and SES, and academic achievement as measured by the English Language Arts component of the LEAP 21 for 4th graders in a middle/junior high configuration was not found to be significant $F\ (3, 23) = .455$, $p > .05$, with an adjusted R^2 of -.067 as shown in Table 11. Therefore, the hypothesis failed to be rejected. As reported in Table 12, neither school size nor SES appear to impact the academic achievement of 4th graders in a middle/junior high configuration as measured by the English Language Arts component of the LEAP 21.

The product of school size and SES was also not found to be significant.

Table 10.

Descriptive Statistics for 4th Grade ELA LEAP 21 in a Middle/Junior High Configuration

	Mean	Std. Deviation
4th ELA: %Passing	56.930	37.5044
SIZE	499.33	214.682
SES (Poverty Level)	63.64	21.19
SIZE x SES	29984.64	14399.95

Table 11.

Multiple Regression Analysis for Variables Predicting 4th Grade ELA LEAP 21 Percentage Rates in a Middle/Junior High Configuration
N=27

MODEL	SS	df	MS	*F*
Regression	2047.479	3	682.493	.455
Residual	34523.517	23	1501.022	
Total	36570.997	26		

Table 12.

Coefficients for Variables 4th Grade ELA LEAP 21 Percentage Rates in a Middle/Junior High Configuration
N=27

	Beta	SE of Mean	t-stat
Constant	125.867	83.739	1.503
SIZE	-.121	.137	-.885
SES	-.755	1.167	-.647
SIZE x SES	1.327E-03	.002	.652

H_{2aiii}. Null Hypothesis (2aiii) stated that there is no significant relationship among school size, SES, the interaction effect of school size and SES, and academic achievement as measured by the English Language Arts component of the LEAP 21 for 4th graders in a combination configuration. Descriptive statistics are reported in Table 13. The multiple linear regression calculated to test the relationship among school size, SES, and the interaction effect of school size and SES, and academic achievement as measured by the English Language Arts component of the LEAP 21 for 4th graders in a combination configuration was not found to be significant $F(3, 58)=1.245$, $p > .05$, with an adjusted R^2 of .012. Therefore, the hypothesis failed to be rejected as shown in Table 14. As reported in Table 15, neither school size nor SES appear to impact the academic achievement of 4th graders in a combination configuration as measured by the English Language Arts component of the LEAP 21. The product of school size and SES was also not found to be significant.

Table 13.

Descriptive Statistics for 4th Grade ELA LEAP 21 in a Combination Configuration

	Mean	Std. Deviation
4th ELA: %Passing	74.30	20.211
SIZE	408.90	151.575
SES (Poverty Level)	60.468	17.0243
SIZE X SES	24322.602	12018.1666

Table 14.

Multiple Regression Analysis for Variables Predicting 4th Grade ELA LEAP 21 Percentage Rates in a Combination Configuration
N=62

MODEL	SS	df	MS	F
Regression	1507.204	3	502.401	1.245
Residual	23410.195	58	403.624	
Total	24917.400	61		

Table 15.

Coefficients for Variables 4th Grade ELA LEAP 21 Percentage Rates in a Combination Configuration
N=61

	Beta	SE of Mean	t-stat
Constant	107.135	36.162	2.963*
SIZE	-3.913E-02	.082	-.478
SES	-.534	.502	-1.063
SZxSES	6.360E-04	.001	.557

*p < .05

H_{1b}. Null Hypothesis (1b) stated that there is no significant relationship among school size, SES, the interaction of school size and SES, and academic achievement at the 4th grade level as measured by the Mathematics component of the LEAP 21. An F-test was used to test the hypothesis that the slope coefficients were homogeneous across grade-level configurations. The calculated F-statistic of 3.53 exceeded the critical value of 2.6, with the result that the hypothesis was rejected. These results suggest that the effects of school size, SES, and the interaction of school size and SES on academic achievement as measured by the percentage of students passing the Mathematics component of the LEAP 21 differentiate across grade-level configurations at the 4th grade level. Therefore, separate multiple linear regressions were calculated to test the relationship among school size, SES, the interaction effect of school size and SES, and academic achievement as measured by the Mathematics component of the LEAP 21.

H_{2bi}. Null Hypothesis (2bi) stated that there is no significant relationship among school size, SES, the interaction effect of school size and SES, and academic achievement as measured by the Mathematics component of the LEAP 21 for 4th graders in an elementary configuration. Descriptive statistics are reported in Table 16. The multiple linear regression calculated to test the relationship among school size, SES, and the interaction effect of school size and SES, and academic achievement as measured by the Mathematics component of the LEAP 21 for 4th graders in an elementary configuration was found to be significant $F (3, 690)=23.456$, $p < .05$, with an adjusted R^2 of .089. Therefore, the hypothesis was rejected as shown in Table 16. As reported in Table 17, SES was found to be a significant determiner of academic achievement for 4th graders in an elementary configuration as measured by the Mathematics component of the LEAP 21. As shown in Table 18, the percentage of students participating in the free or reduced lunch program seems to negatively impact the student achievement of 4th graders in an elementary configuration as measured by the Mathematics component of the LEAP 21. However, neither school size nor the product of school size and SES were found to be significant.

Table 16.

Descriptive Statistics for 4th Grade MATH LEAP 21 in an Elementary Configuration

	Mean	Std. Deviation
4th MATH: %Passing	74.92	22.51
SIZE	455.49	192.54
SES (Poverty Level)	70.23	21.48
SIZE X SES	30985.59	14915.60

Table 17.

Multiple Regression Analysis for Variables Predicting 4th Grade MATH LEAP 21 Percentage Rates in an Elementary Configuration
N=694

MODEL	SS	df	MS	F
Regression	32482.914	3	10827.638	23.456*
Residual	318518.09	690	461.620	
Total	351001.01	693		

*p < .05

Table 18.

Coefficients for Variables 4th Grade MATH LEAP 21 Percentage Rates in an Elementary Configuration
N=694

	Beta	SE of Mean	t-stat
Constant	86.181	7.274	11.847*
SIZE	1.118E-02	.013	.872
SES	-.288	.099	-2.906*
SIZE X SES	1.263E-04	.000	.682

*p < .05

H_{2bi}i. Null Hypothesis (2bii) stated that there is no significant relationship among school size, SES, the interaction effect of school size and SES, and academic achievement as measured by the Mathematics component of the LEAP 21 for 4th graders in a middle/junior high configuration. Descriptive statistics are reported in Table 19. As shown in Table 20, the multiple linear regression calculated to test the relationship among school size, SES, and the interaction effect of school size and SES, and academic achievement as measured by the Mathematics component of the LEAP 21 for 4th graders in a middle/junior high configuration was not found to be significant $F\ (3,\ 23) = .358$, $p > .05$, with an adjusted R^2 of -.080. Therefore, the hypothesis failed to be rejected. As shown in Table 21, neither school size nor SES appear to impact the academic achievement as measured by the Mathematics component of the LEAP 21 of 4th graders in a middle/junior high configuration. The product of school size and SES was not also found to be significant.

Table 19.

Descriptive Statistics for 4th Grade MATH LEAP 21 in a Middle/Junior High Configuration

	Mean	Std. Deviation
4th MATH: %Passing	57.42	35.24
SIZE	499.33	214.68
SES (Poverty Level)	63.64	21.19
SIZE X SES	29984.64	14399.95

Table 20.

Multiple Regression Analysis for Variables Predicting 4th Grade MATH LEAP 21 Percentage Rates in a Middle/Junior High Configuration
N=27

MODEL	SS	df	MS	F
Regression	1439.448	3	479.816	.358
Residual	30847.459	23	1341.194	
Total	32286.907	26		

Table 21.

Coefficients for Variables 4th Grade MATH LEAP 21 Percentage Rates in a Middle/Junior High Configuration N=27

	Beta	SE of Mean	t-stat
Constant	48.884	79.155	.618
SIZE	6.950E-03	.130	.054
SES	.359	1.103	.325
SIZE X SES	-5.922E-04	.002	-.308

H_{2biii}. Null Hypothesis (2biii) stated that there is no significant relationship among school size, SES, the interaction effect of school size and SES, and academic achievement as measured by the Mathematics component of the LEAP 21 for 4^{th} graders in a combination configuration. Descriptive statistics are reported in Table 22. As shown in Table 23, the multiple linear regression calculated to test the relationship among school size, SES, and the interaction effect of school size and SES, and academic achievement as measured by the Mathematics component of the LEAP 21 for 4^{th} graders in a combination configuration was not found to be significant $F(3, 58)=.659$, $p > .05$, with an adjusted R^2 of -.017. As reported in Table 24, neither school size nor SES appear to impact the academic achievement as measured by the mathematics component of the LEAP 21 of 4^{th} graders in a combination configuration. The product of school size and SES was also not found to be significant.

Table 22.

Descriptive Statistics for 4th Grade MATH LEAP 21 in a Combination Configuration

	Mean	Std. Deviation
4th MATH: %Passing	72.48	22.34
SIZE	408.90	151.58
SES (Poverty Level)	60.48	17.02
SIZE X SES	24322.60	12018.17

Table 23.

Multiple Regression Analysis for Variables Predicting 4th Grade MATH LEAP 21 Percentage Rates in a Combination Configuration
N=62

MODEL	SS	df	MS	F
Regression	1004.225	3	334.742	.659
Residual	29445.765	58	507.686	
Total	30449.990	61		

Table 24.

Coefficients for Variables 4th Grade MATH LEAP 21 Percentage Rates in a Combination Configuration
N=62

	Beta	SE of Mean	t-stat
Constant	87.916	40.556	.034
SIZE	-1.003E-02	.092	-.109
SES	-.323	.563	-.574
SIZE X SES	3.379E-04	.001	.264

H_{1c}. Null Hypothesis (1c) stated that there is no significant relationship among school size, SES, the interaction of school size and SES, and academic achievement at the 8th grade level as measured by the English Language Arts component of the LEAP 21.

