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The Effect of School Size and the Interaction of School Size and Class Type on Selected Student Achievement Measures in Tennessee Elementary Schools

Kenneth Earl Nye
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To the Graduate Council:

I am submitting herewith a dissertation written by Kenneth Earl Nye entitled "The Effect of School Size and the Interaction of School Size and Class Type on Selected Student Achievement Measures in Tennessee Elementary Schools." I have examined the final electronic copy of this dissertation for form and content and recommend that it be accepted in partial fulfillment of the requirements for the degree of Doctor of Education, with a major in Educational Administration.

Mary Jane Connelly, Major Professor

We have read this dissertation and recommend its acceptance:

Gary Ubbens, Katherine High, John Ray

Accepted for the Council:

Carolyn R. Hodges

Vice Provost and Dean of the Graduate School

(Original signatures are on file with official student records.)

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The Effect of School Size and the Interaction of School Size and Class Type on Selected Student Achievement Measures in Tennessee Elementary Schools

A Dissertation
Presented for the
Doctor of Education
Degree
The University of Tennessee, Knoxville

Kenneth Earl Nye

August, 1995

DEDICATION

This dissertation is dedicated to my wife

Dr. Barbara A. Nye

for her loving encouragement and commitment to education and public service;

to my children

Kristianne, Kelly, Kendra, Christopher and Michael

for their patience and contribution to the time required to complete this study;

to my mentor

Dr. John M. Crothers

for his support to begin this intellectual journey;

to my great aunt

Ms. Mildred L. Nye

for her enduring belief in education;

and to my parents

Mr. Lowell E. Nye and Mrs. Ruth M. Nye

for their lifetime of love and support.

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ABSTRACT

The purpose of this study was to analyze student academic achievement in reading and mathematics for grades K through 3 to determine if there was a school-size effect. This study further analyzed whether the school-size effect differed across the three class types: small (S), regular (R), and regular with aide (RA), to which students had been assigned. Several null hypotheses were posited regarding the effect of school size and interaction of the school-size effect with each of the three class types on the academic achievement of students.

This study of school size benefited from having an extant database of information on over 7,000 students with random assignment of students and teachers to classes within each school. These students were randomly selected and heterogeneously assigned to three class types based on an average teacher-student ratio: S=1:15, R=1:25, RA=1:25. This study employed correlation, t-test, and other appropriate statistical tests to determine any effect of school size and the interaction of school size and class type. The class was used as the unit of analysis for both the school-size and class-type effects.

The extant database used to conduct this study was developed from a statewide, longitudinal study of the effect of class type on student achievement (Project STAR) within 79 elementary schools in 42 Tennessee public school systems during 1985-89. At the end of the longitudinal study 76 schools remained in the database. The class-type study utilized a "within school" research design with the class as the unit of analysis. This allowed for control of individual teacher effects and other contextual variables (e.g. school leadership, curriculum, instructional materials, and expenditures).

The class-type study found that the S class type has a positive, statistically significant ($p \leq .001$) and educationally important effect (effect size from .22 to .44) on student achievement for grades K through 3 (Word et al., 1990).

The null hypotheses of this study on school size were not supported. The study found that the negative relationship between school size and the academic achievement of students reported in the research literature was evident in the extant database. The negative effect of large school size differed for the three class types and by school location. The negative effect of large school size on student achievement in all three class types was most evident for inner-city schools School size did not have a significant effect on student achievement in rural schools. The S class type produced the highest student achievement of the three class types except in small rural schools where the RA class type produced the highest student achievement. The S class type countered the negative effect of large school size on student achievement better than the RA class type.

Overall, the study findings indicated that small school size was more important to student achievement in mathematics and the S class type was more important to student achievement in reading. School size alone did not appear to account for the negative effect of large schools on student achievement. The negative effect of large school size on student achievement in both reading and mathematics for all three class types became more evident as students progressed in school during grades K through 3.

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CHAPTER I

INTRODUCTION TO THE STUDY

I. INTRODUCTION

For the last few decades individual American elementary and secondary schools have been growing larger in terms of student enrollment. This growth in individual school enrollment has been supported by policymakers and educators based on perceived benefits of consolidating smaller schools into larger units to produce more cost-effective organizational structures and the belief that larger school organizations can offer improved curriculum and instructional benefits.

The issue of school size, as determined by total student enrollment, has continued to be debated in terms of financial benefits and student outcomes. The purpose of this study was to analyze student academic achievement in grades K through 3 to determine if there is an effect of school size on reading and mathematics, and whether the school-size effect differs across three class types: small (S), regular (R), and regular with aide (RA), to which students had been assigned. The present study includes a review of previous empirical studies regarding the effect of school size on curriculum, student attitude, and achievement outcomes. The study does not deal with the issue of perceived cost benefits of having schools with larger student enrollments. Until the relationship between school size and student outcomes can be better understood, a logical argument cannot be made to support a particular school size in order to realize the maximum cost benefits.

The improvement of the academic achievement of students in America's schools has become of increased concern to policymakers and educators, as well as parents and the general public. This has been spurred by concern for the readiness of the nation's work force to compete in an increasingly international economy and marketplace. Civic, political and business leaders have spoken out in particular demanding that schools be more than repositories of knowledge or social clubs, and that students leave high school ready to engage in productive work and life-long learning. At the same time, the demographics of the nation and the family-support structures for children have changed dramatically during the past 40 years, while the basic structures and processes of schools have remained constant. Schools often appear to many parents to be prepared or inclined to serve only a small portion of students well. These changes in student needs, community expectations, and parent satisfaction have caused policymakers and educators to rethink basic assumptions around which schools have traditionally been organized and instructional programs planned.

The learning process is affected by many factors both internal and external to the school building. Considerable effort has occurred through the effective schools movement of the past two decades to improve the internal organizational processes and expectations for student and teacher interaction to provide the most effective learning environment possible. Recent attention has been drawn to the context factors of schools which effect student academic achievement such as school leadership, faculty preparation and professional development, curriculum structure, school resources, size of individual class enrollments, and school size based on total student enrollment. These context

factors are important process indicators of school performance which are linked to student outcomes (Oakes, 1989). This study provides additional information with regard to the influence of the size of individual class enrollments and school size based on total student enrollment on student achievement.

II. THE PROBLEM

American schools are becoming increasingly larger in terms of student enrollment in individual schools. Mean school size of all schools has increased fivefold in student enrollment since 1930 from fewer than 100 to over 550 students. The average secondary school enrollment has increased to 1000 (Fowler, 1992) and average elementary school enrollment to over 400 (Lunenburg & Ornstein, 1991). It was once the common experience of seniors to attend high schools with total enrollments of 400 or fewer students, to have graduating classes of 75 or fewer students, and to have come from elementary schools significantly smaller than their high schools. Today, according to Fowler, most students graduate from high schools with enrollments of 500 or more, and in suburban, urban, and inner-city areas from schools with enrollments over 1,000. Their elementary school experience was likely to have been in a school with an enrollment of 500 or more (National Center for Educational Statistics, 1992). It is not uncommon to find elementary schools with 600-800 students. The smallest elementary schools of 200 or fewer students are predominantly in rural areas where transportation or local politics prevent consolidation. Other smaller elementary schools of 200 to 400 enrollment are in rural and small urban communities and in some suburban areas where populations of

families with young children reside in housing patterns less dense than neighboring inner-city areas. However, the larger elementary schools of 400 to 600 and over 600 can be found in rural, suburban and urban communities depending on local community decisions regarding facility construction and school district attendance zones.

Although several studies have argued the merits of creating high schools with larger enrollments and others have argued against increasing student enrollment in both high schools and elementary schools, many of these studies have lacked a database of sufficient size from which to substantiate the influence of school size on student academic outcomes. Some studies have also been lacking in today's standards for quantitative research and statistical rigor in terms of random assignment of students or use of appropriate statistical analysis over a longitudinal period. Thus, policymakers and educators have had to make decisions about construction of school facilities and enrollment size independent of sufficient research information. These decisions concerning school size can have a profound effect on students' ability to learn, to be involved in school activities, and to graduate from school (Oxley, 1994). If school size has an effect of student academic achievement, policy and administrative decisions in this area also have long-term implications for the overall costs of schooling in America. Policymakers and educators need a clearer understanding of the effect of school size on student achievement to guide their decisions.

Some researchers suggest that there are certain sizes of student enrollment in a school that have a more positive effect on student achievement (Lunenburg & Ornstein, 1991). If breakpoints in the size of student enrollment in individual schools exist where

the effect on academic achievement can be determined and what the effect is, then policymakers and educators can consider this information regarding the effect of school size on student outcomes in the school planning and approval process. In turn, it may be possible to consider some ways to ameliorate any negative effect on student achievement of school size when it exists.

Previous research on school size has not provided evidence beyond the main effect of school size. These studies have not determined how any negative effect incurred by school size can be addressed other than suggesting changes in the overall size of enrollment in schools. Given the enormous capital investment and time commitment required for construction of school facilities, rapid changes in the size of individual school enrollments based upon the size of school facilities are not likely to occur. More easily controlled instructional approaches which provide a positive influence on student achievement within existing individual school facilities need to be identified and considered along with optimal school size.

One example of a more easily controlled instructional approach is class type organization based on the teacher-student ratio which is used for each individual class within the school. Recent research findings have demonstrated a positive effect for the S class type on student achievement in grades K through 3 (Word et al., 1990). The S class type may demonstrate one way to ameliorate any negative effect of school size in the early elementary grades. In addition to determining school-size effect, an analysis of the interaction between school-size and class-type effects should be conducted to assist policymakers and educators in determining appropriate school size and whether decisions

about class type can positively influence student achievement in elementary schools when any negative effect is incurred by school size.

III. THE PURPOSE

The specific purpose of this study was to analyze student academic achievement in grades K through 3 to determine if there is an effect of school size on achievement in reading and mathematics, and whether the school-size effect differs across three class types to which students had been assigned.

IV. HYPOTHESES

Several null hypotheses were posited regarding the effect of school size and the interaction of the school-size effect with each of three class types: small (S), regular (R), and regular with aide (RA).

1. There is no difference in effect between small and large school size as determined by total student enrollment on student achievement in reading for grades K through 3.
2. There is no difference in effect between small and large school size as determined by total student enrollment on student achievement in mathematics for grades K through 3.
3. There is no difference in effect of large school size for the S, R, and RA class types as determined by the teacher-student ratio for individual classes on student achievement in reading for grades K through 3.

4. There is no difference in effect of large school size for the S, R, or RA class types as determined by the teacher-student ratio for individual classes on student achievement in mathematics for grades K through 3.
5. There is no difference in effect of small school size for the S, R, and RA class types as determined by the teacher-student ratio for individual classes on student achievement in reading for grades K through 3.
6. There is no difference in effect of small school size for the S, R, and RA class types as determined by the teacher-student ratio for individual classes on student achievement in mathematics for grades K through 3.

V. POTENTIAL BENEFITS OF THE STUDY

This study attempted to discover enrollment breakpoints at which school size has an effect on student academic achievement in the early elementary grades of K through 3. This study also attempted to provide more reliable evidence about the effect of school size on academic achievement as measured by standardized tests by using an extant database with information on over 7,000 students from 79 schools (76 schools remained at the end of the study). This study benefited from the database produced from the random assignment of students and teachers to classes within each school during grades K through 3 of a statewide, longitudinal study in Tennessee of class-type effects during 1985-89.

Improving academic outcomes of students in school is a major agenda item for policymakers, educators, parents, and the general public. The student achievement outcomes of schools are affected not only by what students personally bring to the

learning process, but also by the complex factors influencing the school climate, the effectiveness of school personnel, and the interaction of teachers and students. One contributing factor to school climate, teacher effectiveness, and interaction of teachers and students that is administratively mutable is school size as defined by the size of student enrollment.

If breakpoints for optimal school size can be established in relation to academic achievement, then this factor, like size of class enrollment, grade-level organization, or retention in grade, can be considered as school policies are established. If a certain school size has a more positive effect on student achievement, it could prove to be more cost-effective to restrict school size than to have a fairly large percentage of students repeating grades, receiving special remedial resource programs which are supplemental to the regular instructional program, or eventually dropping out of school due to lack of academic success or non-affiliation.

Accountability regarding the efficient expenditure of public funds and the provision of positive student academic outcomes is of paramount concern to policymakers and educators, as well as parents and the general public. If accountability can be improved through easily understood policies that boost public confidence in schools, then taxpayers may be more willing to provide sufficient support for education.

If schools of a certain enrollment size have better academic outcomes, then we can better analyze other factors that influence or improve student outcomes and overall school accountability. Perhaps teacher communication, parent involvement, and neighborhood support are better in schools with certain enrollment size, and these may be

easier to establish through a policy establishing optimal school size. Over time, it could be more cost-effective in terms of desired student academic outcomes to require optimal school size rather than provide additional training and resources for all teachers to try to handle more complex communication and involvement in a school organization. The same argument for cost-effectiveness may be true in terms of implementing complex, individualized reading and mathematics programs for at-risk students, or self-concept development programs that try to improve school climate and influence student academic outcomes.

Considering other context variables such as class type, as determined by teacher-student ratio, also plays a critical role in determining student outcomes. Implementing programmatic changes in schools which are not of an optimal enrollment size or which use less effective class types within the school may not prove as effective or as enduring as actually changing or limiting the size of enrollment in a school or individual classes to enhance student academic outcomes. The use of optimal school size may be even more effective in producing positive student outcomes if other important context variables such as class type are also considered in tandem.

VI. DEFINITION OF TERMS

The following terms and concepts are defined specifically for use within the context of this study.

Class Type: Three class types for grades K through 3 based on average teacher-student ratio as defined in Project STAR: small 1:15, regular 1:25, and regular with aide 1:25.

Lasting Benefits Study (LBS): A follow-up study of the continuing benefits on academic achievement for Project STAR students who participated in the S class type after all students returned to the standard class type (average teacher-student ratio 1:25) available in the subsequent grades of 4 through 6. All students who participated in Project STAR were assigned to individual classes beginning in grade 4 according to each school's normal assignment procedure.

Optimal School Size: A size of total student enrollment in a school that produces a significantly better advantage for students in reading and mathematics achievement as determined by standardized achievement tests.

Project STAR (Student-Teacher Achievement Ratio): An experimental study funded by the Tennessee General Assembly by House Bill 544 passed in May 1985 which authorized a major policy study to consider the effects of individual class enrollment size (teacher-student ratio) on student academic achievement in the elementary school grades of K through 3. Students and teachers were randomly assigned to individual classes.

School Size: The size of an elementary school as determined by total student enrollment: small: enrollment <470, medium: enrollment 470 to 670, and large: enrollment >670.

School Type: Inner-city schools are those located in metropolitan areas that had more than one-half of their students on free or reduced cost lunch (indicative of low income family background). Suburban schools are those located in outlying areas of metropolitan areas. Urban schools are those located in a town of over 2,500 and serving primarily an urban population based on the census definition Rural schools are all other schools not

meeting the classification criteria for the other three school types. These school types were used in establishing the Project STAR database.

VII. ASSUMPTIONS

1. Measuring student achievement is central to improving school effectiveness and providing school accountability.
2. The elementary school grades of K through 3 in school provide foundation subjects and basic skill instruction in reading and mathematics important to future academic success as measured by standardized achievement tests.
3. Student scores on standardized tests of reading and mathematics are important predictors of overall student performance in school.
4. The effect of school-size and class-type variables on student achievement is important to study during the elementary school grades of K through 3 because of the potential long-term benefits from starting students successfully in school.
5. Student scores on standardized tests in reading and mathematics are good criterion variables for analyzing the effect of independent variables such as school size and class type on student achievement.
6. Existing standardized test scores in reading and mathematics from a state-wide, longitudinal study of the effect of three class types on student achievement, based on random assignment of students and teachers to class type, provide an appropriate data set for studying the effect of school size and the interaction of school size with class type on student achievement.

7. Variables such as school size and class type can be controlled by school administrators and policymakers.

VIII. LIMITATIONS AND DELIMITATIONS OF THE STUDY

This study of school size is based on data from an existing experiment, Project STAR, which has been recognized for the rigor of its statistical design and its contribution to education (Orlich, 1991). The Project STAR research design has been shown to have both internal and external validity. Thus, the database itself is not limiting in terms of its usefulness for drawing conclusions from additional analysis of the data in relation to such variables as school size. It will be possible to generalize from this study to other elementary school populations of grades K through 3.

It will not be possible to generalize to all elementary school populations, or to middle and high school populations in terms of the effect of school size on academic achievement since the Project STAR experiment included only the early elementary grades of K through 3 in the state of Tennessee. In addition, it will not be possible to generalize from this study to student populations in elementary schools of fewer or greater numbers of students than those in the Project STAR experiment.

Because of the "within school" research design of Project STAR, each participating school was required to have all three class types with the S class type having a minimum of 13 students and a maximum of 17 students, and the R and RA class type having a minimum of 22 students and a maximum of 28 students each. Thus, individual schools had to have at least 57 students at the participating grade levels. The resulting

database includes 79 schools (76 schools remained at the end of the study) with the smallest average enrollment at any individual school of 329 students and the largest average enrollment at any individual school of 1,070 students.

Some argue that standardized tests do not present a total picture of academic achievement. However, these types of tests are commonly used criteria for measurement of mastery of knowledge by students at a given point in time. Standardized tests enjoy great face validity as a numerical representation of what students know and can do. State policymakers and the general public view standardized test scores as the primary indicator of individual student academic achievement and overall school performance. Standardized test scores were used for academic achievement measurement purposes in Project STAR. This study of school size used the test scores from the standardized, norm-referenced and criterion-referenced tests used by the state of Tennessee during 1985-89 and used in Project STAR.

IX. ORGANIZATION OF THE STUDY

Chapter I of this study consists of an introduction, a statement of the problem to be examined, a statement of the purpose of the study, and the hypotheses posited. It contains a discussion of the potential benefits of obtaining a better understanding of the effect of school size and the interaction of school size and class type on student academic achievement, definition of terms used, assumptions, a statement of the study's limitations and delimitations, and an outline of the organization of the study.

Chapter II consists of an introduction including a description of the effective schools research and literature, a review of school size research and literature, and a description of the class type research of Project STAR. It contains a discussion of the issues surrounding the topic of school size and surveys the research and literature available on the topic.

Chapter III provides an introduction and a detailed discussion of the methodology employed in the study. It contains an analysis of extant database of Project STAR and a description of the steps and the statistical procedures used to analyze the extant database in terms of the effect of school size and the interaction of school size and class type on student academic achievement.

Chapter IV presents the statistical treatment of the data. It contains an introduction, a presentation of the pilot study results, and the results from the study's statistical treatment of the extant database.

Chapter V presents the summary of findings from the analysis of the study's statistical treatment results and contains the conclusions of the study. It concludes with recommendations for school policy, administrative decisions, and future research.

CHAPTER II

REVIEW OF SELECTED AND RELATED LITERATURE

I. INTRODUCTION

During the 1970s and 1980s extensive research was conducted on effective schools (Northwest Regional Education Laboratory, 1990). The resulting research reports and literature influenced both school practice and preparation programs for school personnel (National Association of Elementary School Principals, 1991). Many studies and numerous articles were produced on the topic of school effectiveness. These helped to support and shape the education reform movement during these two decades and into the 1990's (e.g. Averich et al., 1974; Austin, 1979; Austin & Holowenzak, 1985; Block, 1983; Borenger et al., 1985; Bossert, 1985; Brookover, 1981; Clark et al., 1984; Cohen, 1981 & 1982; High & Achilles, 1986; Miller, 1983; Murphy & Hallinger, 1985 & 1988; Ralph & Tenessey, 1983; Stallings, 1985; Valentine & Bowman, 1991; Westbrook, 1982).

The research on effective schools in part was a response to the changing roles required of schools and the demands for more accountability in the expenditure of public dollars to support education. The effective schools research resulted in a large body of literature that strongly suggested various instructional conditions which must be present in schools for the successful performance of students. The conditions include the actions and perspective needed by personnel administering the individual school unit as well as those providing direct instruction. The volumes of research span information on the importance of planning and setting learning goals, classroom organization and management, efficient

use of learning time, establishing explicit and equitable classroom standards, careful orientation of students and parents to instruction goals, regular and appropriate assessment, and early and extra help for students at risk of school failure.

In addition to the research on effective schools, a large body of literature exists on effective teaching strategies (e.g. Barr & Dreeben, 1977; Behling, 1981; Berliner, 1976 & 1985; Block et al., 1989; Centra & Potter, 1980; Duffy, 1980; Firestone & Brody, 1975). Appropriate instructional practice by teachers was viewed during this time as the foundation for student academic performance. This research included information on the importance of instructional practice in such areas as setting high expectations for students, using incentives and rewards, allowing students to develop self-responsibility, and using cooperative learning and hands-on learning strategies.

Among the array of effective schools studies are those which addressed leadership competencies related to effective schools (National Association of Secondary School Principals, December 1982). In these studies leadership was seen as essential to school improvement. Believing that all students can learn, communicating the school vision, seeking out innovative curriculum practice, setting high expectations, supporting parent involvement, and maintaining a safe, orderly school environment were among the essential leadership competencies identified.

The effective schools research brought new attention to assessment of student academic achievement. During the 1980s and 1990s assessment of student academic outcomes became a central component of federal and state efforts to create performance indicators for the entire grades K through 12 educational system. These performance

indicators were intended to provide better accountability measures for monitoring the condition of education and to provide better information for policy and administrative decisions regarding schools and school systems.

Monitoring context indicators of school performance such as structure, resources and organization processes was also viewed as essential to provide information for policymakers and school administrators to make decisions (Oakes, 1989). Oakes argued that monitoring context indicators would reduce the tendency for educators to narrow programs and curriculum in order for students to score well on limited student academic outcome measures such as standardized achievement tests. Context indicators would also provide information about the circumstances present in the learning environment in which particular levels of student academic outcomes were achieved Context indicators included such variables as school leadership, faculty preparation and commitment, curriculum structure, school resources, size of individual class enrollments, and school size based on total enrollment.

Student academic outcomes based on norm-referenced test (NRT) and criterion-referenced test (CRT) scores, comprised the base for most of the primary data for educational performance indicator systems and received greater press coverage and public attention than school context variables. The school reform movement in the 1980s and 1990s was largely motivated by political and economic sector demands for accountability and improvement of student academic performance on standardized achievement tests (Berlak et al., 1992).

The rapidly changing nature of student and family demographics after the 1950s (Hamburg, 1992), and the advent of new technological requirements in the workplace and community life also increased the pressures for school reform. The family as a basic unit of society changed in terms of the rapid increase in single-head households, working mothers with very young children, family mobility at all income levels and the critical demands on all parents of balancing work responsibilities and family demands (Adams, 1987; Mayler, 1988). Coupled with the changed nature of the family were patterns of stress among youth evidenced during the preadolescent and high school years. Numerous adolescent suicides, increased sexual activity and teen pregnancy rates, along with widespread drug use including smoking and alcohol indicated new levels of stress (Hamburg, 1992). The severity of violent actions, including the use of firearms, among youth populations also increased during the 1980s and 1990s along with the expansion of "gang" activity in schools (Lal et al., 1993).

The school environment and the purpose of schooling were influenced by public accountability demands, changing demographics, and trends in the youth culture. The curriculum and educational technology of schools attempted to respond to these various external influences and new learning improvement objectives. Schools employed new, innovative instructional strategies and programs to promote basic literacy, courses with challenging and advanced subject matter, and the use of tools such as computer technology, video discs, and satellite communications to enhance the learning environment. Development of programs associated with or located in schools which provided early intervention and parent education aimed at preventing the early failure of

children in school were promoted nationally by many professional education associations as well as business and industry organizations (National Association of State Boards of Education, 1988). Some states such as Missouri and Kentucky adopted statewide pre-kindergarten programs and parent involvement, while in other states like Tennessee the implementation of pre-kindergarten programs and parent involvement was encouraged on a voluntary basis as part of local school system operations and incorporated in the state's goals for school improvement (Appalachian Educational Laboratory, 1993).

Within this framework of social and educational system change, an education reform movement prompted by increased accountability for student academic outcomes began taking place. The use of standardized achievement tests was the most pervasive and visible means of assessing student academic outcomes in the current education system. This dependence on standardized tests was due largely to the ease of administration and scoring. Determining progress by schools on student academic performance goals was limited primarily to student scores on standardized achievement tests. A national debate existed on the "high stakes" use of such tests because of the limited capability of current psychometric measurement to validate total academic achievement. However, these were the only academic achievement data broadly available which policymakers and educators could use during this period of decentralized school control (Berlak et al., 1992).

While the magnitude of research on effective schools can inform policymakers on how to reform the instructional process in public education, certain contextual aspects of improving student academic performance still puzzle researchers, policymakers, and educators. One of the areas requiring further exploration is the relationship of context

variables such as the classroom teacher-student ratio and school size based on enrollment with student academic achievement. It is important to better understand these two variables as it may be easier, and in some cases more cost-effective, to control these aspects of a school than the instructional methods and other contextual variables within the education system.

II. SCHOOL-SIZE RESEARCH AND LITERATURE

The effect of the student enrollment size within a school facility has been a topic of investigation for several decades (e.g. Barker & Gump, 1964; Conant, 1959; Haller, 1992; Lindsay, 1982; Stemnock, 1974). Some educators and policymakers believed that increasing the size of school enrollment was an important educational improvement. Conant (1959) viewed larger units as more cost-efficient and more educationally effective. Three of his most popular arguments for larger schools were increased opportunities for teacher subject-area specialization, a greater breadth of course offerings and administrative cost savings. Other educators and policymakers viewed the increasing size of enrollment in schools with concern as to the effect on student outcomes. Barker and Gump (1964) along with Lindsay (1982) argued that larger school size mitigated against student involvement and participation in school activities and development of leadership abilities. Stemnock (1974) and Haller (1992) each researched the effects of larger school enrollment on student academic achievement. Their studies did not support larger school size as a means to improve academic achievement. However, similar to the studies of the size of individual class enrollments (teacher-student ratio),

where no one had successfully defined the exact number of students that constitutes a large or small class type, the studies on the size of schools did not universally define what number of students constitutes a large-size or small-size school. This lack of a clear specification of school enrollment levels for determining school-size types may in part be the result of the rapidly changing pattern of school size during the twentieth century.

At the beginning of the twentieth century, there were approximately 160,000 public school districts in the United States of America serving about 16 million students. Near the end of the twentieth century there were some 16,000 or fewer public school districts (Guthrie, 1979) serving approximately 43 million students. During this same period of time the number of individual schools decreased from over 400,000 to approximately 85,000. In large part, this reduction was the result of the consolidation of single teacher schools. In the 1990s the United States educated most students in schools with over 500 enrollment and in school districts with over 5,000 enrollment, both large as measured by past standards of size (National Center for Educational Statistics, 1992). A small-size school was still common, although this occurred primarily in rural areas and in some suburban or small urban school districts. In 1987, only 31 percent of schools in the United States enrolled fewer than 300 students and only 20 percent of school districts enrolled fewer than 2,125 students (Howley, 1989).

Based on a review of research by Lunenburg and Ornstein (1991), the average student enrollment for elementary schools in the United States was 403 and for secondary schools was 721. These authors defined a school as too small if staff and curriculum under-utilization occurred, and the operating unit cost per student exceeded the average

cost in the state. The authors also asserted that a school was too large when there was a loss of school identity among students or personnel, students were unable to participate fully in social and athletic activities or had difficulty interacting among themselves, or students felt that they did not belong to the student body or school in general (Ornstein, 1989) Lunenburg and Ornstein (1991) related overt behaviors such as delinquency, drug abuse, gangs, cult activities, or other expressed feelings of isolation or despair among students as evidence that a school was too large.

Using the Digest of Education Statistics (1989) to identify the size of school enrollments, Lunenburg and Ornstein indicated that in terms of numbers, the 19 percent of public elementary schools with enrollments of fewer than 200 students were too small and the 27 percent of secondary schools with enrollments under 300 students were too small. Those schools with over 600 students comprised 16.5 percent of elementary schools and were considered too large. Secondary schools considered too large were 10 percent of the schools. These schools had enrollments over 1,500 with 46 percent of the schools with enrollments over 3,000. These statements regarding too small or too large of enrollments were based on judgments of what was good for students in terms of available curriculum in the case of small schools and the opportunity for social development in the case of large schools (Lunenburg & Ornstein, 1991).