An F-test was used to test the hypothesis that the slope coefficients were homogeneous across grade-level configurations. The calculated F-statistic of 3.33 exceeded the critical value of 2.6, with the result that the hypothesis was rejected. These results suggest that the effects of school size, SES, and the interaction of school size and SES on academic achievement as measured by the percentage of students passing the English Language Arts component of the LEAP 21 differentiate across grade-level configurations at the 8th grade level. Therefore, separate multiple linear regressions were calculated to test the relationship among school size, SES, the interaction effect of school size and SES, and academic achievement as measured by the English Language Arts component of the LEAP 21.

H_{2ci}. Null Hypothesis (2ci) stated that there is no significant relationship among school size, SES, the interaction effect of school size and SES, and academic achievement as measured by the English Language Arts component of the LEAP 21 for 8th graders in an elementary configuration. Descriptive statistics are reported in Table 25. As shown in Table 26, the multiple linear regression calculated to test the relationship among school size, SES, the interaction effect of school size and SES, and academic achievement as measured by the English Language Arts component of the LEAP 21 for 8th graders in an elementary configuration was found to be significant $F\ (3,\ 48)=3.721$, $p < .05$, with an adjusted R^2 of .138. Therefore, the hypothesis was rejected. SES was found to be a significant determiner of academic achievement for 8th graders in an elementary configuration as measured by the English Language Arts component of the LEAP 21. As reported in Table 27, the percentage of students participating in the free or reduced lunch program seems to negatively impact the student achievement of 8^{th} graders in an elementary configuration as measured by the English Language Arts component of the LEAP 21. However, neither school size nor the product of school size and SES were found to be significant.

Table 25.

Descriptive Statistics for 8^{th} Grade ELA LEAP 21 in an Elementary Configuration

	Mean	Std. Deviation
8^{th} ELA: %Passing	74.76	24.22
SIZE	421.42	297.75
SES (Poverty Level)	59.36	17.72
SIZE X SES	24398.19	18531.32

Table 26.

Multiple Regression Analysis for Variables Predicting 8th Grade ELA LEAP 21 Percentage Rates in an Elementary Configuration
N=52

MODEL	SS	df	MS	F
Regression	5640.688	3	1880.229	3.721*
Residual	24255.404	48	505.321	
Total	29896.092	51		

*p < .05

Table 27.

Coefficients for Variables 8th Grade ELA LEAP 21 Percentage Rates in an Elementary Configuration
N=52

	Beta	SE of Mean	t-stat
Constant	118.856	19.627	6.056*
SIZE	-4.527E-02	.034	-1.344
SES	-.874	.319	-2.745*
SIZE X SES	1.102E-03	.001	1.933

*p < .05

H_{2cii}. Null Hypothesis (2cii) stated that there is no significant relationship among school size, SES, the interaction effect of school size and SES, and academic achievement as measured by the English Language Arts component of the LEAP 21 for 8th graders in a middle/junior high configuration. Descriptive statistics are reported in Table 28. As shown in Table 29, the multiple linear regression calculated to test the relationship among school size, SES, the interaction effect of school size and SES, and academic achievement as measured by the English Language Arts component of the LEAP 21 for 8th graders in a middle/junior high configuration was found to be significant F (3, 186)=10.729, $p < .05$, with an adjusted R^2 of .134. Therefore, the hypothesis was rejected. However, as shown in Table 30, neither school size nor SES appear to signficantly impact the academic achievement of 8th graders in a middle/junior high configuration as measured by the English Language Arts component of the LEAP 21. The product of school size and SES was also not found to be significant determiner of students passing the exam.

Table 28.

Descriptive Statistics for 8th Grade ELA LEAP 21 in a Middle/Junior High Configuration

	Mean	Std. Deviation
8th ELA: %Passing	87.08	15.08
SIZE	540.79	225.63
SES (Poverty Level)	63.39	20.46
SIZE X SES	33004.72	16364.25

Table 29.

Multiple Regression Analysis for Variables Predicting 8th Grade ELA LEAP 21 Percentage Rates in a Middle/Junior High Configuration
N=190

MODEL	SS	df	MS	F
Regression	6336.603	3	2112.201	10.729*
Residual	36615.934	186	196.860	
Total	42952	189		

*p < .05

Table 30.

Coefficients for Variables 8th Grade ELA LEAP 21 Percentage Rates in a Middle/Junior High Configuration
N=190

	Beta	SE of Mean	t-stat
Constant	89.747	8.819	10.176*
SIZE	8.792E-03	.014	.648
SES	-.216	.125	-1.726
SIZE X SES	1.892E-04	.000	.934

*p < .05

H_{2ciii}. Null Hypothesis (2ciii) stated that there is no significant relationship among school size, SES, the interaction effect of school size and SES, and academic achievement as measured by the English Language Arts component of the LEAP 21 for 8th graders in a Secondary configuration. Descriptive statistics are reported in Table 31. The multiple linear regression calculated to test the relationship among school size, SES, the interaction effect of school size and SES, and academic achievement as measured by the English Language Arts component of the LEAP 21 for 8th graders in a Secondary configuration was not found to be significant F (3, 99)= .672, $p > .05$, with an adjusted R^2 of -.010 as shown in Table 32. Therefore, the hypothesis failed to be rejected. As shown in Table 33, neither school size nor SES appear to impact the academic achievement of 8^{th} graders in a secondary configuration as measured by the English Language Arts component of the LEAP 21. The product of school size and SES was also not found to be significant.

Table 31.

Descriptive Statistics for 8^{th} Grade ELA LEAP 21 in a Secondary Configuration

	Mean	Std. Deviation
8^{th} ELA: %Passing	76.45	26.93
SIZE	687.	452.38
SES (Poverty Level)	47.99	20.75
SIZE X SES	29446.68	18439.76

Table 32.

Multiple Regression Analysis for Variables Predicting 8^{th} Grade ELA LEAP 21 Percentage Rates in a Secondary Configuration
N=103

MODEL	SS	df	MS	F
Regression	1476.734	3	492.245	.672
Residual	72496.106	99	732.284	
Total	73972.839	102		

Table 33.

Coefficients for Variables 8th Grade ELA LEAP 21 Percentage Rates in a Secondary Configuration
N=103

	Beta	SE of Mean	t-stat
Constant	90.603	11.497	7.880*
SIZE	-1.282E-02	.012	-1.088
SES	-.302	.213	-1.419
SIZE X SES	3.110E-04	.000	1.103

*p < .05

H_{2civ}. Null Hypothesis (2civ) stated that there is no significant relationship among school size, SES, the interaction effect of school size and SES, and academic achievement as measured by the English Language Arts component of the LEAP 21 for 8th graders in a combination configuration. Descriptive statistics are reported in Table 34. The multiple linear regression calculated to test the relationship among school size, SES, and the interaction effect of school size and SES, and academic achievement as measured by the English Language Arts component of the LEAP 21 for 8^{th} graders in a combination configuration was not found to be significant $F\ (3,\ 70) = 2.16$, $p > .05$, with an adjusted R^2 of .046. These results are reported in Table 35. Therefore, the hypothesis failed to be rejected. School size, SES, and the product of school size and SES were not found to be jointly significant determiners of the academic achievement of 8^{th} graders in a combination configuration as measured by the

English Language Arts component of the LEAP 21. In a combination configuration, as total enrollment increased the academic achievement of 8th graders as measured by the Language Arts component of the LEAP 21 decreased. Also, the percentage of students participating in the free or reduced lunch program seems to negatively impact the student achievement of 8th graders in a combination configuration as measured by the English Language Arts component of the LEAP 21. These results are reported in Table 36.

Table 34.

Descriptive Statistics for 8th Grade ELA LEAP 21 in a Combination Configuration

	Mean	Std. Deviation
8th ELA: %Passing	73.12	23.32
SIZE	413.70	219.75
SES (Poverty Level)	58.82	17.84
SIZE X SES	23991.80	14214.62

Table 35.

Multiple Regression Analysis for Variables Predicting 8th Grade ELA LEAP 21 Percentage Rates in a Combination Configuration
N=74

MODEL	SS	df	MS	F
Regression	3367.224	3	1122.408	2.162
Residual	36344.948	70	519.214	
Total	39712.171	73		

Table 36.

Coefficients for Variables 8th Grade ELA LEAP 21 Percentage Rates in a Combination Configuration

	Beta	SE of Mean	t-stat
Constant	117.469	19.074	6.158*
SIZE	-9.140E-02	.045	-2.027*
SES	-.770	.305	-2.525*
SIZE X SES	1.616E-03	.001	2.164*

*p < .05

H_{1d}. Null Hypothesis (1d) stated that there is no significant relationship among school size, SES, the interaction of school size and SES, and academic achievement at the 8th grade level as measured by the Mathematics component of the LEAP 21. An F-test was used to test the hypothesis that the slope coefficients were homogeneous across grade-level configurations. The calculated F-statistic of 4.32 exceeded the critical value of 2.6, with the result that the hypothesis was rejected. These results suggest that the effects of school size, SES, and the interaction of school size and SES on academic achievement as measured by the percentage of students passing the Mathematics component of the LEAP 21 differentiate across grade-level configurations at the 8th grade level. Therefore, separate multiple linear regressions were calculated to test the relationship among school size, SES, the interaction effect of school size and SES, and academic achievement as measured by the Mathematics component of the LEAP 21.

H_{2di}. Null Hypothesis (2di) stated that there is no significant relationship among school size, SES, the interaction effect of school size and SES, and academic achievement as measured by the Mathematics component of the LEAP 21 for 8th graders in an elementary configuration. Descriptive statistics are reported in Table 37. As shown in Table 38, the multiple linear regression calculated to test the relationship among school size, SES, and the interaction effect of school size and SES, and academic achievement as measured by the mathematics component of the LEAP 21 for 8th graders in an elementary configuration was not found to be significant $F\ (3,\ 48) = 2.174,\ p > .05$, with an adjusted R^2 of .065. Therefore, the hypothesis failed to be rejected. As reported in Table 39, neither school size nor SES appear to impact the academic achievement as measured by the mathematics component of the LEAP 21 of 8th graders in an elementary configuration. The product of school size and SES was also not found to be significant.

Table 37.