An explanation for the emphasis in the United States on creating large schools comes from Callahan's text Education and the Cult of Efficiency (1962). Callahan associated bigness with growth and productive efficiency which provides a greater opportunity to specialize. This perspective followed post-World War II industrialization

in the business sector and the business beliefs about efficiency and organization size that were prevalent in the 1960s.

Conant (1959) added support for large high schools during a period of school consolidation. He advocated large, comprehensive high schools with graduating classes of more than 100. Conant considered small schools a problem in terms of their lack of special facilities and subjects, and because they were wasteful from an economic standpoint. He defended large schools because they were well organized, provided something for all students, and promoted racial integration and democratic values.

Since the mid-1960s, small-size schools has been a topic of interest for research due to the increase of poor academic performance in large-size, inner-city and urban schools and the concern for affective benefits which contribute to student achievement in all schools (Barker & Gump, 1964; Lindsay, 1982; Haller, 1992; Fowler & Walberg, 1991; Haller, Monk & Tien, 1992). These studies looked at student participation in school at the high school level. More recently, a student classroom participation study documented increased participation in school by elementary students who were enrolled in the S class type (Finn & Cox, 1992; Finn et al., 1992). However, these researchers did not investigate the effect of school size or other contextual variables in relation to the small class-type effect on student participation in school.

Unks (1989) stated that the strengths of small schools such as promoting a sense of community, minimum bureaucracy, and a curriculum reflective of the currently supported academic core in English, history, science and math were overlooked. Cusick (1983) argued the merits of large high schools in terms of status, leadership opportunities,

extracurricular activities, and the benefits of recognition and affiliation. Ornstein (1989) again added to the school-size debate when he argued that sociological data support small schools as the hub of a neighborhood where parent and school involvement were high with each experiencing positive pressure from the other to cooperate on school and civic goals.

Coleman (1961) commented on school size by documenting that only 25 percent of students in large high schools considered themselves a part of school life and no more than 15 percent considered themselves as a part of the "in crowd." Gregory and Smith (1987) supported Coleman's research in their review of school-size studies on high schools. They saw high schools as communities and recommended a school size of no more than 250. They were concerned with governance and the organization of space and time in schools which would lead to positive human functioning. Goodlad in A Place Called School (1984) reported that a sense of community was more easily obtainable in smaller schools that were found in small towns.

Lunenburg and Ornstein (1991) analyzed the research debate around school size in favor of smaller schools. They concluded that smaller schools provided better peer recognition, and that these schools were less expensive due to salaries and fewer curriculum and instructional offerings. They stated: "student outcomes (even when social class is held constant) appear to be higher in small schools (p. 435)."

During the 1980s, various authors (Brubaker, 1988; Ornstein, 1989; and Mulholland, 1980) suggested that the debate about school size would return to cost factors versus student achievement. They suggested that construction of big school facilities would be decreased due to high building costs for cafeterias, gymnasiums, and

auditoriums as well as major maintenance, fuel, and administrative costs associated with large facilities. This discussion was related to the overall energy crisis occurring at that time. Other research discussed below concerns the analysis of student outcomes in the debate about school size.

Barker and Gump (1964) studied small high schools in Kansas. They concluded that small high schools offered students increased leadership role opportunities as well as chances for greater participation in extracurricular activities than did larger schools. This was an important study because several measures of school affiliation were obtained. School affiliation was seen as closely related to school achievement and persistence toward graduation (Lindsay, 1984).

A fairly large body of literature documenting the effect of staff characteristics and curriculum variables on academic achievement in relation to school size is available (e.g. Barker & Gump, 1964; Barker, 1985; Haller & Monk, 1988; Haller et al., 1990; Monk, 1982; Stemnock, 1974). Some of these studies documented support for larger schools and others portrayed data supporting smaller schools (e.g. Haller & Monk, 1988; Haller et al., 1990; Monk, 1982). Some other studies reviewed the effect of school size on standardized achievement test performance, while only a few studies controlled for student socioeconomic status (SES) (e.g. Eberts et al., 1984; Walberg & Fowler, 1987; Fowler & Walberg, 1991). One study analyzed the interaction of SES with school size and district size to predict student achievement (Freidkin & Neocochea, 1988).

The focus of recent research on school size concerns whether school size actually affects student achievement and what kinds of students might benefit from the

various sizes of schools. Stemnock (1974) reviewed the literature on school size from 1924 to 1974. His review included approximately 120 studies. The studies primarily concerned variables such as staff specialization and credentials, costs, teaching styles, and course offerings. The studies which focused on curriculum variables supported increases in school size. A smaller number of the studies conducted between 1924 and 1960 looked at the effect of school size on student achievement and found little if any difference in the achievement of students in small as compared to large schools. However, these studies did not recommend increases in school size. These studies did not control for the influence of student SES on students' achievement scores.

Beginning in the 1960s, concern for students at risk of educational failure as a result of such things as low student SES drew the attention of policymakers away from concentrating on curriculum issues to focusing on student outcomes. School climate and school leadership research related to student performance increased. Some researchers suggested that good school climate and effective instructional leadership would be easier to achieve in small rather than in large schools (Freidkin & Neocochea, 1988).

Because of the important influence of student SES, this variable must be included to consider the effects of class type or school size. A few studies on school size controlled for the SES of students. O'Hare (1988) pointed out that the poverty rate of rural areas was generally high and that poverty was known to have a depressing effect on student achievement. Free and reduced-lunch participation rates of students, which was the indicator most often used to determine student SES, was usually higher in inner-city

areas where there were more single heads of household and lower availability of food from farming; however, rural schools also had large numbers of poor students.

Studies by Eberts et al. (1984); Giesbrecht (1978); and Walberg and Fowler (1987) which controlled for student SES confirmed a positive effect of small school size on the achievement of students. Some recent studies that did not control very well for the influence of SES found no differences in student achievement between large and small schools (Melnick, Shibles & Gable, 1987). Freidkin and Neocochea (1988) found that student achievement was negatively affected in large schools and large districts with high percentages of low-SES students. Conversely, student achievement was positively affected in large schools and large districts with large percentages of high-SES students. The positive effect for students in large, high-SES schools and districts was smaller than the strong, negative effect on students in large, low-SES schools and districts. These findings suggested that having smaller schools might be an important strategy for the education of socioeconomically disadvantaged students, and that the benefits of larger schools for other students may be less than that previously suggested by earlier studies. Howley (1989) in a review of research on school effects also found that small schools provided substantial benefits to low-SES students. Aspects of small schools which contributed to this effect might include small class size, good student affect, and cooperative interpersonal relationships (Howley, 1989).

Other recent studies considered process variables such as school climate and instructional leadership as they effect student achievement in small and large schools. Stockard and Mayberry (1986) found that these variables influenced small and large

schools in different ways. The studies on process variables and the important findings by Freidkin and Neocochea (1988) about the relationship of student SES and student achievement, strongly suggested the need to control for student SES when examining school-size effect and the influence of other variables such as class type and school leadership on student achievement.

Much of the recent attention in the school size debate has been given to high schools because the reasons for smaller elementary schools has been viewed as more evident and the rationale for consolidation of elementary schools in terms of more subject area specialization and cost efficiency is seen as less justifiable (Fowler, 1992). Several researchers studied the effect of school size on student outcomes and administrative costs in high schools (Coleman et al., 1966; Guthrie, 1979; Haller et al., 1990; Haller, 1992; Haller et al., 1992; Lindsay, 1982 & 1984; Sher & Tompkins, 1977; Summers & Wolfe, 1977). According to Guthrie (1979) and Sher and Tompkins (1977), there was some evidence that bigger schools were not necessarily more economical, especially in rural areas. There was also some evidence that student academic achievement was higher in smaller schools (Coleman et al., 1966; Summers & Wolfe, 1977).

Lindsay's (1982) study provided empirical support that smaller high schools had some other important advantages. He substantiated several of Barker and Gump's (1964) findings on student participation by using a nationally representative sample of students. Lindsay found that school size affects student participation and satisfaction independent of the effects of student SES and academic ability. Additionally, he found that the effect of school size was independent of urban and rural location, and that school

size had an independent effect on student attendance. Participation, satisfaction and attendance were lower in larger schools.

In a later article, Lindsay (1984) added to the findings about school-size effect in terms of the enduring influence of school size. He stated, "Students who participate in extracurricular activities during high school are more likely to participate in a broad range of social activities as young adults, controlling for other known influences (p. 81)." Lindsay found that high school activity participation was higher for students in smaller schools. Their participation was determined more by school size than by student SES, academic ability, gender, sociability, curriculum track, and rank in class. Thus, school size had a long-term effect on adolescent socialization apart from the influence of the family. Smaller schools could lead to less alienation within high school and contribute positively to young adult participation after schooling, according to Lindsay. Participation in high school co-curricular activities was viewed as an important contributor to student success in school and later life. Participation in co-curricular activities by all students was found to be greater in small high schools (Cockman, 1989). Other research (Finn et al., 1992) showed that the small class type can also increase student participation and improve academic performance in elementary schools.

School size and program comprehensiveness was studied using evidence from the national High School And Beyond data (Haller et al., 1990). These researchers found substantial variation in the comprehensiveness of mathematics, science, and foreign language programs at a given school size with no common point at which the programs of smaller schools approximate those of larger schools. Thus, an important conclusion made

by these authors was that large schools had advanced alternative courses which served a very small percent of students and that few schools, however small, lacked basic courses. Therefore, consolidation into large schools must be considered against the logic of having smaller schools that had advantages for students' social development (Hamilton, 1983). Haller suggested that advanced courses could be offered by means of new computer and video technology at small schools versus accepting the argument for large schools in the name of curriculum comprehensiveness.

Haller (1992) also debated the merits of rural small schools on the basis of whether creating larger institutions would increase student misbehavior or indiscipline. In light of the potential for increased disciplinary problems in big schools, Haller reviewed data from the High School and Beyond study. Haller found that school size had a relatively small effect on truancy and disorderliness in rural schools. Specifically, increasing the size of rural high schools from 400 to 800 would not lead to a substantial increase in discipline problems (truancy and disorderly behavior). Other studies (Fowler & Walberg, 1991; Gabarino, 1978; Gottfredson, 1985) indicated that large urban schools had more discipline problems than did small schools.

Haller (1992) also argued against the creation of large schools on the basis of these being more equitable and efficient. He suggested that these criteria did not provide clear reasons for public policy decisions such as school consolidation, and that citizen preferences on other factors such as discipline were more appropriate for decision making. Haller pointed out that data on equity and efficiency of larger schools did not support consolidation and notes that keeping rural schools small just to control discipline problems

was also not warranted. He concluded that data on public opinion for keeping small schools, facts about the length of bus rides, and the size of children's classes were more logical reasons to keep small rural schools, without any existing evidence supporting larger school size.

Small schools and higher order thinking skills were addressed by Haller et al. (1992). This study found that school size and student achievement were largely unrelated. The researchers did cite the need for further study of the relationship between school size and higher order thinking skills, since these may be acquired earlier than high school or in mathematics and science at all grade levels. Thus, school size, prior to high school, may be related to the development of these skills or these skills may be taught in introductory courses in every high school regardless of size. Haller et al. (1992) also suggested that these types of skills may result from parenting skills, innate ability or teaching strategies versus the numbers of courses or the course content. In summary, these researchers found no significant advantages in relation to student achievement outcomes for large schools which offer more advanced courses.

In one study, researchers examined the relationship between the size of middle schools and student achievement. Plecki (1992) used trend analysis to study the relationship between enrollment and reading scores. This study found inconclusive results from an analysis that attempted to assess the importance of school size in explaining the variance in student performance in middle and elementary schools. "None of the findings in the study support the notion that larger schools are associated with improved student performance (p. 20)." The study also concluded that the nature of school size may be

different for middle schools as compared to elementary schools. Low SES for students was again found to be a significant factor related to student performance.

Researchers consistently identified school size as an important variable affecting student achievement (Haller, 1992). As noted earlier in this literature review, research is needed to more definitively answer what specific school size is beneficial to student achievement. Research is also needed to identify the characteristics within small or large schools that produce positive student achievement. For example, the interaction of class type with school size also needs to be examined to determine if the size of student enrollment in individual classes ameliorates any negative effect of school size.

Based on the need for better constructed studies on school size that consider student SES, the current study will benefit from the random assignment of students and teachers to class type and the "within-school" research design which produced the Project STAR database. This study will help to establish whether there is an important influence of school size and class type on student achievement in reading and mathematics for grades K through 3 as measured by standardized tests. The findings of this study will be particularly important because of the large, longitudinal database produced by Project STAR.

The current study will contribute to further understanding the relationship of one quantifiable school-context variable, school size, to student academic achievement. In addition, the interaction and influence of school size and class type on student achievement will be better understood. The findings from this study will also be useful in further study of school-context variables and in making school policy and administrative decisions

relevant to producing improved student outcomes. When quantifiable school-context variables such as school size and class type are better understood, better models for investigating more complex school-context variables such as school leadership can be developed.

III. CLASS-TYPE STUDY AND SELECTED FINDINGS

From 1985-89 researchers from four universities in Tennessee cooperated with the Tennessee Department of Education on a large study which included over 7,000 students in a state mandated experiment called Project STAR (Student-Teacher Achievement Ratio). The experiment studied the effect of class type, based on teacher-student ratio, on student achievement while they were in grades K through 3. A follow-up study was conducted during 1989-92 on these same students' achievement in grades 4 through 6. The follow-up study was called the Lasting Benefits Study.

Students were enrolled in the Project STAR schools and classrooms for kindergarten (n=6328), grade 1 (n=6835), grade 2 (n=6846), and grade 3 (n=6804) of the intervention. The Lasting Benefits Study continued studying the progress of Project STAR students in grade 4 (n=4320), grade 5 (n=4649), and grade 6 (n=4333) when they returned to the standard class type available in these grades through "regular" assignment.

A conservative multivariate analysis (Finn & Bock, 1985) was used to study the actual effect of the three class types: small (S), regular (R), and regular with aide (RA), on student achievement recognizing the effects of teachers and class on individual student achievement. The study found that the S class type had a positive, statistically

significant ($p \leq .001$) and educationally important effect (effect size from .22 to .44) on student academic achievement for grades K through 3 on state-mandated standardized norm-referenced tests and criterion-referenced tests of basic skills (Word et al., 1990).

Follow-up research, the Lasting Benefits Study, during 1989-92 investigated the academic performance of Project STAR students when they returned to the R class type through "regular" assignment in the subsequent grades 4 through 6. Continuing analysis was conducted to determine the duration and ongoing significance of the class-type effect. The S class-type effect was found to be positive and pervasive up to three years after the S class-type experience in grades K through 3 had ended and all students returned to the R class type (B. Nye et al., 1992 & 1993).

The Project STAR study has been cited as "the most significant education research done in the United States of America during the past 25 years" (Orlich, 1991, p. 632). The class-type experiment employed random assignment of students and teachers to three class types based on an average teacher-student ratio: small 1:15, regular 1:25, and regular with aide 1:25. The actual range of enrollment allowed for each class type was: small class = 13 to 17 students, regular class = 22 to 26 students, regular class with full-time teacher aide = 22 to 26 students. The experiment used a "within school" research design which meant that each school had students randomly assigned to all three class types. All Tennessee school districts were asked to participate in the study. There were 1,100 elementary schools in Tennessee at the time of the study.

Using a power analysis, the Project STAR researchers determined that they would need approximately 100 classes of each of the three class types to maintain

sufficient numbers to use the class as the unit of analysis. Forty-two of the 140 school districts in Tennessee were selected and 79 elementary schools in those districts selected served as school sites for the Project STAR class-type intervention study. By the end of the Project STAR experiment, 76 schools remained in the study.

Schools selected agreed to (1) participate for four years, (2) allow on-site observations for quality control of the consistency of implementation of the experiment, (3) participate in some extra testing and data collection, and (4) allow random assignment of students and teachers to the three class types. All sites had to have space for the total number of class treatments and have at least 57 students enrolled in kindergarten, since the minimum size of the three class types was 13 for the S class type and 22 for the R and RA class types.

Some very small schools were excluded from the study, but this was necessary for the random assignment of teachers and the "within school" research design which assured that all the class types were present in every Project STAR school. These design features helped to control for individual teacher effects and certain school variables such as school leadership, curriculum, textbook adoptions, expenditures, and others The average annual student enrollment over the four years of Project STAR for the 76 schools which remained in the study ranged from 328 for the smallest school to 1070 for the largest school. See Appendix B for information on student enrollment in the 76 schools.

The state paid for additional teachers and teacher aides for the study during 1985-89. The only intervention of the Project STAR experiment was class type. The existing school district policies and practices were followed. Thus, no student as a result

of Project STAR received fewer services or less of anything normally offered by public schools in the participating districts.

The student was the primary unit of data collection, but the class (i.e. class average) was the unit of analysis since this was a study of class-type effect. This method of analysis recognized that each student was not an independent measure since the teacher and classmates influence the classroom learning environment. Using the class as a unit of analysis and the "within school" design provided for a conservative measure of the effect of class type on student achievement.

The measurements of student achievement used in Project STAR were the Stanford Achievement Test (SAT) and Tennessee's Basic Skills First (BSF) test. The norm-referenced SAT covered reading, mathematics, spelling, listening, and in the higher grades science and social science, and provided subscores for both reading and mathematics. The criterion-referenced BSF test covered reading and mathematics objectives of the curriculum taught in Tennessee schools (Word et al., 1990). The measurement of student achievement used in the Lasting Benefits Study was the Tennessee Comprehensive Assessment Program (TCAP) which included both the Comprehensive Test of Basic Skills (CTBS/4) published by CTB/McGraw Hill, the norm-referenced component, and a criterion-referenced test component customized to assess skill levels learned from the state's mathematics and language arts curriculum (B. Nye et al., 1992 & 1993).

Two key research design decisions were made in the Project STAR class-type experiment. One was the random assignment of both teachers and students, and the

second was to have a "within school" design as mentioned earlier. The control group design was Campbell and Stanley (1963) design number 6, a randomized experiment employing the post-test analysis only. The primary analysis was built on the post-test only design with additional analysis employing other analytic models (Word et al., 1990).

A multivariate analysis was used to determine the effect of the S, R, and RA class types on achievement scores. The interaction of class type and school location (inner-city, urban, suburban and rural) was also investigated. Details are available on the entire study in the Project STAR final technical report available from the Tennessee Department of Education (Word et al., 1990).

Scaled score means for the three Project STAR class types were compared through multivariate analysis of variance (MANOVA) for unequal *n*'s using the MULTIVARIANCE program (Finn & Bock, 1984). The analysis examined the mean differences among the class types, the mean differences among the four school geographic locations, and the interaction between class types and locations. Achievement scores for various sub-tests were compared separately. Scores from both the Stanford Achievement Test or SAT (norm-referenced) and the Tennessee Basic Skills First or BSF test (criterion-referenced) were analyzed at each grade level.

The major achievement results for Project STAR students appear in Appendix A, Table A-1 of this study (Word et al., 1990). Essentially students in S class type did statistically significantly better ($p \leq .01$ or better) than did students in the R and RA class types. The class-type effect was found to be significant equally in all geographic

locations (inner-city, urban, suburban and rural) and favored the S class type condition during all grade levels from kindergarten through third grade.

The most significant gains were made by students in first grade and there was a positive class-type benefit in achievement gains for minority students in small classes at all grade levels (Word et al., 1990). Indeed, minority students outperformed their peers in the other two class conditions. See Appendix A, Table A-2 for more detail of the analysis of the Project STAR results for minority students.

The Project STAR study demonstrated a powerful influence of class type based on the statistical significance of the difference in gain on standardized tests between class types. It addressed educational significance by presenting the "effect size," a measure which shows how much the statistically significant gain was relative to the standard deviation of scores. Effect sizes ranged from .08 in kindergarten to .40 in third grade for minority students in the small class-type treatment. The effect sizes for students in the S class type were in the .20 to .27 range, demonstrating moderately strong effects of class type on student achievement for all types of students and in all types of school locations (Achilles et al., 1993; B. Nye et al., 1992).

CHAPTER III

METHODOLOGY

I. INTRODUCTION

In this exploratory study, the researcher analyzed the effect of school size and the interaction of school size and class type on student achievement in reading and mathematics in grades K through 3. For this study the researcher used the large, extant database from the Project STAR class-type experiment (Word et al., 1990) to examine the effect of school size. Project STAR employed the random assignment of both teachers and students to one of three class types: small (S), regular (R), and regular with aide (RA), and utilized a "within school" design to control for such factors as textbook selection, quality of teacher, principal effectiveness, expenditures and other school-level factors. The class-type experiment also employed a control group design; it was a randomized experiment which employed post-test only analysis and other statistical treatment. This exploratory study of school size was confined to the extant database, therefore, the quality of Project STAR research design and database influenced the quality of this study.

II. STUDY DESIGN AND STATISTICAL PROCEDURES

The design for this exploratory study of school size called for additional analysis of the extant database. To determine if the typical school-size effect reported in the research literature (e.g., Haller et al., 1990; Fowler & Walberg, 1991; Fowler, 1992) is present in the Project STAR database, a pilot study was completed as step one. Using the

test-score class means for reading and mathematics test scores on the Stanford Achievement Test (SAT) and the Basic Skills First (BSF) test of first grade students in the R class type and for grades K through 3 students for all three class types combined, a statistical test for correlation was completed following a Wilks-Shapiro test for equal variances.

The Pearson product-moment correlation ($p \leq .05$) was applied to the first grade, R class type test scores of all 76 schools remaining in the database at the end of the Project STAR study to look for a relationship between the test-score class means for reading and mathematics and school size based on enrollment. For the analysis of the R class type, the test-score class means of all the R class types with 21 or fewer students were deleted. This criterion provides an analysis of school-size effect in the Project STAR schools without the class-type interventions of the S and RA class types and eliminates any classes that fall out of the range of the teacher-student ratio as defined in Project STAR for the R class type.

Next, the correlation was applied to grades K through 3 for all three class types combined. For this analysis of all the class types combined, the test-score class means of all the R and RA class types with 21 students or fewer and the S class type with 18 students or greater were deleted. A Signs test to determine any statistical significance in the direction of the correlations across several test scores and grade levels was also applied. This pilot step in determining any school-size effect was important as most prior research on school-size effects has dealt with student populations other than the early elementary grades.

The pilot study findings are displayed in Appendix C, Tables C-1 and C-2. The negative correlations shown in these tables between student academic achievement as measured by standardized tests and school size support the findings of a detrimental effect of large school size on student achievement reported in the literature (Haller et al., 1990; Fowler & Walberg, 1991; Fowler, 1992). While the correlations are negative, the magnitude is in the small to medium range (Cohen, 1988) and are not statistically significant for all subjects or grade levels. However, the overall negative direction of the correlations across grades K through 3 is statistically significant (13 of 14 negative, Signs test $p \leq .005$). These findings suggested the need for further study of the effect of school size and the interaction between school size and class type on student achievement using the entire Project STAR database to see if a school-size effect exists for all grade levels and whether it is the same or differs by class type.

In step two of the study design, the 76 schools remaining in the database were divided into largest schools in enrollment size (>670 students) and smallest schools in enrollment size (<470 students). The division of schools in this manner provided sample sizes of n=18 schools for the largest schools group and n=17 schools for the smallest schools group which approximate the upper and lower quartile of school size in the Project STAR database while maintaining at least a 200 student enrollment difference. See tables in Appendix B for information on school-size and class-type enrollments for these and the other Project STAR schools. The t-test for independent samples ($p \leq .10$) and the Signs test ($p \leq .10$) to determine any statistical significance in the direction of the differences were used to compare the difference between the test-score class means of

reading and mathematics for the first grade, R class type in the 18 largest schools and in the 17 smallest schools. The .10 level of statistical significance for the t-tests and the Signs test were used to avoid a type II error of underestimating any genuine difference due to the small "*n*" provided by reducing the number of schools for this aspect of the study design.

Step three of the study design involved repeating the same analysis procedures for step one and step two using the test-score class means for reading and the test-score class means for mathematics for the first grade, S class type. For the analysis of the S class type, the test-score class means of all the S class types with 18 or more students were deleted as these classes fall out of the range of the teacher-student ratio defined in Project STAR for the S class type. See Appendix B, Tables B-3 through B-21 for further information on class-type enrollments in the schools studied.

Step four of the study design involved repeating the same analysis procedures of step one and step two on test data for the first grade, RA class type. The analysis followed the same decision rule for the number of students enrolled in individual classes as in the analysis of the R class type.

In the fifth step of the study design, the analysis procedures were repeated for the S, R, and RA class types for grades K, 2, and 3 as done for first grade in the pilot study and in steps two, three, and four of the study design. The analysis for each class type was repeated separately for each of the other grade levels to determine if the Project STAR database continued to reflect at each grade level the findings from prior research

and in the literature and from the pilot study about the detrimental effect of larger school size on student achievement.

Following the analysis of all three class types for grades K through 3 for the correlation between the test-score class means and school size, and analyzing the sample of the largest and smallest schools for differences in the test-score class means, the t-test for independent samples and the Signs test for direction were applied to matched pairs of large and small schools in the Project STAR database. Schools from the largest schools and smallest schools groups were matched based upon comparable student socioeconomic status (SES), race, and gender characteristics. See Appendix B, Tables B-24 and B-25 for specific information on the matched pairs of schools.

In the sixth step of the study design, the same criteria of class enrollments for the R class type and for the S class type were followed. The same decision for class enrollments was maintained for the RA class type as for the R class type. This step of the analysis was conducted for each year (grades K through 3) of the available Project STAR test data to determine if any negative correlation of school size with student achievement on test scores produced differences in test-score class means for any of the class types when controlling for variables such as student SES, race, and gender. Additional analyses were conducted in step six as necessary using other appropriate statistical procedures to add to the basic correlation, t-test, and Signs test analyses.

Based on the results of the analyses from steps one through six of the study design, further analyses was conducted to explore interactions between school size and

class type to see if class type ameliorates the negative effect of school size on student achievement as measured by test scores.

Student SES is a variable that has been shown to have an effect on achievement tests scores when studying school size (Friedkin & Neocochea, 1988). The study design with regard to the interaction of school size and class type controlled for student SES through the Project STAR random assignment of students to class type and the "within school" design of the class-type experiment (Word et al., 1990). In addition, the last step of the study design provided for a matching of schools based on SES, race and grades.

Statistical significance for this study on school size was set at $p \leq .05$ for correlations of the entire Project STAR database and reported at the $p \leq .10$ for t-tests and Signs tests due to the small "*n*" of schools and classes created by the study design.

III. RESEARCH QUESTIONS

Questions:

1. Does the Project STAR database contain the school-size effect on student achievement reported in the literature and prior research?
2. What is the effect of small school size (student enrollment <470) and large school size (student enrollment >670) on student achievement in reading for grades K through 3?

3. What is the effect of small school size (student enrollment <470) and large school size (student enrollment >670) on student achievement in mathematics for grades K through 3?

4. What is the effect of the interaction of class type based on average teacher-student ratio (small 1:15, regular 1:25, and regular with aide 1:25) with school size on student achievement in reading for grades K through 3 if school size is shown to have an effect on student achievement?

5. What is the effect of the interaction of class type based on average teacher-student ratio (small 1:15, regular 1:25, and regular with aide 1:25) with school size on student achievement in mathematics for grades K through 3 if school size is shown to have an effect on student achievement?

CHAPTER IV

DATA ANALYSIS

I. INTRODUCTION

The purpose of this study was to analyze student achievement in grades K through 3 to determine if there is a school-size effect on achievement in reading and mathematics, and if so, whether the school-size effect differs across three class types: S=small, R=regular, and RA=regular with aide, to which students had been assigned. The database from Project STAR, a statewide, longitudinal study of the effect of class type, based on teacher-student ratio, on student achievement in 79 Tennessee public elementary schools during 1985-89, was examined. At the end of the longitudinal study 76 schools remained in the Project STAR database. These 76 schools were included in the study of school-size effect and the interaction of the school-size effect with each of three class-type effects.