Descriptive Statistics for 8th Grade MATH LEAP 21 in an Elementary Configuration

	Mean	Std. Deviation
8th MATH: %Passing	73.88	24.16
SIZE	421.42	297.75
SES (Poverty Level)	59.36	17.72
SIZE X SES	24398.19	18531.32

Table 38.

Multiple Regression Analysis for Variables Predicting 8th Grade MATH LEAP 21 Percentage Rates in an Elementary Configuration
N=52

MODEL	SS	df	MS	F
Regression	3561.635	3	1187.212	2.174
Residual	26217.387	48	546.196	
Total	29779.022	51		

Table 39.

Coefficients for Variables 8th Grade MATH LEAP 21 Percentage Rates in an Elementary Configuration
N=52

	Beta	SE of Mean	t-stat
Constant	104.385	20.406	5.115*
SIZE	-1.226E-02	.035	-.350
SES	-.587	.331	-1.774
SIZE X SES	3.910E-04	.001	.513

*p < .05

H_{2dii}. Null Hypothesis (2dii) stated that there is no significant relationship among school size, SES, the interaction effect of school size and SES, and academic achievement as measured by the Mathematics component of the LEAP 21 for 8th graders in a middle/junior high configuration. Descriptive statistics are reported in Table 40. As shown in Table 41, the multiple linear regression calculated to test the relationship among school size, SES, and the interaction effect of school size and SES, and academic achievement as measured by the Mathematics component of the LEAP 21 for 8th graders in a middle/junior high configuration was found to be significant F (3, 186)= 9.044, $p < .05$, with an adjusted R^2 of .113. Therefore, the hypothesis was rejected. As reported in Table 42, school size and SES appear to jointly impact the academic achievement as measured by the Mathematics component of the LEAP 21 of 8th graders in a middle/junior high configuration, but were not found to be independently significant.

Table 40.

Descriptive Statistics for 8th Grade MATH LEAP 21 in a Middle/Junior High Configuration

	Mean	Std. Deviation
8th MATH: %Passing	83.92	19.33
SIZE	540.79	225.63
SES (Poverty Level)	63.39	20.46
SIZE X SES	33004.72	16364.25

Table 41.

Multiple Regression Analysis for Variables Predicting 8th Grade MATH LEAP 21 Percentage Rates in a Middle/Junior High Configuration
N=190

MODEL	SS	df	MS	F
Regression	8990.673	3	2996.891	9.044*
Residual	61634.626	186	331.369	
Total	70625.298	189		

*p < .05

Table 42.

Coefficients for Variables 8th Grade MATH LEAP 21 Percentage Rates in a Middle/Junior High Configuration
N=190

	Beta	SE of Mean	t-stat
Constant	82.291	11.442	7.192*
SIZE	2.191E-02	.018	1.244
SES	-.171	.162	-1.058
SIZE X SES	1.934E-05	.000	.941

*p < .05

H_{2diii}. Null Hypothesis (2diii) stated that there is no significant relationship among school size, SES, the interaction effect of school size and SES, and academic achievement as measured by the Mathematics component of the LEAP 21 for 8th graders in a secondary configuration. Descriptive statistics are reported in Table 43. As shown in Table 44, the multiple linear regression calculated to test the relationship among school size, SES, and the interaction effect of school size and SES, and academic achievement as measured by the Mathematics component of the LEAP 21 for 8th graders in a secondary configuration was not found to be significant $F(3, 99) = .772$, $p > .05$, with an adjusted R^2 of -.007. Therefore, the hypothesis failed to be rejected. As reported in Table 45, neither school size nor SES appear to impact the academic achievement as measured by the Mathematics component of the LEAP 21 of 8th graders in a secondary configuration. The product of school size and SES was also not found to be significant.

Table 43.

Descriptive Statistics for 8th Grade MATH LEAP 21 in a Secondary Configuration

	Mean	Std. Deviation
8th MATH: %Passing	76.16	28.39
SIZE	687	452.38
SES (Poverty Level)	47.99	20.75
SIZE X SES	29446.68	18439.76

Table 44.

Multiple Regression Analysis for Variables Predicting 8th Grade MATH LEAP 21 Percentage Rates in a Secondary Configuration
N=103

MODEL	SS	df	MS	F
Regression	1878.679	3	626.226	.512
Residual	80328.808	99	811.402	
Total	82207.487	102		

Table 45.

Coefficients for Variables 8th Grade MATH LEAP 21 in a Secondary Configuration
N=103

	Beta	SE of Mean	t-stat
Constant	93.614	12.103	7.735*
SIZE	-1.340E-02	.012	-1.081
SES	-.273	.224	-1.218
SIZE X SES	1.649E-04	.000	.556

*p < .05

H_{2div}. Null Hypothesis (2div) stated that there is no significant relationship among school size, SES, the interaction effect of school size and SES, and academic achievement as measured by the Mathematics component of the LEAP 21 for 8^{th} graders in a combination configuration. Descriptive statistics are reported in Table 46. As shown in Table 47, the multiple linear regression calculated to test the relationship among school size, SES, and the interaction effect of school size and SES, and academic achievement as measured by the Mathematics component of the LEAP 21 for 8^{th} graders in a combination configuration was found to be significant F (3, 70)= 2.662, $p < .05$, with an adjusted R^2 of .064. Therefore, the hypothesis was rejected. As reported in Table 48, school size, SES, and the product of school size and SES were found to be significant determiners of the academic achievement of 8^{th} graders in a combination configuration as measured by the Mathematics component of the LEAP 21. As school size and poverty level increased, the percentage of students passing the exam decreased.

Table 46.

Descriptive Statistics for 8^{th} Grade MATH LEAP 21 in a Combination Configuration

	Mean	Std. Deviation
8^{th} MATH: %Passing	70.69	24.17
SIZE	413.70	219.75
SES (Poverty Level)	58.82	17.84
SIZE X SES	23991.799	14214.6184

Table 47.

Multiple Regression Analysis for Variables Predicting 8^{th} Grade MATH LEAP 21 in a Combination Configuration
N=74

MODEL	SS	df	MS	F
Regression	4366.98	3	1455.660	2.662*
Residual	38274.534	70	546.779	
Total	42641.515	73		

*p < .05

Table 48.

Coefficients for Variables 8^{th} Grade MATH LEAP 21 in a Combination Configuration
N=74

	B	SE of Mean	t
Constant	112.928	19.574	5.769*
SIZE	-9.422E-02	.046	-2.036*
SES	-.806	.313	-2.575*
SIZE X SES	1.841E-03	1.083	2.403*

*p < .05

H_{1e}. Null Hypothesis (1e) stated that there is no significant relationship among school size, SES, the interaction of school size and SES, and academic achievement at the 10^{th} grade level as measured by the English Language Arts component of the GEE 21. An F-test was used to test the hypothesis that the slope coefficients were homogeneous across grade-level configurations. The calculated F-statistic of 3.36 exceeded the critical value of 2.6, with the result that the hypothesis was rejected. These results suggest that the effects of school size, SES, and the interaction of school size and SES on academic achievement as measured by the percentage of students passing the English Language Arts component of the GEE 21 differentiate across grade-level configurations at the 10^{th} grade level. Therefore, separate multiple linear regressions were calculated to test the relationship among school size, SES, the interaction effect of school size and SES, and academic achievement as measured by the English Language Arts component of the GEE 21.

H_{2ei}. Null Hypothesis (2ei) stated that there is no significant relationship among school size, SES, the interaction effect of school size and SES, and academic achievement as measured by the English Language Arts component of the GEE 21 for 10th graders in a secondary configuration. Descriptive statistics are reported in Table 49. As shown in Table 50, the multiple linear regression calculated to test the relationship among school size, SES, and the interaction effect of school size and SES, and academic achievement as measured by the English Language Arts component of the GEE 21 for 10th graders in a secondary configuration was found to be significant $F(3, 222) = 13.693$, $p < .05$, with an adjusted R^2 of .145. Therefore, the hypothesis was rejected. As reported in Table 51, SES was found to be a significant determiner of academic achievement for 10th graders in a secondary configuration as measured by the English Language Arts component of the GEE 21. The percentage of students participating in the free or reduced lunch program seems to negatively impact the student achievement of 10th graders in a secondary configuration as measured by the English Language Arts component of the GEE 21. However, neither school size nor the product of school size and SES were found to be significant.

Table 49.

Descriptive Statistics for 10th Grade ELA GEE 21 in a Secondary Configuration

	Mean	Std. Deviation
10th ELA: %Passing	85.57	17.01
SIZE	788.34	479.60
SES (Poverty Level)	47.57	20.05
SIZE X SES	33988.32	21841.27

Table 50.

Multiple Regression Analysis for Variables Predicting 10th Grade ELA GEE 21 in a Secondary Configuration
N=226

MODEL	SS	df	MS	F
Regression	10163.801	3	3387.934	13.693*
Residual	54926.358	222	247.416	
Total	65090.159	225		

*p < .05

Table 51.

Coefficients for Variables 10th Grade ELA GEE 21 in a Secondary Configuration
N=226

	Beta	SE of Mean	t-stat
Constant	89.330	5.383	16.594*
SIZE	4.991E-03	.005	.984
SES	-.249	.100	-2.493*
SIZE X SES	1.220E-04	.000	1.100

*p < .05

H_{2eii}. Null Hypothesis (2eii) stated that there is no significant relationship among school size, SES, the interaction effect of school size and SES, and academic achievement as measured by the English Language Arts component of the GEE 21 for 10th graders in a combination configuration. Descriptive statistics are reported in Table 52. As shown in Table 53, the multiple linear regression calculated to test the relationship among school size, SES, and the interaction effect of school size and SES, and academic achievement as measured by the

English Language Arts component of the GEE 21 for 10th graders in a combination configuration was found to be significant $F(3, 67) = 3.454$, $p < .05$, with an adjusted R^2 of .095. As reported in Table 54, school size, SES, and the product of school size and SES were found to be significant determiners of the academic achievement of 10th graders in a combination configuration as measured by the English Language Arts component of the GEE 21. Therefore, the hypothesis was rejected.