This study of school size consisted of several steps employing correlation, t-test and the Signs test to determine any effect of school size and the interaction of school size and class type on student achievement in reading and mathematics. The class was used as the unit of analysis for both the school-size and class-type effects. The study limited the use of test-score class means to those classes with enrollments in the range of Project STAR defined teacher-student ratios (S class type $\leq$17; R and RA class types $\geq$22). The Project STAR study found the S class-type intervention has a positive, statistically significant ($p \leq .001$) and educationally important effect (ES=.22 to .44) over

the "typical" school situation represented by the R class type and the "typical" class-type intervention represented by the RA class type (Word et al., 1990). See Appendix A for the design and major student achievement results of the Project STAR study.

The results of this study of school-size effect are reported in response to the research questions which generated them. The discussion of the statistical treatment of the test score data is divided into two sections. The first section deals with the results which correspond to the school-size effects reported in the literature and prior research. A correlation of school size with the test-score class means of grades K through 3 for the three class types and a Signs test to determine any statistically significant direction in the correlations were used to assess whether an effect of school size on student achievement is evident in the Project STAR database, as expected from prior school-size research.

The second section discusses the results of further analysis to determine the effect of large school size and small school size on student achievement in reading and mathematics for grades K through 3. A t-test of the differences in test-score class means and a Signs test to determine any statistically significant direction of the differences for the test-score class means for each of the three class types for the largest schools and the smallest schools in the Project STAR database were used to assess the effect of school size on student achievement. First, the 18 largest schools and the 17 smallest schools in the database were analyzed Then matched pairs from these two groups of schools provided a set of the 12 large schools and the 12 small schools with comparable student SES, race and gender characteristics which were analyzed. Within these two groups of matched schools there were two subgroups of matched schools identified. These two

subgroups included five large inner-city schools and five small inner-city schools, and five large rural schools and five small rural schools which were analyzed separately.

The second section also discusses the results of analysis to determine the interaction of school-size effect with class-type effect on student achievement in reading and mathematics for grades K through 3. A t-test of differences in test-score class means of the largest schools and the smallest schools among and between the three class types at grades K through 3 and a Signs test to determine any statistically significant direction of the differences for test-score class means were used to assess the interaction of class type and school size on student achievement.

II. STATISTICAL TREATMENT OF RESULTS

CORRELATION RESULTS

The Pearson product-moment correlation and the Signs test of direction were applied to the test-score class means of the three class types: S=small, R=regular and RA=regular with aide, at each grade level for grades K through 3 to determine if the typical school-size effect reported in the research literature is present in the Project STAR database. These statistical tests were applied in several steps as described in Chapter III, Methodology, including a pilot study of grade 1, to R class type test scores and grades K through 3 test-score class means of all three class types combined. See Appendix C, Tables C-1 and C-2, for pilot study findings.

The pilot study found negative correlations between test-score class means of the R class type and school size for grade 1, and between the test-score class means of all

three class types combined and school size for grades K through 3. These results from the pilot study indicated the need for further study of school-size effect and the interaction of school-size effect with each of three class-type effects using the entire Project STAR database.

Table 1 presents the correlations and the Signs test of direction for the test-score class means in reading and mathematics for the S class type (≤17 students) and school enrollment in grades K through 3.

Table 1: Correlation Between Test-score Class Means of Small Class Type and School Enrollment

		SAT		BSF	
Grade	*n*[a]	Reading	Mathematics	Reading	Mathematics
K	127	.1134	.0575	---	---
1	114	.0176	-.0611	.0877	-.0638
2	124	-.1218	-.1196	-.0892	-.1902*
3	119	-.1138	-.1175	-.0994	-.1847*

Note. Signs test: 10 of 14 negative correlations, not statistically significant. SAT=Stanford Achievement Test. BSF=Basic Skills First test. BSF not administered in kindergarten.

[a]*n*=number of class means with enrollment ≤17.

*p≤.05.

The negative correlations in Table 1 are in the small range of magnitude (Cohen, 1988). The negative correlations are statistically significant for BSF mathematics in both grade 2 (p≤.05) and grade 3 (p≤.05). The correlations for grades K through 3 between the S class type test scores and school enrollment are negative for ten of 14 tests. Using the Signs test to determine any statistical significance in the direction of the correlations, the number of negative correlations between test-score class means of the S

class type and school enrollment for grades K through 3 is not statistically significant (NS). However, in kindergarten and grade 1 the correlations are positive in two of six tests, while in grade 2 and grade 3 the correlations are negative in all eight tests. The number of negative correlations for these two grade levels between test-score class means of the S class type and school enrollment is statistically significant (eight of eight, Signs test $p \leq .05$). For the mathematics tests in grades K through 3 the number of negative correlations is not statistically significant (six of seven, Signs test NS), but the two negative correlations which are statistically significant occur in mathematics.

These results indicate that there is a negative correlation for student achievement in reading and mathematics with large school size in grade 2 and grade 3 for the S class type. The correlations for student achievement in reading and mathematics with large school size in grades K through 3 become negative the longer students are in school and as they progress to higher grade levels even with a positive class-type intervention represented by the S class type. The negative correlation for student achievement with large school size is greatest for mathematics at grade 2 and grade 3.

Table 2 presents the correlations and the Signs test of direction for the test-score class means in reading and mathematics for the R class type ($\geq$22 students) and school enrollment in grades K through 3.

The negative correlations in Table 2 are in the small to medium range of magnitude (Cohen, 1988). The negative correlations are statistically significant for SAT mathematics in grade 1 ($p \leq .05$) and BSF mathematics in grade 1 ($p \leq .01$). The correlations for grades K through 3 between the R class type test scores and school

Table 2: Correlation Between Test-score Class Means of Regular Class Type and School Enrollment

		SAT		BSF	
Grade	n^a	Reading	Mathematics	Reading	Mathematics
K	66	.1079	-.0509	---	---
1	79	-.1609	-.2609*	-.2179	-.3014**
2	86	-.1409	-.1717	-.0343	.0201
3	65	-.1157	-.0980	-.1295	-.2042

Note. Signs test: 12 of 14 negative correlations, $p \leq .05$. SAT=Stanford Achievement Test. BSF=Basic Skills First test. BSF not administered in kindergarten.

[a]*n*=number of class means with enrollment ≥22.

*$p \leq .05$. **$p \leq .01$.

enrollment are negative for 12 of 14 tests. Using the Signs test to determine statistical significance in the direction of the correlations, the number of negative correlations between test-score class means of the R class type and school enrollment for grades K through 3 is statistically significant ($p \leq .05$).

These results indicate a negative correlation for student achievement in reading and mathematics with large school size in grades K through 3 for the "typical" school situation represented by the R class type. The negative correlation for student achievement with large school size is greatest for mathematics at grade 1.

Table 3 presents the correlations and the Signs test of direction for the test-score class means in reading and mathematics for the RA class type (≥22 students) and school enrollment in grades K through 3.

The negative correlations in Table 3 are in the small range of magnitude (Cohen, 1988). The negative correlation for SAT reading in grade 2 is statistically significant ($p \leq .05$). The correlations for grades K through 3 between RA class type test

Table 3: Correlation Between Test-score Class Means of Regular with Aide Class Type and School Enrollment

		SAT		BSF	
Grade	n^a	Reading	Mathematics	Reading	Mathematics
K	71	-.0694	-.1817	---	---
1	73	-.2143	-.1039	-.0008	-.0736
2	90	-.2365*	-.1952	-.1436	-.1406
3	83	-.0824	-.0119	-.0237	-.0528

Note. Signs test: 14 of 14 negative correlations, $p \leq .0001$. SAT=Stanford Achievement Test. BSF=Basic Skills First test. BSF not administered in kindergarten.

[a]n=number of class means with enrollment ≥ 22.

*$p \leq .05$.

scores and school enrollment are negative for 14 of 14 tests. Using the Signs test to determine any statistical significance in the direction of the correlations, the number of negative correlations between test-score class means of the RA class type and school enrollment for grades K through 3 is statistically significant (Signs test $p \leq .0001$).

These results indicate a negative correlation for student achievement in reading and mathematics with large school size in grades K through 3 for the "typical" school class-type intervention represented by the RA class type. The negative correlation for student achievement with large school size is greatest for reading in grade 2.

The three tables of correlation (Tables 1, 2 and 3) indicate that the negative correlation for student achievement with large school size is somewhat greater for the RA class type (14 of 14 negative correlations, Signs test $p \leq .0001$) than for the R class type (12 of 14 negative correlations, Signs test $p \leq .05$) or the S class type (ten of 14 negative correlations, Signs test NS). The negative correlations are greatest for the R class type at grade 1 in mathematics. The two negative correlations for the R class type in grade 1

mathematics are statistically significant ($p \leq .01$) and in the small to medium range of magnitude (Cohen, 1988). The negative correlation for student achievement with large school size is somewhat more prevalent for mathematics than reading when considering all three class types together. Four of the five negative correlations that are statistically significant are in mathematics. The number of negative correlations for student achievement with large school size is greater in the higher grades. All 12 of the correlations in grade 3 for reading and mathematics with school size across the three class types are negative (Signs test $p \leq .005$), while 11 of 12 of the correlations for reading and mathematics in grade 2 are negative (Signs test $p \leq .01$), and ten of 12 of the correlations for reading and mathematics in grade 1 are negative (Signs test $p \leq .05$). In kindergarten, where only the SAT tests were administered, three of six correlations for test scores class means for reading and mathematics with school size across the three class types are negative (Signs test NS).

Table 4 presents the correlations of test-score class means in reading and mathematics for all three class types combined and school enrollment in grades K through 3 for the four school locations.

Project STAR found that the positive effect of small class type, based on teacher-student ratio, on student achievement occurred across all school locations (Word et al., 1990). See Appendix C, Tables C-3 through C-6 for the results of correlations and Signs test of test-score class means in reading and mathematics for the three class types and school enrollment in grades K through 3 for each of the four school locations (inner-city, suburban, rural and urban) using the entire Project STAR database. The definitions

Table 4: Correlation Between Test-score Class Means of the Three Class Types Combined and School Enrollment by Location

		SAT		BSF	
Grade	n^a	Reading	Mathematics	Reading	Mathematics
		Inner-city			
K	59	.0804	-.0243	---	---
1	55	.0203	-.1340	.0448	-.0498
2	67	-.0470	-.0810	.0991	.0192
3	47	-.1111	-.1514	-.1882	-.4160**
		Suburban			
K	62	.2884*	.2183	---	---
1	58	.1005	-.0070	.1621	-.0314
2	74	-.1177	-.1724	-.0999	-.1715
3	65	-.0709	-.0738	.0788	.0427
		Rural			
K	122	.0102	-.0722	---	---
1	125	-.0231	-.0803	-.0834	-.1590
2	135	.0237	.0765	-.0060	.0135
3	131	.0394	.0883	.0362	.0375
		Urban			
K	21	.5743**	.3686	---	---
1	28	.3853*	.4372*	.2444	.2001
2	24	.2701	.1186	.1396	-.0279
3	24	-.0076	.1231	-.0817	.1187

Note. SAT=Stanford Achievement Test. BSF=Basic Skills First test. BSF not administered in kindergarten.

[a]*n*=number of class means with enrollment $\leq$17 for the S class type and $\geq$22 for the R and RA class types enrollment $\geq$22.

*p$\leq$.05. **p$\leq$.01.

of these school locations for the Project STAR study are included in Appendix A. These correlation results from the entire database suggest some differences in the effect of school size on student achievement which is associated with school location.

T-TEST AND THE SIGNS TEST RESULTS

Following the correlations test, a t-test and the Signs test of direction for the difference were applied to the test-score class means of the largest schools in enrollment

(>670 students) and the smallest schools in enrollment (<470 students) in the Project STAR database. The division of schools in the database using this enrollment criterion provided sample sizes of n=18 schools for the largest schools group and n=17 schools for the smallest schools group. The number of schools in these two samples approximates the upper and lower quartiles of school size in the database while maintaining at least a 200 student enrollment difference between the two samples. Schools in the Project STAR database ranged from 329 to 1070 students in average enrollment for the four years of the study. See Appendix B, Table B-1, for further information on school size enrollment for the Project STAR schools. The range of enrollment for the 18 largest schools group of this school size study is 675 to 1070 students and for the 17 smallest schools group is 329 to 466 students. See Appendix B, Tables B-2, B-22 and B-23 for school size enrollment and other student information on the 18 largest schools and the 17 smallest schools (18 versus 17 group) in the database.

Table 5 presents the t-test and the Signs test of direction for the difference in the test-score class means of reading and mathematics for the S class type ($\leq$17 students) for the 18 largest schools and the 17 smallest schools.

The test-score class means for the S class type show nine of 14 negative differences between the 18 versus 17 group. Using the Signs test to determine any statistical significance in the direction of the differences, the number of negative differences is not statistically significant (NS). The positive difference in SAT reading for grade 1 is statistically significant for the t-test ($p \leq .10$) with an effect size of .49. This significant positive difference in test-score class means between the 18 versus 17 group is

Table 5: Difference in Test-score Class Means of Small Class Type for the 18 Largest Schools and the 17 Smallest Schools

Grade	n[a]	Reading M	Reading SD	Mathematics M	Mathematics SD
		SAT			
K					
Large	38	442.4	20.5	490.1	29.4
Small	22	436.3	18.8	485.2	31.2
		+6.1		+4.9	
1					
Large	36	529.1	32.8	534.0	26.2
Small	17	513.1	30.0	530.6	27.0
		+16.0*[1]		+3.4	
2					
Large	38	585.1	28.2	579.9	25.9
Small	24	590.9	22.8	588.6	24.1
		-5.8		-8.7	
3					
Large	33	620.1	22.3	620.2	22.0
Small	26	622.5	20.3	625.1	21.9
		-2.4		-4.9	
		BSF			
K					
Large	38	---	---	---	---
Small	22	---	---	---	---
1					
Large	36	28.0	2.5	39.6	2.9
Small	17	27.0	2.9	39.8	2.8
		+1.0		-.2	
2					
Large	38	39.8	3.1	52.2	3.5
Small	24	40.6	3.4	54.4	2.7
		-.8		-2.2*[2]	
3					
Large	32	32.8	3.1	50.6	4.9
Small	26	33.1	3.2	52.5	3.6
		-.3		-1.9*[3]	

Note. Signs test: 9 of 14 negative differences, not statistically significant. SAT=Stanford Achievement Test. BSF=Basic Skills First test. BSF not administered in kindergarten.

[a]n=number of class means with enrollment $\leq$17.

*[1]$p \leq .10$ based on t-test; t=1.70, df=51. *[2]$p \leq .05$ based on t-test; t=-2.53, df=60. *[3]$p \leq .10$ based on t-test; t=-1.66, df=56.

one of five positive differences in SAT and BSF tests at the kindergarten and grade 1 levels (five of six, Signs test NS). However, all differences in the test-score class means between the 18 versus 17 group are negative for grade 2 and grade 3. The number of negative differences at these two grade levels is statistically significant (eight of eight, Signs test $p \leq .05$). The negative differences in BSF mathematics at grade 2 and grade 3 are statistically significant for the t-test ($p \leq .05$ and $p \leq .10$) with effect sizes of .63 and .39.

Although these results for the 18 versus 17 group in the database, like the correlation results reported earlier for the S class type in the entire Project STAR database, indicate that the effect of large school size on student achievement in reading and mathematics is not statistically significant for grades K through 3 in the S class type, the number of negative differences become statistically significant (Signs test $p \leq .05$) the longer students are in school and as they progress to higher grade levels, even with the positive class-type intervention represented by the S class type. Students in the S class type in grade 2 and grade 3 of a small school do better than students in the S class type for the same grades in a large school, particularly in mathematics. Students in the S class type in kindergarten and grade 1 of a large school tend to do better than students in the S class type for the same grades in a small school size, particularly in reading.

Table 6 presents the t-test and the Signs test of direction for the difference in the test-score class means of reading and mathematics for the R class type ($\geq$22 students) for the 18 largest schools and the 17 smallest schools.

The test-score class means for the R class type show nine of 14 negative differences between the 18 versus 17 group. Using the Signs test to determine any

Table 6: Difference in Test-score Class Means of Regular Class Type for the 18 Largest Schools and the 17 Smallest Schools

Grade	n^a	Reading M	Reading SD	Mathematics M	Mathematics SD
		SAT			
K					
Large	20	438.2	23.0	483.3	37.1
Small	9	433.0	19.3	489.3	32.7
		+5.2		-6.0	
1					
Large	24	499.0	30.0	514.0	27.0
Small	13	501.0	29.5	522.1	26.4
		-2.0		-8.1	
2					
Large	33	571.6	25.3	570.1	25.3
Small	13	573.0	22.7	574.2	20.4
		-1.4		-4.1	
3					
Large	23	607.9	21.7	610.0	23.5
Small	6	603.6	18.3	605.2	19.2
		+4.3		+4.8	
		BSF			
K					
Large	20	---	---	---	---
Small	9	---	---	---	---
1					
Large	24	24.2	3.1	36.5	3.5
Small	13	25.1	3.8	38.2	2.8
		-.9		-1.7	
2					
Large	33	37.8	4.6	51.1	3.7
Small	13	37.2	4.6	49.6	3.9
		+.6		+1.5	
3					
Large	24	31.5	3.3	48.4	5.2
Small	6	31.6	1.9	49.7	2.9
		-.1		-1.3	

Note Signs test: 9 of 14 negative differences, not statistically significant. SAT=Stanford Achievement Test. BSF=Basic Skills First test. BSF not administered in kindergarten.

[a]n=number of class means with enrollment $\geq$22.

statistical significance in the direction of the differences, the number of negative differences is not statistically significant (NS). The pattern of negative and positive differences is mixed for the various grade levels and for reading and mathematics. Five of six differences are negative at the kindergarten and grade 1 levels for the R class type, but this is not statistically significant (Signs test NS). The differences are evenly split between positive and negative for grade 2 and grade 3 (four of eight, Signs test NS). Reading has four of seven negative differences and mathematics has five of seven negative differences, but neither of these number of differences is statistically significant (Signs test NS). No differences in test-score class means for grades K through 3 are statistically significant for the t-test.

Although the correlation results reported earlier for the entire Project STAR database indicate a negative effect of large school size on student achievement in reading and mathematics for the "typical" school situation represented by the R class type in grades K through 3, results of the t-test and the Signs test on the differences in test-score class means of large and small schools do not support that conclusion within the 18 versus 17 group from the database when the *n* is lower.

Table 7 presents the t-test and the Signs test of direction for the difference in the test-score class means of reading and mathematics for the RA class type ($\geq$22 students) for the 18 largest schools and the 17 smallest schools.

The test-score class means for the RA class type show 12 of 13 negative differences and one tie between the 18 versus 17 group. Using the Signs test to determine any statistical significance in the direction of the differences, the number of negative

Table 7: Difference in Test-score Class Means of Regular with Aide Class Type for the 18 Largest Schools and the 17 Smallest Schools

Grade	n^a	Reading M	Reading SD	Mathematics M	Mathematics SD
		SAT			
K					
Large	25	434.2	21.3	474.0	30.2
Small	9	438.5	24.9	488.3	43.5
		-4.3		-14.3	
1					
Large	21	510.5	30.6	523.2	26.2
Small	15	527.8	28.3	530.9	24.3
		-17.3*		-7.7	
2					
Large	32	575.9	23.9	571.2	22.2
Small	15	581.1	22.6	578.1	25.2
		-5.2		-6.9	
3					
Large	28	612.8	15.8	614.6	17.8
Small	15	612.9	18.3	613.9	25.9
		-.1		+.7	
		BSF			
K					
Large	25	---	---	---	---
Small	9	---	---	---	---
1					
Large	21	25.9	2.6	38.0	3.1
Small	15	25.9	2.4	38.9	2.7
		0		-.9	
2					
Large	32	38.2	4.2	51.4	4.3
Small	15	38.8	4.0	52.4	2.5
		-.6		-1.0	
3					
Large	28	32.2	2.6	49.8	4.0
Small	15	32.0	2.7	50.1	3.9
		+.2		-.3	

Note. Signs test: 12 of 13 negative differences and 1 tie, $p \leq .005$. SAT=Stanford Achievement Test. BSF=Basic Skills First test. BSF not administered in kindergarten.

[a]n=number of class means with enrollment ≥ 22.

*$p \leq .10$ based on t-test; t=-1.73, df=34.

differences is statistically significant (Signs test $p \leq .05$). All of the differences are negative for grades K through 2 (ten of ten, $p \leq .01$). Six of seven differences are negative for both reading and mathematics, but this number of differences is not statistically significant (NS). The negative difference in SAT reading for grade 1 is statistically significant for the t-test ($p \leq .10$) with an effect size of .57. The only positive differences are in the SAT mathematics at grade 3 and BSF reading at grade 3. Both of these small differences are not statistically significant for the t-test (NS).

These results, like the correlation results reported earlier for the entire Project STAR database, indicate a negative effect of large school size on student achievement in reading and mathematics in grades K through 3 for the "typical" school class-type intervention represented by the RA class type. However, any advantage for students in the RA class type for kindergarten, grade 1 and grade 2 in the smaller schools over those students in the RA class type in the larger schools appears to narrow by grade 3.

Table 8 summarizes the significance for the t-test and the sign for difference between the test-score class means for the three class types in the 18 largest schools and the 17 smallest schools.

A Signs test shows the negative effect of large school size as greater on the RA class type (12 of 14 negative differences, Signs test $p \leq .05$) than on the S and R class types (each with nine of 14 negative differences, Signs test NS). The total negative differences across the three class types is statistically significant (30 of 42, Signs test $p \leq .01$) with 16 of 21 negative differences for mathematics across the three class types

Table 8: Significance and Sign for Difference in Test-score Class Means of the Same Class Type in the 18 Largest Schools and the 17 Smallest Schools

	SAT		BSF	
Grade	Reading	Mathematics	Reading	Mathematics
		Small class type		
K	NS (+)	NS (+)	---	---
1	.10 (+)	NS (+)	NS (+)	NS (-)
2	NS (-)	NS (-)	NS (-)	.05 (-)
3	NS (-)	NS (-)	NS (-)	.10 (-)
		Regular class type		
K	NS (+)	NS (-)	---	---
1	NS (-)	NS (-)	NS (-)	NS (-)
2	NS (-)	NS (-)	NS (+)	NS (+)
3	NS (+)	NS (+)	NS (-)	NS (-)
		Regular with aide class type		
K	NS (-)	NS (-)	---	---
1	.10 (-)	NS (-)	NS (-)	NS (-)
2	NS (-)	NS (-)	NS (-)	NS (-)
3	NS (-)	NS (+)	NS (+)	NS (-)

Note. Signs test: 30 of 42 negative differences, $p \leq .01$. SAT=Stanford Achievement Test. BSF=Basic Skills First test. BSF not administered in kindergarten. NS=not statistically significant.

(Signs test $p \leq .05$). The total negative differences across the three class types for reading is 14 of 21 (Signs test NS).

The Project STAR study examined class-type effect over a four year period of time. The longitudinal study showed that students in the S class type did statistically better ($p \leq .05$ or better) than did students in the R or RA class types. See Appendix A for major student achievement results from the Project STAR study. The test-score class

means of the S class type are the highest of the three class types for both the 18 largest schools (14 of 14) and the 17 smallest schools (ten of 14) from the Project STAR database. The test-score class means of the RA class type are the second highest most often for both the largest schools (12 of 14) and the smallest schools (11 of 14). See Appendix C, Table C-7 for a summary of the test-score class means for the three class types in the 18 versus 17 group in the Project STAR database.

Table 9 presents a summary of the significance for the t-test and the sign for difference between the test-score class means for combinations of the S class type with the R and RA class types for the 18 largest schools and the 17 smallest schools.

The positive differences between the test-score class means of the S class type versus the test-score class means of the R and RA class types in reading and mathematics are statistically significant (t-test) for many grade levels in both the 18 largest schools and the 17 smallest schools. The number of positive differences is also statistically significant for three of the four comparisons (14 of 14 and 14 of 14 positive differences, Signs test $p \leq .0001$; and 13 of 14 positive differences, Signs test $p < .005$) and approaches statistical significance on the fourth comparison (10 of 14 positive differences, Signs test NS). See Appendix C, Tables C-31 through C-34, for the t-test and the Signs test results for these comparisons.

Although the results as shown in Table 9 are not statistically significant (t-test) for every grade level and subject area, they support the Project STAR study findings of a statistically significant positive effect on student achievement by the S class type. The t-test results show that for small schools the statistically significant positive effect on

Table 9: Significance and Sign for Difference in Test-score Class Means Between the Small Class Type and the Regular and Regular with Aide Class Types in the 18 Largest and 17 Smallest Schools

	SAT		BSF	
Grade	Reading	Mathematics	Reading	Mathematics
LS/S vs. LS/R				
K	NS (+)	NS (+)	---	---
1	.001 (+)	.01 (+)	.001 (+)	.001 (+)
2	.05 (+)	NS (+)	.05 (+)	NS (+)
3	.05 (+)	.10 (+)	NS (+)	.10 (+)
LS/S vs. LS/RA				
K	NS (+)	.05 (+)	---	---
1	.05 (+)	NS (+)	.005 (+)	.05 (+)
2	NS (+)	NS (+)	.10 (+)	NS (+)
3	NS (+)	NS (+)	NS (+)	NS (+)
SS/S vs. SS/R				
K	NS (+)	NS (-)	---	---
1	NS (+)	NS (+)	NS (+)	NS (+)
2	.05 (+)	.10 (+)	.05 (+)	.001 (+)
3	.05 (+)	.05 (+)	NS (+)	.10 (+)
SS/S vs. SS/RA				
K	NS (-)	NS (-)	---	---
1	NS (-)	NS (-)	NS (+)	NS (+)
2	NS (+)	NS (+)	NS (+)	.05 (+)
3	NS (+)	NS (+)	NS (+)	.10 (+)

Note. LS=large school. SS=small school. S=small class type. R=regular class type. RA=regular with aide class type. SAT=Stanford Achievement Test. BSF=Basic Skills First test. BSF not administered in kindergarten. NS=not statistically significant.

student achievement by the S class type occurs at grade 2 and grade 3, while for the large schools the statistically significant positive effect on student achievement by the S class type occurs at all grade levels for the comparison of the S class type with the R and RA class types.

Seven of eight positive differences in the small schools at grade 2 and grade 3 between the test-score class means of the S class type versus the test-score class means of the R class type are statistically significant (t-test) and all eight of the differences are

positive (Signs test $p \leq .05$). Two of eight positive differences in the small schools at grade 2 and grade 3 between the test-score class means of the S class type versus the test-score class means of the RA class type are statistically significant (t-test) and all eight of the differences are positive (Signs test $p \leq .05$). The differences in the small schools at kindergarten and grade 1 are not statistically significant. These results suggest that small school size has a positive effect on student achievement in kindergarten and grade 1 for the R and RA class types that to some degree can compare with the positive effect of the S class type on student achievement in those same grades, particularly for the RA class type. In addition, the results show that the S class type counters the negative effect of large school size on student achievement in kindergarten and grade 1 for the R class type and in kindergarten through grade 2 for the RA class type, particularly the R and RA class types in grade 1 for both reading and mathematics.

Table 10 presents a summary of the significance from the t-test and the sign for difference between the test-score class means for other selected combinations of the three class types with school size in the 18 largest schools and the 17 smallest schools. See Appendix C, Tables C-8 through C-12, for the t-test and the Signs test results of the selected combinations.