Table 52.

Descriptive Statistics for 10th Grade ELA GEE 21 in a Combination Configuration

	Mean	Std. Deviation
10th ELA: %Passing	71.11	22.77
SIZE	442.72	203.65
SES (Poverty Level)	58.38	17.46
SIZE X SES	25626.96	13765.3337

Table 53.

Multiple Regression Analysis for Variables Predicting 10th Grade ELA GEE 21 in a Combination Configuration
N=71

MODEL	SS	df	MS	F
Regression	4859.255	3	1619.752	3.454*
Residual	31419.698	67	468.951	
Total	36278.952	70		

*p < .05

Table 54.

Coefficients for Variables 10th Grade ELA GEE 21 in a Combination Configuration
N=71

	Beta	SE of Mean	t-stat
Constant	60.041	20.611	2.913*
SIZE	2.817E-02	.047	.602
SES	-.116	.329	-.352
SIZE X SES	2.091E-04	.001	.273

*p < .05

H_{1f}. Null Hypothesis (1f) stated that there is no significant relationship among school size, SES, the interaction of school size and SES, and academic achievement at the 10th grade level as measured by the Mathematics component of the GEE 21. An F-test was used to test the hypothesis that the slope coefficients were homogeneous across grade-level configurations. The calculated F-statistic of .84 was less than the critical value of 2.6, with the result that the hypothesis failed to be rejected. These results suggest that the effects of school size, SES, and the interaction of school size and SES on academic achievement as measured by the percentage of students passing the Mathematics component of the GEE 21 do not differentiate across grade-level configurations at the 10th grade level. So as to assess the effect of each grade-level configuration relative to the other, a separate dummy variable was introduced for the combination grade-level configuration. The secondary grade-level configuration was the reference grade-level configuration. The combined regression equation was calculated.

H_{2f}. Null Hypothesis (2f) stated that there is no significant relationship among school size, SES, the interaction of school size and SES, grade-level configuration, and academic achievement at the 10th grade level as measured by the Mathematics component of the GEE 21. Descriptive statistics for 10th graders in a secondary configuration are reported in Table 55 and for 10th graders in a Combination configuration in Table 56. As shown in Table 57, the multiple linear regression calculated to test H_{2f} was found to be significant $F(4, 292)=15.765$, $p<.05$, with an adjusted R^2 of .166. Therefore, the hypothesis was rejected. As reported in Table 58, the percentage of tenth graders passing the Mathematics component of the GEE 21 is expected to vary according to the grade-level configuration of the school. Tenth graders in a secondary configuration seem to perform better on the Mathematics component of the GEE 21 than do their counterparts in a combination configuration. As school size increases, tenth graders are expected to achieve at higher levels. Neither SES nor the interaction of SES and size are significantly correlated with student achievement as measured by the Mathematics component of the GEE 21 at the 10th grade level.

Table 55.

Descriptive Statistics for 10th Grade MATH GEE 21 in a Secondary Configuration

	Mean	Std. Deviation
10th ELA: %Passing	83.13	19.01
SIZE	788.34	479.60
SES (Poverty Level)	47.57	20.05
SIZE X SES	33988.32	21841.27

Table 56.

Descriptive Statistics for 10th Grade MATH GEE 21 in a Combination Configuration

	Mean	Std. Deviation
10th ELA: %Passing	70.64	21.83
SIZE	442.72	203.65
SES (Poverty Level)	58.38	17.46
SIZE X SES	25626.96	13765.34

Table 57.

Multiple Regression Analysis for Variables Predicting 10th Grade MATH GEE 21
N=297

MODEL	SS	df	MS	F
Regression	21858.765	4	5464.691	15.765*
Residual	101214.46	292	346.625	
Total	123073.22	296		

*p < .05

Table 58.

Coefficients for Variables 10th Grade MATH GEE 21
N=297

	B	SE of Mean	t
Constant	82.778	5.520	14.995*
SIZE	1.160E-02	.006	2.009*
SES	-.171	.100	-1.718
SIZE X SES	-1.904E-05	.000	-.159
COMBO Dummy	-6.786	-.142	-2.50*

*p < .05

Research question three. Research question three focused on the differential effects of school size and SES levels on student achievement in Louisiana public schools in grades 4, 8, and 10 as measured by the English Language Arts and Mathematics components of the LEAP 21 and GEE 21. Three sub-hypotheses involved the relationship among these variables by grade level. The grade-level configurations with a sufficient number of observations were utilized in testing these hypotheses.

H_{3a}. Null Hypothesis (3a) stated that the effects of school size and SES levels on student academic achievement as measured by the English Language Arts and Mathematics components of the LEAP 21 do not differ for 4^{th} graders in an elementary combination. This hypothesis was assessed through the use of Multivariate Analysis of Variance (MANOVA). The dependent variables were the percentage of students that had passed the English Language Arts and

Mathematics components of the LEAP 21. SES (poverty level) was defined as the percentage of students participating in the free or reduced price lunch program. The SES levels were divided into three ranges, namely, level 1 SES (0-50%), level 2 SES (51-79%), and level 3 (80-100%). Additionally, elementary schools were identified according to size as measured by total enrollment as follows: Small (0-300), Medium (300-599), and Large (600+). As shown in Table 59, the differential and interaction effects of school size and SES levels were then calculated. Homogeneous subsets for 4^{th} graders in an elementary configuration are reported in Table 60. No significant effect was found for the interaction of school size and SES levels (*Lambda*(8, 1364) = 1.83, *p* > .05.

A significant effect of SES levels was found *Lambda*(4, 1364) = 8.67, p < .05 with the result that the hypothesis was rejected. Follow-up univariate ANOVAs indicated that the percentage of students passing the English Language Arts and Mathematics components of the LEAP 21 were significantly influenced by the percentage of students participating in the federal free or reduced price lunch program. Post-hoc tests were then conducted to determine which groups were significantly different. Tukey's HSD was used to determine the nature of the difference among groups. This analysis revealed that schools in which fewer than 80% of students were participating in the free and reduced lunch program had significantly higher rates of students passing the English Language Arts and Mathematics components of the LEAP 21 than did schools in which greater than 80% of students participated in the free or reduced lunch program.

A significant effect of size was also found *Lambda*(4, 1364) = 11.007, $p < .05$. Follow-up univariate ANOVAs indicated that both the percentage of students passing the English Language Arts and Mathematics components of the LEAP 21 were significantly influenced by school size. Post-hoc tests were then conducted to determine which groups were significantly different. Tukey's HSD was used to determine the nature of the difference among groups. In regards to the English Language Arts component of the LEAP 21, this analysis revealed that schools with a total enrollment of 600 or more had significantly higher rates of students passing the English Language Arts component of the LEAP 21 than did schools with a total enrollment of fewer than 600. Schools with a total enrollment of between 300 and 599 also had significantly higher rates of students passing the English Language Arts component of the LEAP 21 than did schools with a total enrollment of fewer than 300. In regards to the Mathematics component of the LEAP 21, this analysis revealed that schools with a total enrollment more had significantly higher rates of students passing the Mathematics component of the LEAP 21 than did schools with a total enrollment of fewer than 300.

Table 59.

Multivariate Analysis of Variance (MANOVA) for 4th Graders in an Elementary Configuration

Source	SS	df	MS	F
Intercept				
ELA	2754485.32	1	2754485.32	7314.11
MATH	2553708.97	1	2553708.97	5568.29
SES				
ELA	7984.5	2	3992.26	10.60
MATH	13325.98	2	6662.99	14.53
SIZE				
ELA	16078.17	2	8039.06	21.35
MATH	14445.28	2	7222.64	15.75
SIZE X SES				
ELA				
MATH	227.96	4	56.99	.151
	2840.771	4	710.19	1.55

Table 60.

Homogeneous Subsets for 4th Graders in an Elementary Configuration

	ELA MEAN	*N*	MATH MEAN
SES 1	83.89	147	80.94
SES 2	79.26	244	78.97
SES 3	72.67	301	68.69
SIZE 1	66.61	146	66.27
SIZE 2	79.05	403	76.20
SIZE 3	83.67	143	80.14

H_{3b}. Null Hypothesis (3b) stated that the effects of school size and SES levels on student academic achievement as measured by the English Language Arts and Mathematics components of the LEAP 21 do not differ for 8^{th} graders in a middle/junior high configuration. This hypothesis was assessed through the use of Multivariate Analysis of Variance (MANOVA). The dependent variables were the percentage of students that had passed the English Language Arts and Mathematics components of the LEAP 21. SES (poverty level) was defined as the percentage of students participating in the free or reduced price lunch program. The SES levels were divided into three ranges, namely, level 1 SES (0-50%), level 2 SES (51-79%), and level 3 (80-100%). Additionally, middle/junior high schools were identified according to size as measured by total enrollment as follows: Small (0-399), Medium (400-600), and Large (700+). As shown in Table 61, the differential effects of school size and SES levels were then calculated. The homogeneous subsets for 8^{th} graders in a middle/junior high configuration are reported in Table 62. No significant effect was found for the interaction of school size and SES levels *Lambda*(8, 358) = .335, $p < .05$.

A significant effect of SES levels was found *Lambda*(4, 358) = 1.52, $p < .05$ with the result that the hypothesis was rejected. Follow-up univariate ANOVAs indicated that the percentage of students passing the Mathematics component of the LEAP 21 was significantly influenced by the percentage of students participating in the federal free and reduced price lunch program. Post-hoc tests were then conducted to determine which groups were significantly different. Tukey's HSD was used to determine the nature of the difference among groups. This analysis revealed that there was a significant difference in the percentage of 8th grade students in a middle/junior high configuration passing the Mathematics component of the LEAP between schools in which 80% or more of students were participating in the free or reduced lunch program versus schools in which 50% or fewer of students had participated in the free or reduced lunch program.

A significant effect of size was also found *Lambda*(4, 358) = 4.50, $p < .05$. Follow-up univariate ANOVAs indicated that both the percentage of students passing the English Language Arts and Mathematics components of the LEAP 21 were significantly influenced by school size. Post-hoc tests were then conducted to determine which groups were significantly different. Tukey's HSD was used to determine the nature of the difference among groups. For both the English Language Arts and the Mathematics components of the LEAP 21, a significantly greater percentage of students passed the exams in schools with a total enrollment of 400 or more than did schools with a total enrollment of fewer than 400.