The test-score class means for the LS/S class type versus the SS/R class type show 14 of 14 positive differences. Using the Signs test to determine any statistical significance in the direction of the differences, the number of positive differences is statistically significant ($p \leq .0001$). Five of the positive differences in test-score class means are statistically significant (t-test) with four of those five differences occurring in reading:

Table 10: Significance and Sign for Difference in Test-score Class Means Between Other Selected Combinations of Class Types in the 18 Largest Schools and the 17 Smallest Schools

	SAT		BSF	
Grade	Reading	Mathematics	Reading	Mathematics
LS/S vs. SS/R				
K	NS (+)	NS (+)	---	---
1	.01 (+)	NS (+)	.05 (+)	NS (+)
2	NS (+)	NS (+)	.10 (+)	.05 (+)
3	NS (+)	NS (+)	.10 (+)	NS (+)
LS/S vs. SS/RA				
K	NS (+)	NS (+)	---	---
1	.01 (+)	NS (+)	NS (+)	NS (+)
2	NS (+)	NS (+)	NS (+)	NS (-)
3	NS (+)	NS (+)	NS (+)	NS (+)
LS/RA vs. SS/R				
K	NS (+)	NS (-)	---	---
1	NS (+)	NS (+)	NS (+)	NS (-)
2	NS (+)	NS (-)	NS (+)	NS (+)
3	NS (+)	NS (+)	NS (+)	NS (+)
LS/RA vs. LS/R				
K	NS (-)	NS (-)	---	---
1	NS (+)	NS (+)	.05 (+)	NS (+)
2	NS (+)	NS (+)	NS (+)	NS (+)
3	NS (+)	NS (+)	NS (+)	NS (+)
SS/RA vs. SS/R				
K	NS (+)	NS (-)	---	---
1	.05 (+)	NS (+)	NS (+)	NS (+)
2	NS (+)	NS (+)	NS (+)	.05 (+)
3	NS (+)	NS (+)	NS (+)	NS (+)

Note. LS=large school. SS=small school. S=small class type. R=regular class type. RA=regular with aide class type. SAT=Stanford Achievement Test. BSF=Basic Skills First test. BSF not administered in kindergarten. NS=not statistically significant.

grade 1 SAT reading, $p \leq .01$, ES=.95; grade 1 BSF reading, $p \leq .05$, ES=.76; grade 2 BSF reading, $p \leq .10$, ES=.57; grade 3 SAT reading, $p \leq .10$, ES=.90; and grade 2 BSF mathematics, $p \leq .05$, ES=.66. The results are similar for the test-score class means of LS/S class type versus SS/RA class type. The results for this combination show 13 of 14 positive differences. The number of positive differences is statistically significant (Signs

test $p \leq .005$). One of the positive differences in test-score class means is statistically significant (t-test): grade 1 BSF reading, $p \leq .01$, ES=.88.

These results on the t-test and the Signs test combined with the negative correlations for student achievement with large school size reported earlier for the R and RA class types indicate that the positive effect of the S class type reported by the Project STAR study counters to some degree the negative effect of large school size on student achievement in reading and mathematics. This occurs for the comparison with students in the "typical" school situation in grades K through 3 represented by the R class type or in comparison with students in the RA class type representing the "typical" school class-type intervention. The positive effect of the S class type in countering the negative effect of large school size on student achievement is somewhat greater for reading than for mathematics. The number of positive differences for reading is 14 of 14 (Signs test $p \leq .0001$) and for mathematics the number of positive differences is 13 of 14 (Signs test $p \leq .005$). Five of the six statistically significant differences between test-scores class means (t-test) are in reading.

The difference in test-score class means between the R and RA class types in the various combinations for large school size and small school size show that the test-score class means for the RA class type are higher in most cases. Most of the differences are positive between SS/RA class type versus SS/R class type (13 of 14, Signs test $p \leq .005$). Most of the differences are also positive between LS/RA class type versus LS/R class type (12 of 14, Signs test $p \leq .05$), between LS/RA versus SS/R class type (11 of 14, Signs test $p \leq .10$), and between LS/RA class type versus SS/R class type (ten of 14, Signs

test NS). The statistically significant differences (t-test) for test-score class means occur between LS/RA class type versus LS/R class type in grade 1 BSF reading ($p \leq .05$, ES=.55) and between SS/RA class type versus SS/R class type in grade 1 SAT reading ($p \leq .05$, ES=.91) and in grade 2 BSF mathematics ($p \leq .05$, ES=.72).

These results on the t-test and the Signs test combined with the negative correlations for student achievement with large school size reported earlier for the R and RA class types indicate that the RA class-type effect counters to some degree, although not as much as the S class-type effect, the negative effect of large school size on student achievement in reading and mathematics. This occurs for the comparison with students in the "typical" school situation in grades K through 3 represented by the R class type. Students in the RA class type do better than students in the R class type in both the 18 largest schools and the 17 smallest schools, particularly in reading.

Following application of the t-test and the Signs test of direction for the difference in to the test-score class means of the 18 largest schools and the 17 smallest schools, the same tests were applied to matched pairs of 12 schools (12 versus 12 group) taken from the largest school group and the smallest school group. The 12 pairs of schools were matched based upon comparable student SES, race and gender characteristics. The matching of schools from the 18 largest schools group and the 17 smallest schools group produced five inner-city, one urban, one suburban, and five rural sets of school pairs. See Appendix B, Tables B-24 and B-25 for specific information on the 12 matched pairs of schools.

Table 11 presents the t-test and the Signs test of direction for the difference in the test-score class means in reading and mathematics for the S class type ($\leq$17 students) for matched pairs of the 12 large schools and the 12 small schools.

The test-score class means for the S class type show 12 of 14 negative differences for the 12 versus 12 group. Using the Signs test to determine any statistical significance in the direction of the differences, the number of negative differences is statistically significant (Signs test $p \leq .05$). The number of negative differences for mathematics is statistically significant (seven of seven, $p \leq .10$). Two negative differences are statistically significant (t-test): grade 2 BSF mathematics, $p \leq .10$, ES=.56; and grade 3 BSF mathematics, $p \leq .10$, ES=.53. There are no differences which are statistically significant (t-test) at the kindergarten and grade 1 levels. Four of six tests at these two grade levels show negative differences between the large school and the small school test-score class means. This contrasts with the five of six positive differences in test-score class means reported earlier for the S class type at these same grade levels in the 18 versus 17 group. (See Table 15.) All of the differences in test-score class means for the 12 versus 12 group for grade 2 and grade 3 are negative (eight of eight, Signs test $p \leq .05$).

These results correspond to the correlation results for the S class type in the entire Project STAR database, and the t-test and the Signs test on the differences in the test-score class means for the S class type of the 18 versus 17 group. All of these results indicate that the effect of large school size on student achievement in reading and mathematics for grades K through 3 becomes negative the longer students are in school and as they progress to higher grade levels, even with the positive class-type intervention

Table 11: Difference in Test-score Class Means of Small Class Type for Matched Pairs of the 12 Large Schools and the 12 Small Schools

Grade	n[a]	Reading M	Reading SD	Mathematics M	Mathematics SD
		SAT			
K					
Large	24	443.9	22.0	490.5	31.8
Small	14	440.0	20.3	496.1	32.7
		+3.9		-5.6	
1					
Large	25	525.8	34.2	530.7	25.1
Small	12	513.7	34.7	534.2	29.1
		+12.1		-3.5	
2					
Large	26	582.1	23.3	577.1	23.9
Small	17	588.1	23.4	584.4	23.7
		-6.0		-7.3	
3					
Large	22	619.7	23.9	618.0	24.5
Small	19	621.5	20.4	627.3	21.5
		-1.8		-9.3	
		BSF			
K					
Large	24	---	---	---	---
Small	14	---	---	---	---
1					
Large	25	27.3	2.6	39.2	2.9
Small	12	27.5	2.9	40.0	2.9
		-.2		-.8	
2					
Large	26	39.4	2.7	52.1	3.4
Small	17	40.4	3.5	54.0	2.8
		-1.0		-1.9*	
3					
Large	22	32.4	3.3	49.9	5.5
Small	19	32.8	3.4	52.8	3.5
		-.4		-2.9**	

Note. Signs test: 12 of 14 negative differences, $p \leq .05$. SAT=Stanford Achievement Test. BSF=Basic Skills First test. BSF not administered in kindergarten.

[a]n=number of class means with enrollment ≤ 17.

*$p \leq .10$ based on t-test; t=-1.92, df=41. **$p \leq .10$ based on t-test; t=-1.97, df=38.

represented by the S class type. In this analysis of the 12 versus 12 group, students in the S class type in grade 2 and grade 3 of a small school do better than students in the S class type for the same grades in a large school, particularly in mathematics. Students in the S class type in kindergarten and grade 1 of a small school tend to do better than students in the S class type for the same grades in a large school for mathematics, while students in the S class type for the same grades in a large school tend to do better for reading.

Table 12 presents the t-test and the Signs test of direction for the difference in the test-score class means in reading and mathematics for the R class type ($\geq$22 students) for matched pairs of the 12 large schools and the 12 small schools.

The test-score class means for the R class type show seven negative differences and seven positive differences for the 12 versus 12 group. Using the Signs test to determine any statistical significance in the direction of the differences, both the number of negative differences and positive differences are not statistically significant (seven of 14, NS). There is no apparent pattern of differences for the R class type at any of the grade levels or for either reading or mathematics. No differences are statistically significant for the t-test.

The correlation results reported earlier for the entire Project STAR database indicate a negative effect of large school size on student achievement in reading and mathematics for the "typical" school situation represented by the R class type in grades K through 3 (Signs test $p \leq .05$). While these results contrast with the correlation results, they compare with the t-test and the Signs test on the differences in the test-score class means for the R class type of the 18 versus 17 group. Like those results, these results of

Table 12: Difference in Test-score Class Means of Regular Class Type for Matched Pairs of the 12 Large Schools and the 12 Small Schools

Grade	n^a	Reading M	Reading SD	Mathematics M	Mathematics SD
		SAT			
K					
Large	14	437.7	24.2	482.3	34.2
Small	5	428.1	17.1	487.9	35.8
		+9.6		-5.6	
1					
Large	17	503.4	32.4	515.9	27.1
Small	10	498.7	31.3	523.0	27.5
		+4.7		-7.1	
2					
Large	21	573.6	29.5	573.2	28.8
Small	10	575.2	25.4	577.0	22.7
		-1.6		-3.8	
3					
Large	15	611.7	23.1	613.4	24.9
Small	4	600.9	22.9	603.9	24.6
		+10.8		+9.5	
		BSF			
K					
Large	14	---	---	---	---
Small	5	---	---	---	---
1					
Large	17	23.8	3.5	36.4	3.7
Small	10	25.4	4.2	38.5	3.1
		-1.6		-2.1	
2					
Large	21	37.9	5.3	51.7	3.8
Small	10	37.2	5.2	49.8	4.3
		+.7		+1.9	
3					
Large	15	31.9	3.7	48.8	6.1
Small	4	31.0	2.1	49.4	2.9
		+.9		-.6	

Note. Signs test: 7 of 14 negative differences, not statistically significant. SAT=Stanford Achievement Test. BSF=Basic Skills First test. BSF not administered in kindergarten.

[a]n=number of class means with enrollment $\geq$22.

the t-test and the Signs test on the differences in test-score class means for the 12 versus 12 group do not support the conclusion of a negative effect of large school size for the R class type at a statistically significant level.

Table 13 presents the t-test and the Signs test of direction for the difference in the test-score class means in reading and mathematics for the RA class type ($\geq$22 students) for matched pairs of the 12 large schools and the 12 small schools.

The test-score class means for the RA class type show nine of 13 negative differences for the 12 versus 12 group. Using the Signs test to determine any statistical significance in the direction of the differences, the number of negative differences is not statistically significant (Signs test NS). Five of six differences at kindergarten and grade 1 are negative, but this number of differences is not statistically significant (Signs test NS). The number of negative differences for mathematics is statistically significant (seven of seven, Signs test $p \leq .10$). There are no differences in the reading or mathematics test-score class means that are statistically significant for the t-test.

These results, like the correlation results reported earlier for the entire Project STAR database and the t-test and the Signs test on the differences in the test-score class means for the RA class type of the 18 versus 17 group, indicate a negative effect of large school size on student achievement in mathematics in grades K through 3 for the "typical" school class-type intervention represented by the RA class type. These results do not support the same conclusion for student achievement in reading. Four of six differences with one tie in the reading test-score class means for the 12 versus 12 group are positive in

Table 13: Difference in Test-score Class Means of Regular with Aide Class Type for Matched Pairs of the 12 Large Schools and the 12 Small Schools

Grade	n^a	Reading M	Reading SD	Mathematics M	Mathematics SD
		SAT			
K					
Large	18	437.1	22.4	476.6	30.4
Small	6	442.7	29.3	495.0	53.1
		-5.6		-18.4	
1					
Large	14	517.3	29.9	528.3	27.4
Small	8	528.7	28.5	531.1	20.6
		-11.4		-2.8	
2					
Large	21	579.5	25.9	574.6	24.3
Small	10	575.8	24.2	576.9	27.4
		+3.7		-2.3	
3					
Large	18	610.3	17.5	612.2	19.5
Small	9	607.0	20.6	615.4	33.5
		+3.3		-3.2	
		BSF			
K					
Large	18	---	---	---	---
Small	6	---	---	---	---
1					
Large	14	26.2	2.6	38.3	3.5
Small	8	25.9	2.9	38.4	2.6
		+.3		-.1	
2					
Large	21	38.5	4.3	52.0	4.5
Small	10	38.1	4.7	52.1	2.6
		+.4		-.1	
3					
Large	18	31.4	2.7	49.2	4.8
Small	9	31.4	2.6	49.4	4.6
		0		-.2	

Note. Signs test: 9 of 13 negative differences and 1 tie, not statistically significant. SAT=Stanford Achievement Test. BSF=Basic Skills First test. BSF not administered in kindergarten.

[a]n=number of class means with enrollment $\geq$22.

contrast to six of seven differences for reading being negative for the 18 versus 17 group. (See Table 7.)

Table 14 presents a summary of the significance for the t-test and the sign for difference between the test-score class means for the three class types in matched pairs of the 12 large schools and the 12 small schools.

A Signs test shows the negative effect of large school size as greater on the S class type (12 of 14 negative differences, Sign test $p \leq .05$) than on the R class type (seven of 14 negative differences, Sign test NS) and the RA class type (nine of 14 negative differences, Sign test NS). The total negative differences across the three class types is statistically significant (28 of 41, Signs test $p \leq .05$) with 19 of 21 negative differences for mathematics across the three class types (Signs test $p \leq .01$). The total positive differences across the three class types for reading is 11 of 20 (Signs test NS).