Table 61.

Multivariate Analysis of Variance (MANOVA) for 8th Graders in a Middle/Junior High Configuration

Source	SS	df	MS	F
Intercept				
ELA	1127542.70	1	1125742.70	5553.53
MATH	1033374.79	1	1033374.79	3046.42
SES				
ELA	835.43	2	417.72	2.06
MATH	2090.31	2	1045.16	3.08
SIZE				
ELA	3569.70	2	1784.851	8.79
MATH	4308.92	2	2154.46	6.35
SIZE X SES				
ELA	297.35	4	74.34	.37
MATH	657.41	4	164.35	.49

Table 62.

Homogeneous Subsets for 8th Graders in a Middle/Junior High Configuration

	ELA MEAN	N	MATH MEAN
SES 1	90.65	51	89.06
SES 2	87.44	78	84.46
SES 3	82.14	60	76.79
SIZE 1	79.42	51	74.96
SIZE 2	87.91	92	85.38
SIZE 3	93.70	46	90.64

H_{3c}. Null Hypothesis (3c) stated that the effects of school size and SES levels on student academic achievement as measured by the English Language Arts and Mathematics components of the GEE 21 do not significantly differ for 10th graders in a secondary configuration. This hypothesis was assessed through the use of Multivariate Analysis of Variance (MANOVA). The dependent variables were the percentage of students that had passed the English Language Arts and Mathematics components of the GEE 21. SES (poverty level) was defined as the percentage of students participating in the free or reduced price lunch program. The SES levels were divided into three ranges, namely, level 1 SES (0-35%), level 2 SES (36-59%), and level 3 (60-100%). Additionally, secondary schools were identified according to size as measured by total enrollment as follows: Small (0-499), Medium (500-899), and Large (900+). As shown in Table 63, the differential effects of school size and SES levels were then calculated. Homogeneous subsets for 10th graders in a middle/junior high configuration are reported in Table 64. No significant effect was found for the interaction of school size and SES levels *Lambda*(8, 432) = .252, $p > .05$.

A significant effect of SES levels was found *Lambda*(4, 432) = 4.086, $p < .05$ with the result that the hypothesis was rejected. Follow-up univariate ANOVAs indicated that the percentage of students passing the English Language Arts and Mathematics components of the GEE 21 were significantly influenced by the percentage of students participating in the federal free or reduced price lunch program. Post-hoc tests were then conducted to determine which groups were significantly different. Tukey's HSD was used to determine the nature of the difference among groups. This analysis revealed that schools in which fewer than 60% of students were participating in the free or reduced lunch program had significantly higher rates of students passing the English Language Arts and Mathematics components of the LEAP 21 than did schools in which 60% or more of students had participated in the free or reduced lunch program.

A significant effect of size was also found *Lambda*(4, 432) = 4.381, $p < .05$. Follow-up univariate ANOVAs indicated that both the percentage of students passing the English Language Arts and Mathematics components of the LEAP 21 were significantly influenced by school size. Post-hoc tests were then conducted to determine which groups were significantly different. Tukey's HSD was used to determine the nature of the difference among groups. For both the English Language Arts and the Mathematics components of the LEAP 21, a significantly greater percentage of students passed the exams in schools with a total enrollment of 900 or more than did schools with a total enrollment of fewer than 900.

Table 63.

Multivariate Analysis of Variance (MANOVA) for 10^{th} Graders in a Secondary Configuration

Source	SS	df	MS	F
Intercept				
ELA	1361015.94	1	1361015.94	5397.06
MATH	1259965.98	1	1259965.98	4081.52
SES				
ELA	2252.08	2	1126.04	4.47
MATH	5122.24	2	2561.12	8.30
SIZE				
ELA	4396.76	2	2198.38	8.72
MATH	1588.57	2	1588.57	5.15
SIZE X SES				
ELA	733.36	4	183.34	.727
MATH	1676.70	4	419.18	1.36

Table 64.

Homogeneous Subsets for 10^{th} Graders in a Middle/Junior High Configuration

	ELA MEAN	N	MATH MEAN
SES 1	90.80	72	89.61
SES 2	86.41	91	84.63
SES 3	78.39	63	73.57
SIZE 1	79.26	79	77.79
SIZE 2	84.96	66	80.42
SIZE 3	92.23	81	90.57

Research question four. Research question four focused on the differential effects of small, medium, and large schools across SES levels on student achievement in

Louisiana public schools in grades 4, 8, and 10 as measured by the English Language Arts and Mathematics components of the LEAP 21 and GEE 21. Nine sub-hypotheses were used to assess the relationship among these variables by grade and by SES level. The grade-level configurations with a sufficient number of observations were utilized in testing these hypotheses.

H_{4a}. Null Hypothesis (4a) stated that there is no significant relationship between school size and student academic achievement as measured by the English Language Arts and Mathematics components of the LEAP 21 for 4th graders in an elementary configuration in which 50% or less of students participate in the federal free or reduced price lunch program. As shown in Table 65, this hypothesis was assessed through the use of Multivariate Analysis of Variance (MANOVA). The dependent variables were the percentage of students passing the English Language Arts and Mathematics components of the LEAP 21. Homogeneous subsets for 4th graders in an SES Level 1 setting are reported in Table 66. Elementary schools were identified according to size as measured by total enrollment as follows: Small (0-300), Medium (300-599), and Large (600+). A significant effect of size was found *Lambda*(4, 286) = 6.75, $p < .05$ with the result that the hypothesis was rejected. Follow-up univariate ANOVAs indicated that the percentage of students passing the English Language Arts and Mathematics components of the

LEAP 21 was significantly influenced by the size of the school. Post-hoc tests were then conducted to determine which groups were significantly different. Tukey's HSD was used to determine the nature of the difference among groups. This analysis revealed that schools in which more than 300 students were enrolled had significantly higher rates of students passing the English Language Arts and Mathematics components of the LEAP 21 than did schools with enrollments of fewer than 300.

Table 65.

Multivariate Analysis of Variance (MANOVA) for 4th Graders in an SES Level 1 Setting

Source	SS	df	MS	F
Intercept				
ELA	671839.19	1	671839.19	2881.50
MATH	599655.25	1	599655.25	2209.25
SIZE				
ELA	3250.81	2	1625.40	6.97
MATH	7718.03	2	3859.01	14.22

*P < .05

Table 66.

Homogeneous Subsets for 4th Graders in an SES Level 1 Setting

	ELA MEAN	*N*	MATH MEAN
SIZE 1	71.69	18	62.04
SIZE 2	84.61	79	82.18
SIZE 3	87.15	50	85.77

H_{4b}. Null Hypothesis (4b) stated that there is no significant relationship between school size and student academic achievement as measured by the English Language Arts and Mathematics components of the LEAP 21 for 4th graders in an elementary configuration in which between 51% and 79% of students participate in the federal free or reduced price lunch program. As shown in Table 67, this hypothesis was assessed through the use of Multivariate Analysis of Variance (MANOVA). The dependent variables were the percentage of students passing the English Language Arts and Mathematics components of the LEAP 21. Homogeneous subsets for 4th graders in an SES Level 2 setting are reported in Table 68. Elementary schools were identified according to size as measured by total enrollment as follows: Small (0-300), Medium (300-599), and Large (600+).

A significant effect of size was found *Lambda*(4, 480) = 7.80, $p < .05$ with the result that the hypothesis was rejected. Follow-up univariate ANOVAs indicated that the percentage of students passing the English Language Arts component of the LEAP 21 was significantly influenced by the size of the school. The percentage of students passing the Mathematics component of the LEAP 21 was not significantly influenced by total school enrollment. Post-hoc tests were then conducted to determine which groups were significantly different. Tukey's HSD was used to determine the nature of the difference among groups. This analysis revealed that schools in which more than 300 students were enrolled had significantly higher rates of students passing the English Language Arts component of the LEAP 21 than did schools with enrollments of fewer than 300.

Table 67.

Multivariate Analysis of Variance (MANOVA) for 4th Graders in an SES Level 2 Setting

Source	SS	df	MS	F
Intercept				
ELA	1256131.35	1	1256131.35	3684.56
MATH	1252367.06	1	1252367.06	3307.77
SIZE				
ELA	9530.33	2	4765.16	13.98
MATH	1760.63	2	880.31	2.33

*P < .05

Table 68.

Homogeneous Subsets for 4th Graders in an SES Level 2 Setting

	ELA MEAN	*N*	MATH MEAN
SIZE 1	68.80	60	74.38
SIZE 2	81.40	135	80.07
SIZE 3	86.18	49	81.58

H_{4c}. Null Hypothesis (4c) stated that there is no significant relationship between school size and student academic achievement as measured by the English Language Arts and Mathematics components of the LEAP 21 for 4th graders in an elementary combination in which 80% or more of students participate in the federal free or reduced price lunch program. As shown in Table 69, this hypothesis was assessed through the use of Multivariate Analysis of Variance (MANOVA). The dependent variables were the percentage of students passing the English Language Arts and Mathematics components of the LEAP 21. Homogeneous subsets for 4th graders in an SES Level 3 setting are reported in Table 70. Elementary schools were identified according to size as measured by total enrollment as follows: Small (0-300), Medium (300-599), and Large (600+).

A significant effect of size was found *Lambda*(4, 594) = 4.06, $p < .05$ with the result that the hypothesis was rejected. Follow-up univariate ANOVAs indicated that the percentage of students passing the English Language Arts and Mathematics components of the LEAP 21 was significantly influenced by the size of the school. Post-hoc tests were then conducted to determine which groups were significantly different. Tukey's HSD was used to determine the nature of the difference among groups. This analysis revealed that schools in which more than 300 students were enrolled had significantly higher rates of students passing the English Language Arts and Mathematics components of the LEAP 21 than did schools with enrollments of fewer than 300.

Table 69.

Multivariate Analysis of Variance (MANOVA) for 4th Graders in an SES Level 3 Setting

Source	SS	df	MS	F
Intercept				
ELA	1084914.44	1	1084914.44	2285.14
MATH	967258.00	1	967258.00	1575.93
SIZE				
ELA	7767.34	2	3883.67	8.18
MATH	6341.29	2	3170.64	5.17

*P < .05

Table 70.

Homogeneous Subsets for 4th Graders in an SES Level 3 Setting

	ELA MEAN	*N*	MATH MEAN
SIZE 1	63.34	68	60.23
SIZE 2	75.03	189	70.93
SIZE 3	76.92	44	72.13

H_{4d}. Null Hypothesis (4d) stated that there is no significant relationship between school size and student academic achievement as measured by the English Language Arts and Mathematics components of the LEAP 21 for 8th graders in a middle/junior high combination in which 50% or less of students participate in the federal free or reduced price lunch program. As shown in Table 71, this hypothesis was assessed through the use of Multivariate Analysis of Variance (MANOVA). The dependent variables were the percentage of students passing the English

Language Arts and Mathematics components of the LEAP 21. Homogeneous subsets for 8th graders in an SES Level 1 setting are reported in Table 72. Middle/junior high schools were identified according to size as measured by total enrollment as follows: Small (0-399), Medium (400-699), and Large (700+).

A significant effect of size was found *Lambda*(4, 112) = , $p < .05$ with the result that the hypothesis was rejected. Follow-up univariate ANOVAs indicated that the percentage of students passing the English Language Arts and Mathematics components of the LEAP 21 was significantly influenced by the size of the school. Post-hoc tests were then conducted to determine which groups were significantly different. Tukey's HSD was used to determine the nature of the difference among groups. Schools in which more than 700 students were enrolled had significantly higher rates of students passing the English Language Arts component of the LEAP 21 than did schools with enrollments of fewer than 700. This analysis revealed that schools in which more than 700 students were enrolled had significantly higher rates of students passing the Mathematics component of the LEAP 21 than did schools with enrollments of fewer than 400.

Table 71.

Multivariate Analysis of Variance (MANOVA) for 8th Graders in an SES Level 1 Setting

Source	SS	df	MS	F
Intercept				
ELA	350568.37	1	350568.37	3276.42
MATH	332108.85	1	332108.85	332108.85
SIZE				
ELA	1398.18	2	699.09	6.53
MATH	2069.09	2	1034.55	5.42

*P < .05

Table 72.

Homogeneous Subsets for 8th Graders in an SES Level 1 Setting

	ELA MEAN	*N*	MATH MEAN
SIZE 1	82.21	8	77.19
SIZE 2	88.72	30	87.59
SIZE 3	96.36	22	95.37

H_{4e}. Null Hypothesis (4e) stated that there is no significant relationship between school size and student academic achievement as measured by the English Language Arts and Mathematics components of the LEAP 21 for 8th graders in a middle/junior high combination in which between 51% and 79% of students participate in the federal free or reduced price lunch program. As shown in Table 73, this hypothesis was assessed through the use of Multivariate Analysis of Variance (MANOVA). The dependent variables were the percentage of students passing the

English Language Arts and Mathematics components of the LEAP 21. Homogeneous subsets for 8th graders in an SES Level 2 setting are reported in Table 74. Elementary schools were identified according to size as measured by total enrollment as follows: Small (0-399), Medium (400-699), and Large (700+). No significant effect of size was found *Lambda*(4, 148) = 1.06, $p < .05$ with the result that the hypothesis was accepted.

Table 73.

Multivariate Analysis of Variance (MANOVA) for 8th Graders in an SES Level 2 Setting

Source	SS	df	MS	F
Intercept				
ELA	498190.09	1	498190.09	2413.24
MATH	464219.24	1	464219.24	1482.59
SIZE				
ELA	895.90	2	447.95	2.17
MATH	793.77	2	396.88	1.27

*P < .05

Table 74.

Homogeneous Subsets for 8th Graders in an SES Level 2 Setting

	ELA MEAN	N	MATH MEAN
SIZE 1	82.67	23	79.91
SIZE 2	88.46	41	85.50
SIZE 3	92.30	14	88.88

H_{4f}. Null Hypothesis (4f) stated that there is no significant relationship between school size and student academic achievement as measured by the English Language Arts and Mathematics components of the LEAP 21 for 8th graders in a middle/junior high combination in which 80% or more of students participate in the federal free or reduced price lunch program. As shown in Table 75, this hypothesis was assessed through the use of Multivariate Analysis of Variance (MANOVA). The dependent variables were the percentage of students passing the English Language Arts and Mathematics components of the LEAP 21. Homogeneous subsets for 8th graders in an SES Level3 setting are reported in Table 76. Elementary schools were identified according to size as measured by total enrollment as follows: Small (0-399), Medium (400-699), and Large (700+). No significant effect of size was found *Lambda*(4, 94) = 1.80, $p < .05$ with the result that the hypothesis was accepted.

Table 75.

Multivariate Analysis of Variance (MANOVA) for 8th Graders in an SES Level 3 Setting

Source	SS	df	MS	F
Intercept				
ELA	316503.11	1	316503.11	1015.26
MATH	274834.48	1	274834.48	494.38
SIZE				
ELA	2006.73	2	2006.73	3.22
MATH	2327.96	2	2327.96	2.09

*P < .05

Table 76.

Homogeneous Subsets for 8th Graders in an SES Level 3 Setting

	ELA MEAN	N	MATH MEAN
SIZE 1	74.56	20	68.38
SIZE 2	85.70	21	81.98
SIZE 3	89.83	10	82.69

H_{4g}. Null Hypothesis (4g) stated that there is no significant relationship between school size and student academic achievement as measured by the English Language Arts and Mathematics components of the GEE 21 for 10th graders in a secondary combination in which 35% or less of students participate in the federal free or reduced price lunch program. As shown in Table 77, this hypothesis was assessed through the use of Multivariate Analysis of Variance (MANOVA). The dependent variables were the percentage of students passing the English Language Arts and Mathematics components of the GEE 21. Homogeneous subsets for 10th graders in an SES Level 1 setting are reported in Table 78. Secondary schools were identified according to size as measured by total enrollment as follows: Small (0-499), Medium (500-899), and Large (900+).

A significant effect of size was found *Lambda*(4, 136) = 4.97, $p < .05$ with the result that the hypothesis was rejected. Follow-up univariate ANOVAs indicated that the percentage of students passing the English Language Arts and Mathematics components of the LEAP 21 was significantly influenced by the size of the school. Post-hoc tests were then conducted to determine which groups were significantly different. Tukey's HSD was used to determine the nature of the difference among groups. This analysis revealed that schools in which more than 900 students were enrolled had significantly higher rates of students passing the English Language Arts component of the LEAP 21 than did schools with enrollments of fewer than 500. Schools in which more than 500 students were enrolled had significantly higher rates of students passing the Mathematics component of the LEAP 21 than did schools with enrollments of fewer than 500.

Table 77.

Multivariate Analysis of Variance (MANOVA) for 10th Graders in an SES Level 1 Setting

Source	SS	df	MS	F
Intercept				
ELA	429720.60	1	429720.60	4415.61
MATH	410280.79	1	410280.79	3538.52
SIZE				
ELA	1193.00	2	596.50	6.13
MATH	2361.63	2	1180.81	10.18

*P < .05

Table 78.

Homogeneous Subsets for 10th Graders in an SES Level 1 Setting

	ELA MEAN	*N*	MATH MEAN
SIZE 1	82.83	14	78.55
SIZE 2	90.49	14	88.67
SIZE 3	93.43	44	93.42

H_{4h}. Null Hypothesis (4h) stated that there is no significant relationship between school size and student academic achievement as measured by the English Language Arts and Mathematics components of the GEE 21 for 10th graders in a secondary combination in which between 36% and 59% of students participate in the federal free or reduced price lunch program. As shown in Table 79, this hypothesis was assessed through the use of Multivariate Analysis of Variance (MANOVA). The dependent variables were the percentage of students passing the English Language Arts and Mathematics components of the GEE 21. Homogeneous subsets for 10th graders in an SES Level 2 setting are reported in Table 80. Secondary schools were identified according to size as measured by total enrollment as follows: Small (0-499), Medium 500-899), and Large (900+).

A significant effect of size was found *Lambda*(4, 174) = 2.34, $p < .05$ with the result that the hypothesis was rejected. Follow-up univariate ANOVAs indicated that the percentage of students passing the English Language Arts and Mathematics components of the LEAP 21 was significantly influenced by the size of the school. Post-hoc tests were then conducted to determine which groups were significantly different. Tukey's HSD was used to determine the nature of the difference among groups. This analysis revealed that schools in which more than 900 students were enrolled had significantly higher rates of students passing the English Language Arts and Mathematics component of the LEAP 21 than did schools with enrollments of fewer than 500.

Table 79.

Multivariate Analysis of Variance (MANOVA) for 10th Graders in an SES Level 2 Setting

Source	SS	df	MS	F
Intercept				
ELA	669743.79	1	669743.79	2643.86
MATH	641888.37	1	641888.37	2076.66
SIZE				
ELA	2258.41	2	2258.41	4.46
MATH	2142.43	2	2142.43	3.47

*P < .05

Table 80.

Homogeneous Subsets for 10th Graders in an SES Level 2 Setting

	ELA MEAN	N	MATH MEAN
SIZE 1	80.70	39	79.28
SIZE 2	89.95	26	86.77
SIZE 3	91.44	26	90.53

$H_{4i.}$ Null Hypothesis (4i) stated that there is no significant relationship between school size and student academic achievement as measured by the English Language Arts and Mathematics components of the GEE 21 for 10th graders in a secondary combination in which 60% or more of students participate in the federal free or reduced price lunch program. As shown in Table 81, this hypothesis was assessed through the use of Multivariate Analysis of Variance (MANOVA). The dependent variables were the percentage of students passing the English Language Arts and Mathematics components of the GEE 21. Homogeneous subsets for 10th graders in an SES Level 3 setting are reported in Table 82. Secondary schools were identified according to size as measured by total enrollment as follows: Small (0-499), Medium (500-899), and Large (900+). No significant effect of size was found *Lambda*(4, 118) = 1.67, $p < .05$ with the result that the hypothesis was accepted.

Table 81.

Multivariate Analysis of Variance (MANOVA) for 10th Graders in an SES Level 3 Setting

Source	SS	df	MS	F
Intercept				
ELA	347415.61	1	347415.61	810.60
MATH	298787.89	1	298787.89	563.98
SIZE				
ELA	1635.68	2	817.84	1.91
MATH	816.18	2	408.09	.77

*P < .05

Table 82.

Homogeneous Subsets for 10th Graders in an SES Level 3 Setting

	ELA MEAN	N	MATH MEAN
SIZE 1	75.17	26	69.62
SIZE 2	76.98	26	75.15
SIZE 3	89.32	11	79.17

CHAPTER 5

Summary, Conclusions, and

Recommendations

Introduction

In order to estimate the relationship among school size, socioeconomic status, the interaction of school size and SES, grade-level configuration and academic achievement as measured by the percentage of students passing the English Language Arts and Mathematics components of the LEAP 21 and GEE 21, school level data for all of Louisiana's 1362 public schools were statistically analyzed. The results of this analysis were reported in Chapter IV. The reported results and their implications for educational policymakers will be discussed in this chapter.

Conclusions drawn from the statistical findings for the following research questions will comprise the second section of this chapter: (a) Do the effects of school size, SES, and/or the interaction of school size and SES on academic achievement in Louisiana public schools as measured by the LEAP 21 and the GEE 21 significantly differ across grade-level configurations at the 4^{th}, 8^{th}, and 10^{th} grade levels?, (b) Is there a significant relationship among school size, grade-level configuration, SES, the interaction of school size and SES, and student achievement in Louisiana public schools in grades 4, 8, and 10 as measured by the English Language Arts and Mathematics components of the LEAP 21 and the GEE 21?, (c) Do the effects of school size and SES levels on student achievement as measured by the English Language Arts and Mathematics components of the LEAP 21 and GEE 21 significantly differ in Louisiana public schools in grades 4, 8, and 10?, and (d) Does the effect of school size on student achievement in Louisiana public schools in grades 4, 8, and 10 as measured by the English Language Arts and Mathematics components of the LEAP 21 and GEE 21 significantly differentiate across SES levels? The third section of this chapter will provide implications for practice. In the final section, recommendations for further research will be delineated.

Conclusions

As the nation's schools are continually undergoing school improvement and restructuring as part of the ongoing school reform process, it was necessary to determine the relationship among malleable structural variables that prior research has suggested may mitigate the negative effects of poverty on academic outcomes. The literature review on school size and grade-level configuration indicated that small school size and broad grade-level configurations may reduce the negative relationship between low socioeconomic status and student achievement. However, the review of research stressed that the relationship among the variables included in this study is complex (Bickel & Howley, 2000; Bickel , Howley, Williams, & Glascock, 2000; Coleman, et al, 1966; Howley & Bickel, 2000a; 2000b; Howley, 1995;1996a; 2000a; 2001). The results of this study support the premise that the organizational structures of educational facilities do impact cognitive outcomes in complex ways.

Research question one sought to identify if the effects of school size, SES, and/or the interaction of school size and SES on academic achievement in Louisiana public schools as measured by the LEAP 21 and the GEE 21 significantly differ across grade-level configurations at the 4th, 8th, and 10th grade levels. In examining the percentage of students that passed the English Language Arts and the Mathematics components of the LEAP 21 and the GEE 21 at the 4th, 8th, and 10th grade levels, the effects of school size, socioeconomic status, and the interactions of these variables were found to be significantly different across grade-level configurations (with the exception of the Mathematics component at the 10th grade level). Therefore, Null Hypotheses (1a), (1b), (1c), (1d), and (1e) were rejected while Null Hypothesis (1f) failed to be rejected. The differential effects reported in this study are similar to those reported by Becker (1987). Although Becker identified a significant advantage to locating the sixth grade in an elementary, rather than middle-level, grade span, the advantage declined as student socioeconomic status rose. Becker reported a differential effect of grade-level configuration. Sixth graders in the upper tail of the socioeconomic status distribution performed slightly better in non-elementary settings. As in Becker's study, the results of this study indicate that the grade-level configuration of a school impacts the effect that poverty has on academic outcomes. For example, in elementary configurations the school's poverty level significantly influenced the percentage of 4^{th} grade students passing the English Language Arts and Mathematics components of the LEAP 21 while no such relationship existed in middle/junior high or combination configurations.

Research question two examined the relationship among school size, SES, the interaction of school size and SES, and student achievement. Using the English Language Arts component of the LEAP 21 and GEE 21 as the dependent variable, the greater the percentage of students participating in the federal free or reduced price lunch program the lower the percentage of students passing the examination for 4^{th} and 8^{th} graders in an elementary configuration, for 8^{th} graders in a combination configuration, and for 10^{th} graders in a secondary configuration. Using school size as an independent variable, only 8^{th} graders in a combination configuration were significantly affected. As size increased, the percentage of 8^{th} graders passing the English Language Arts component of the LEAP 21 decreased.

Using the Mathematics component of the LEAP 21 and the GEE 21 as the dependent variable, the greater the percentage of students participating in the federal free or reduced price lunch program the lower the percentage of students passing the exam for 4^{th} graders in an elementary configuration and for 8^{th} graders in a combination configuration. A significantly greater percentage of 10^{th} graders passed the Mathematics component of the GEE 21 in a secondary configuration than did in a combination configuration. Also, in regards to the percentage of 10^{th} graders that passed the Mathematics component of the GEE 21, the percentage of students participating in the federal free or reduced price lunch program did not have a significant impact, but total enrollment did. As total enrollment increased, the percentage of 10^{th} graders passing the Mathematics component of the GEE 21 increased. Similarly, Ornstein (1990) noted that students enrolled in large high schools in the State of Illinois performed better on standardized achievement tests than did their cohorts in smaller schools.

Research question three explored whether or not the effects of school size and SES levels on student achievement, as measured by the percentage of students passing the English Language Arts and Mathematics components of the LEAP 21 and GEE 21, significantly differ in Louisiana public schools in grades 4, 8, and 10. A statistically significant difference among schools with varying poverty levels and with varying total enrollments was revealed. Based on these findings, Null Hypotheses (3a), (3b), and (3c) were rejected. The percentage of students participating in the free or reduced price lunch program was found to impact significantly the percentage of students passing the high stake's tests across the 4^{th}, 8^{th}, and 10^{th} grade levels. Previous research in Louisiana supports these findings regarding the negative effect of poverty levels on academic achievement (Caldas 1993a, White, R. 2000).

Research question four focused on the differential effects of small, medium, and large schools across SES levels on student achievement in Louisiana public schools in grades 4, 8, and 10 as measured by the English Language Arts and Mathematics components of the LEAP 21 and GEE 21. Nine sub-hypotheses examined the differences identified across small, medium, and large sized schools. Null Hypotheses (4a), (4b), (4c), (4d), (4g), and (4h) were rejected. In this study, not all of the differences in mean percentage of students passing the examination were statistically significant. Therefore, Null Hypotheses (4e), (4f), and (4i) failed to be rejected.

At all grades and across all SES levels within an elementary, middle/junior high, and secondary configuration, the mean percentage of students passing the high stakes tests increased as enrollment size increased. More students passed the LEAP 21 in large sized schools than did in small sized schools. The level of poverty did not alter the positive impact of school size on academic achievement. For example, at the 4th grade level in an elementary configuration in which 50% or less of students participated in the free or reduced lunch program, 15% more students passed the English Language Arts component of the LEAP 21 in schools with a total enrollment of greater than 599 than did students enrolled in schools with fewer than 300. In regards to the Mathematics component, 23% more students passed the exam in the large school settings than did in the small school settings. These findings support the research published by Stevenson (1996) wherein the elementary schools in South Carolina that received the most recognition based on students' academic performance tended to be larger in size rather than smaller.

Similar results were reported for the 8th and 10th grade levels. For example, on average 13% more 8th grade students passed the English Language Arts and the Mathematics examinations in schools with an enrollment size of 700 or more than did their counterparts in schools with an enrollment of 399 or fewer. At the 10th grade level, on average 12% more students passed the English Language Arts and the Mathematics examinations in schools with an enrollment size of 900 or more than did 10th graders in schools with an enrollment size of 499 or fewer. These results are supported by the work of Gardner, Ritblatt, Shulamit, and Beatty (2000) who reported that students attending public high schools with enrollments of more than 2000 students scored higher on the total SAT, verbal SAT, and math SAT than their counterparts attending smaller schools with enrollments between 200 and 600 students.

Howley (2000a) reported that in small schools the strength of the relationship between poverty and academic achievement is approximately half what it is in larger schools. The results of this study do not support those reported by Howley (2000a) (with the exception of 8th graders in a combination configuration). Even amongst schools with the highest poverty level, those in which greater than 80% of the students participated in the free or reduced lunch program, as school size increased the percentage of students passing the English Language Arts and Mathematics components of the LEAP 21 also increased. More students passed the English Language Arts examination (14.5%) and more students passed the Mathematics examination (18.2%) in large size schools than did their cohorts in small size schools. This difference may be due to the fact that Louisiana's overall poverty level is high with a large percentage of public school students across educational settings participating in the federal free or reduced price lunch program. Also, school sizes in Louisiana do not vary to the extent that they do in the states where school size has been reported to have a negative impact on achievement. Nonetheless, the differential impact of socioeconomic status and school size across grade-level configurations on achievement suggests that there is a difference in educational settings which affects student performance. As suggested by the literature review, it does appear that academic achievement can be modified by manipulating the organizational structure of schools such as school size and grade-level configuration.

Implications for Practice

The results of this study support the notion that effectiveness and efficiency of school size may best be represented by a U-shaped curve wherein schools may either be too small or too large to operate at optimal levels. It seems that in Louisiana, on average, public PK-12 schools are operating in a size range in which an increase in enrollment results in an increase in achievement. As stated by Hampel, in the January 2002 *Phi Delta Kappan*, "Small schools today strike many educators and policy makers as a potential cure for what ails American schools" (p. 357). Small schools do not seem to be a panacea for Louisiana students at the 4^{th}, 8^{th}, and 10^{th} grade levels. With the exception of 8^{th} graders in a combination configuration, in Louisiana the larger the school the better students seem to perform. Interestingly, on average the school sizes that seemed to make a difference are within the optimal size range recommended by Conant in 1959. Across the 4^{th}, 8^{th}, and 10^{th} grade levels, the schools which enrolled more than 300 students reported the highest percentages of students passing the English Language Arts and Mathematics components of the LEAP 21 and GEE 21.

This study extends existing empirical work on school structure and organization so as to facilitate the school improvement process in the state of Louisiana. The results of this study indicate that policymakers in Louisiana would be well advised to consider that academic quality may be achieved through economies of scale. Kennedy (1999) reported that large California public high schools had higher academic achievement than small California public schools. Perhaps the fact that students in Louisiana, like those in California, perform better in bigger schools can be attributed to greater resources, specialized services, differences in the training and background of teachers and administrators, and superior facilities. However, policymakers are cautioned not to assume that bigger is better as the literature review has suggested that schools can be too large to function at optimal levels.

It should be noted that in this investigation the measurement of school effectiveness was the percentage of students passing Louisiana's high-stakes tests. As stressed in the review of literature, in making decisions about the structure and organization of schools, policymakers are encouraged to examine multiple measures of school effectiveness. Factors such as extra-curricular participation, parental involvement, attendance and graduation rates might serve as additional indicators of school effectiveness. It is recommended that some type of cost-benefit analysis be conducted wherein policymakers assign a value to various outcomes in determining the optimal use of resources. Given the surprising results of this study, more research should be conducted exploring additional inputs, such as curriculum depth and breadth, teacher and administrator characteristics, building facilities, funding, community type, etc.

This study was limited to traditional school settings. Further examination into the effects of school size and grade-level configuration in non-traditional settings, such as those excluded from this study (Charter, Magnet, Alternative, etc.), is merited. In this study, the effects of school size, socioeconomic status, and the interaction of school size and SES differed across grade-level configurations. Further research might indicate that the effects of school size and socioeconomic status vary not only across grade-level configurations, but also according to school type. Also, in each of the models estimated, the adjusted R^2 value is small. This suggests that there may be other variables impacting the percentage of students passing the LEAP 21 examinations not included in this study, which may warrant further investigation.

Recommendations for Further Research

Based on the results of this study and the review of literature related to school size and grade-level configuration, the following recommendations for further research are made:

1. Research should be conducted to determine the ideal school size range for students across grades, grade-level configurations, socioeconomic levels, and school types.
2. Research should be conducted to replicate this study utilizing additional input factors such as teacher and/or administrator characteristics, class size, level of funding, community type, etc.
3. Research should be conducted to replicate the work of Friedkin and Necochea (1988) so as to analyze the effect of size and SES at the district level on academic outcomes.
4. Research should be conducted utilizing Hierarchical Linear Modeling (HLM) statistical techniques to analyze data similar to those included in this study.
5. Research should be conducted to determine the characteristics of various grade-level configurations, such as departmentalization, curriculum, class size,

homework policies, testing and assessment, and teaching practices that may explain the differential impact of school size and socioeconomic status levels upon student achievement.

6. Research should be conducted to replicate this study using average LEAP 21 scores rather than the percentage of students passing the LEAP 21 as the dependent variable.

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APPENDIX A

Letter Requesting Technical Manuals for the Leap Tests

LOUISIANA TECH
UNIVERSITY

CURRICULUM, INSTRUCTION
AND LEADERSHIP

SCHOOL LAW INSTITUTE
EMAIL gullattd@woodard.latech.edu

November 11, 2002

Dr. Fen Chou
Louisiana Department of Education
Division of Student Standards and Assessment
P. O. Box 94064
Baton Rouge, LA 70804

Dear Dr. Chou,

Dr. J. P. Beaudoin suggested that I contact you to request a copy of the technical manuals addressing the reliability and validity measures of the English language arts and mathematics LEAP 21 (4th and 8th grade levels) and the English language arts and mathematics GEE 21 (10th grade). Dr. Beaudoin has been of great assistance to me in developing my dissertation to be entitled *The Effect of School Size and Grade-Level Configuration on the Academic Achievement of Louisiana Public School Students*. The research questions to be addressed by my study are as follows:

(1) Is there a relationship between school size and student achievement in Louisiana public schools in grades 4, 8, and 10 as measured by the Louisiana Educational Assessment Program for the 21st Century (LEAP 21) and the Graduation Exit Examination for the 21st Century (GEE 21)?

(2) Does student achievement in Louisiana public schools in grades 4, 8, and 10 as measured by the LEAP 21 and GEE 21 differentiate across SES levels between large and small schools?

(3) Is there a relationship between grade-level configuration for Louisiana public K-12 schooling and student achievement in grades 4, 8, and 10 as measured by the LEAP 21 and GEE 21?

(4) Does student achievement in Louisiana public schools in grades 4, 8, and 10 as measured by the LEAP 21 and GEE 21 differentiate across SES levels among grade-level configurations in K-12 schools?

As I am planning to use the state's English language arts and mathematics criterion-referenced exams (LEAP 21 and GEE 21) as the measures of academic achievement in my study, my

Committee chairman, Dr. David Gullatt (Louisiana Tech University), has indicated that a discussion of the reliability and validity of these intruments should be included in the methodology section of my dissertation. Any assistance that you may provide will be greatly appreciated. If you have any questions or concerns, please feel free to contact me at Ruston High School (318 255-0807, schopin@lincolnschools.org) or at home (318 255-6862, scarletchopin@hotmail.com). Thank you very much for your help in this endeavor.

Sincerely,

Scarlet L. Chopin, B.A., M..S.

David E. Gullatt, Ph.D.
Professor/Dept Head

APPENDIX B

Letter Requesting Data from Louisiana

Department of Education

LOUISIANA TECH
UNIVERSITY

CURRICULUM, INSTRUCTION
AND LEADERSHIP

SCHOOL LAW INSTITUTE
EMAIL: gullattd@woodard.latech.edu

December 15, 2002

Dr. J. P. Beaudoin
Louisiana Department of Education
Division of School Standards, Accountability, and Assistance
P. O. Box 94064
Baton Rouge, LA 70804

Dear Dr. Beaudoin,

I am writing a dissertation entitled *The Effect of School Size and Grade-Level Configuration on Academic Achievement in Louisiana Public Schools*. The research questions to be addressed by my study are as follows:

(1) Is there a relationship between school size and student achievement in Louisiana public schools in grades 4, 8, and 10 as measured by the Louisiana Educational Assessment Program for the 21st Century (LEAP 21) and the Graduation Exit Examination for the 21st Century (GEE 21)?

(2) Does student achievement in Louisiana public schools in grades 4, 8, and 10 as measured by the LEAP 21 and GEE 21 differentiate across SES levels between large and small schools?

(3) Is there a relationship between grade-level configuration for Louisiana public K-12 schooling and student achievement in grades 4, 8, and 10 as measured by the LEAP 21 and GEE 21?

(4) Does student achievement in Louisiana public schools in grades 4, 8, and 10 as measured by the LEAP 21 and GEE 21 differentiate across SES levels among grade-level configurations in K-12 schools?

The variables to be included in this study are to be operationally defined as follows:

Independent Variables

For the purpose of this study, the following socioeconomic (input factor) and school structure variables (process factors), representing inputs will be included:

(a) The *Socioeconomic Status* (SES) variable will be defined as the proportion of students participating in the federal free and reduced price lunch program during the fall of 2001.

(b) The *School Structure* variables to be included in the proposed model are School Size (SIZE) and Grade Level Configuration (LEVEL). School size (SIZE) will be represented by the total number of students enrolled at each school. The number and type of public elementary and secondary schools to be included in this study include alternative schools, district-approved charter schools, and any schools involving adjudicated juveniles for whom a district is responsible for Student Information System (SIS) reporting. Also included are district schools that provide instruction for elementary and/or secondary students normally assigned and reported at other schools. Schools will be categorized by grade-level configuration (LEVEL) as follows:

Elementary (E): Any school whose grade structure falls within the PK-8 range, which excludes grades 9-12, and which does not fit the definition for Middle/Junior High School.

Middle/Junior High (MJ): Any school whose grade structure falls within the range 4-9, includes grades 7 or 8; and excludes grades PK-3 and 10-12.

Secondary (S): Any school whose grade structure falls within the range 6-12 and includes grades in the 10-12 range; or any school that includes only grade 9.

Combination (C): Any school whose grade structure falls within the range PK-12 and is not described by any of the above definitions. These schools generally contain some grades in the K-6 range and some grades in the 9-12 range. Examples include grade structures such as K-12; K-3, 9-12, and 4-6. Nongraded schools (schools with no grade structure) are also considered combination schools. (Louisiana Department of Education, 2002).

(c) The *Size-by-Socioeconomic Status Interaction Effect* (SSI) variable to be included in the model will be represented by the product of school size (SIZE) and socioeconomic status (SES).

Dependent Variables

For the purposes of this study, the *Academic Achievement* variables representing outputs will be represented by the percentage of students passing the English Language Arts (ELA) and the Mathematics (MATH) LEAP 21 and GEE 21.

My Committee chairman, Dr. David Gullatt (Louisiana Tech University), has suggested that I write this letter to formally request access to the Louisiana Department of Education's data related to the aforementioned variables. Any assistance that you may provide will be greatly appreciated. If you have any questions or concerns, please feel free to contact me at Ruston High School (318 255-0807, schopin@lincolnschools.org) or at home (318 255-6862, scarletchopin@hotmail.com). Thank you very much for your help in this endeavor.

Sincerely,

Scarlet L. Chopin, B.A., M. S.

David E. Gullatt, Ph.D.
Professor/Dept Head