The Project STAR study examined class-type effect over a four year period of time. The longitudinal study showed that students in the S class type did statistically better ($p \leq .05$ or better) than did student is the R or RA class types. See Appendix A for major student achievement results from the Project STAR study. The test-score class means of the S class type are the highest of the three class types for both the 12 large schools (12 of 14) and the 12 small schools (14 of 14). The test-score class means of the RA class type are the second highest most often for both the 12 large schools (nine of 14) and the 12 small schools (ten of 13, 1 tie). See Appendix C, Table C-13, for a summary of test-score class means for the three class types in the 12 versus 12 group from the Project STAR database.

Table 14: Significance and Sign for Difference in Test-score Class Means of the Same Class Type in Matched Pairs of the 12 Large Schools and the 12 Small Schools

	SAT		BSF	
Grade	Reading	Mathematics	Reading	Mathematics
		Small class type		
K	NS (+)	NS (-)	---	---
1	NS (+)	NS (-)	NS (-)	NS (-)
2	NS (-)	NS (-)	NS (-)	.10 (-)
3	NS (-)	NS (-)	NS (-)	.10 (-)
		Regular class type		
K	NS (+)	NS (-)	---	---
1	NS (+)	NS (-)	NS (-)	NS (-)
2	NS (-)	NS (-)	NS (+)	NS (+)
3	NS (+)	NS (+)	NS (+)	NS (-)
		Regular with aide class type		
K	NS (-)	NS (-)	---	---
1	NS (-)	NS (-)	NS (+)	NS (-)
2	NS (+)	NS (-)	NS (+)	NS (-)
3	NS (+)	NS (-)	NS (0)	NS (-)

Note. Signs test: 28 of 41 negative differences and 1 tie, $p \leq .05$. SAT=Stanford Achievement Test. BSF=Basic Skills First test. BSF not administered in kindergarten. NS=not statistically significant.

Table 15 presents a summary of the significance for the t-test and the sign for difference between the test-score class means for combinations of the S class type with the R and RA class types for matched pairs of the 12 large schools and the 12 small schools.

The positive differences between the test-score class means of the S class type versus the test-score class means of the R and RA class types in reading and mathematics are statistically significant (t-test) for several grade levels in both the 12 large schools and

Table 15: Significance and Sign for Differences in Test-score Class Means Between the Small Class Type and the Regular and Regular with Aide Class Types in Matched Pairs of the 12 Large Schools and the 12 Small Schools

	SAT		BSF	
Grade	Reading	Mathematics	Reading	Mathematics
LS/S vs. LS/R				
K	NS (+)	NS (+)	---	---
1	.05 (+)	.10 (+)	.001 (+)	.01 (+)
2	NS (+)	NS (+)	NS (+)	NS (+)
3	NS (+)	NS (+)	NS (+)	NS (+)
LS/S vs. LS/RA				
K	NS (+)	NS (+)	---	---
1	NS (+)	NS (+)	NS (+)	NS (+)
2	NS (+)	NS (+)	NS (+)	NS (+)
3	NS (+)	NS (+)	NS (+)	NS (+)
SS/S vs. SS/R				
K	NS (+)	NS (+)	---	---
1	NS (+)	NS (+)	NS (+)	NS (+)
2	NS (+)	NS (+)	.10 (+)	.01 (+)
3	.10 (+)	.10 (+)	NS (+)	.10 (+)
SS/S vs. SS/RA				
K	NS (-)	NS (+)	---	---
1	NS (-)	NS (+)	NS (+)	NS (+)
2	NS (+)	NS (+)	NS (+)	.10 (+)
3	.10 (+)	NS (+)	NS (+)	.05 (+)

Note. LS=large school. SS=small school. S=small class type. R=regular class type. RA=regular with aide class type. SAT=Stanford Achievement Test. BSF=Basic Skills First test. BSF not administered in kindergarten. NS=not statistically significant.

the 12 small schools. The number of positive differences is also statistically significant for four of four comparisons (14 of 14, 14 of 14, and 14 of 14 positive differences, Signs test $p \leq .0001$; and 12 of 14 positive differences, Signs test $p \leq .05$). See Appendix C, Tables C-35 through C-38, for the t-test and the Signs test results for these comparisons.

Although the results shown in Table 15 are not statistically significant (t-test) for every grade level and subject area, they support the Project STAR findings of a statistically significant positive effect on student achievement by the S class type The

t-test results show that for small schools the statistically significant positive effect on student achievement by the S class type occurs at grade 2 and grade 3, while for the large schools the statistically significant positive effect on student achievement by the S class type occurs only at grade 1 for the comparison of the S and R class types.

Five of eight positive differences at grade 2 and grade 3 between the test-score class means of the S class type versus the test-score class means of the R class type in small schools are statistically significant (t-test) and all eight of the differences are positive (Signs test $p \leq .05$). Three of eight positive differences in small schools at grade 2 and grade 3 between the test-score class means of the S class type versus the test-score class means of the RA class type are statistically significant (t-test) and all eight of the differences are positive (Signs test $p \leq .05$). These results suggest that small school size has a positive effect on student achievement for the R and RA class types that to some degree can compare with the positive effect of the S class type on student achievement in kindergarten and grade 1, particularly for the RA class type. In addition, the results show that the S class type counters the negative effect of large school size on student achievement in kindergarten and grade 1 for the R class type and in grades K through 3 for the RA class type, particularly the R class type in grade 1 for both reading and mathematics which represents the "typical" school situation.

Table 16 presents a summary of the significance for the t-test and the sign for difference between the test-score class means for other selected combinations of the three class types with school size in matched pairs of the 12 large schools and the 12 small

Table 16: Significance and Sign for Difference in Test-score Class Means Between Other Selected Combinations of Class Types in Matched Pairs of the 12 Large Schools and the 12 Small Schools

	SAT		BSF	
Grade	Reading	Mathematics	Reading	Mathematics
LS/S vs. SS/R				
K	NS (+)	NS (+)	---	---
1	.05 (+)	NS (+)	.10 (+)	NS (+)
2	NS (+)	NS (+)	NS (+)	.10 (+)
3	NS (+)	NS (+)	NS (+)	NS (+)
LS/S vs. SS/RA				
K	NS (+)	NS (-)	---	---
1	NS (-)	NS (-)	NS (+)	NS (+)
2	NS (+)	NS (+)	NS (+)	NS (0)
3	NS (+)	NS (+)	NS (+)	NS (+)
LS/RA vs. SS/R				
K	NS (+)	NS (-)	---	---
1	NS (+)	NS (+)	NS (+)	NS (-)
2	NS (+)	NS (-)	NS (+)	NS (+)
3	NS (+)	NS (+)	NS (+)	NS (-)
LS/RA vs. LS/R				
K	NS (-)	NS (-)	---	---
1	NS (+)	NS (+)	.05 (+)	NS (+)
2	NS (+)	NS (+)	NS (+)	NS (+)
3	NS (-)	NS (-)	NS (-)	NS (+)
SS/RA vs. SS/R				
K	NS (+)	NS (+)	---	---
1	.05 (+)	NS (+)	NS (+)	NS (-)
2	NS (+)	NS (+)	NS (+)	NS (+)
3	NS (+)	NS (+)	NS (+)	NS (+)

Note. LS=large school. SS=small school. S=small class type. RA=regular with aide class type. R=regular class type. SAT=Stanford Achievement Test. BSF=Basic Skills First test. BSF not administered in kindergarten. NS=not statistically significant.

schools. See Appendix C, Tables C-14 through C-18 for the t-test and the Signs test results for the selected combinations.

The test-score class means for the LS/S class type versus the SS/R class type show 14 of 14 positive differences. Using the Signs test to determine any statistical significance in the direction of the differences, the number of positive differences is

statistically significant (Signs test $p \leq .0001$). Four of the positive differences in test-score class means are statistically significant (t-test) with three of those four differences occurring in reading: grade 1 SAT reading, $p \leq .05$, ES=.87; grade 1 BSF reading, $p \leq .10$, ES=.73; and grade 2 BSF mathematics, $p \leq .10$, ES=.68. These results compare with the similar analysis of the test-score class means for the 18 versus 17 group where the number of positive differences is statistically significant (14 of 14, Signs test $p \leq .0001$) and five positive differences in test-score class means are statistically significant (t-test) with four of these occurring in reading.

These results for test-score class means for the LS/S class type versus SS/RA class type show ten of 13 positive differences with one tie. The number of positive differences is statistically significant (Signs test $p \leq .10$). No differences in test-score class means are statistically significant (t-test). These results compare with the similar analysis for the 18 versus 17 group where the number of positive differences is statistically significant (13 of 14, Signs test $p \leq .005$) and only one positive difference in reading is statistically significant (t-test $p \leq .01$).

These results on the t-test and the Signs test combined with the negative correlations for student achievement with large school size reported earlier for the R and RA class types, and the similar analysis for the 18 versus 17 group, indicate that the positive effect of the S class type reported by the Project STAR study counters to some degree the negative effect of large school size on student achievement in reading and mathematics. For the 12 versus 12 group, this occurs particularly for the comparison with students in the "typical" school situation in grades K through 3 represented by the R class

type. Students in the S class type also do better than those in the RA class type for the 12 versus 12 group. The number of positive differences is statistically significant (Signs test $p \leq .10$); however, no differences are statistically significant (t-test). In this analysis, the positive effect of the S class type in countering the negative effect of large school size on student achievement still remains greater for reading, as is the case in the analysis of the test-score class means for the 18 versus 17 group. The number of positive differences for reading is 13 of 14 (Signs test $p \leq .005$) and for mathematics the number of positive differences is 11 of 13 with one tie (Signs test $p \leq .05$) Two of three significant differences in test-score class means (t-test) are in reading.

The differences in test-score class means between the R and RA class types in the various combinations for large school size and small school size show the test-score class means for the RA class type are higher in most cases. Most of the differences are positive between SS/RA class type versus SS/R class type (13 of 14, Signs test $p \leq .0001$). While not statistically significant, most of the differences are positive between LS/RA class type versus LS/R class type (nine of 14, Signs test NS) and between LS/RA class type versus SS/R class type (ten of 14, Signs test NS). The statistically significant differences (t-test) for test-score class means occur between LS/RA class type versus LS/R class type in grade 1 BSF reading ($p \leq .05$, ES=.69) and between SS/RA class type versus SS/R class type in grade 1 SAT reading ($p \leq .05$, ES=.96).

These results on the t-test and the Signs test combined with the negative correlations for student achievement with large school size reported earlier for the R and RA class types indicate that the regular with aide class-type effect counters to some

degree, although not as much as the small class-type effect, the negative effect of large school size on student achievement in reading and mathematics. This occurs for the comparison with students in the "typical" school situation in grades K through 3 represented by the R class type. Students in the RA class type do better than students in the R class type in the 12 versus 12 group, particularly in reading. This result compares with a similar analysis for the 18 versus 17 group where students in the RA class type do better, particular in reading.

Following application of the t-test and the Signs test of direction for the difference in the test-score class means of the 12 versus 12 group, the same tests were applied to matched pairs of the five large inner-city schools and the five small inner-city schools (five versus five inner-city group), and then to matched pairs of the five large rural schools and the five small rural schools (five versus five rural group). The number of suburban and urban schools in the 18 largest schools group and the 17 smallest schools group provided only one matched pair for each, so the same analysis could not be conducted for those school location types.

Table 17 presents the t-test and the Signs test of direction for the difference in test-score class means in reading and mathematics for the S class type ($\leq$17 students) for matched pairs of the five large inner-city schools and the five small inner-city schools.

The test-score class means for the S class type show nine of 14 negative differences for five versus five inner-city group. Using the Signs test to determine any statistical significance in the direction of the differences, the number of negative differences is not statistically significant (NS). The negative difference in the BSF

Table 17: Difference in Test-score Class Means of Small Class Type for Matched Pairs of the Five Large Inner-city Schools and the Five Small Inner-city Schools

Grade	n^a	Reading		Mathematics	
		M	SD	M	SD
		SAT			
K					
Large	10	435.7	21.7	482.6	37.6
Small	6	432.6	20.0	485.3	38.0
		+3.1		-2.7	
1					
Large	11	501.8	15.8	516.0	23.2
Small	5	488.0	28.4	514.9	28.4
		+13.8		+1.1	
2					
Large	12	564.5	14.0	562.1	17.3
Small	6	568.0	20.5	567.6	13.3
		-3.5		-5.5	
3					
Large	8	599.7	22.2	600.5	22.0
Small	6	607.5	14.4	613.4	12.7
		-7.8		-12.9	
		BSF			
K					
Large	10	---	---	---	---
Small	6	---	---	---	---
1					
Large	11	27.1	2.6	38.9	3.2
Small	5	26.8	3.6	38.5	3.6
		+.3		+.4	
2					
Large	12	38.2	3.1	51.5	4.2
Small	6	38.3	3.4	52.9	3.2
		-.1		-1.4	
3					
Large	7	29.2	3.6	44.6	3.8
Small	6	31.9	3.5	51.1	3.8
		-2.7		-6.5*	

Note. Signs test: 9 of 14 negative differences, not statistically significant. SAT=Stanford Achievement Test. BSF=Basic Skills First test. BSF not administered in kindergarten.

[a]*n*=number of class means with enrollment $\leq$17.

*$p \leq .05$ based on t-test; t=-13.07, df=11.

mathematics for grade 3 is statistically significant for the t-test ($p \leq .05$, ES=1.71). There are no differences for kindergarten through grade 2 that are statistically significant (t-test). All of the differences in the test-score class means between the five versus five inner-city group are negative for grade 2 and grade 3. The number of negative differences at these two grade levels is statistically significant (eight of eight, $p \leq .05$). This contrasts with the five of six positive differences in test-score class means at the kindergarten and grade 1 levels (Signs test NS).

These results correspond to the correlation results reported earlier for the S class type in the entire Project STAR database, and the t-test and the Signs test of test-score class means for the S class type for the 18 versus 17 group and the 12 versus 12 group. All of these results indicate that the effect of large school size on student achievement in reading and mathematics for grades K through 3 becomes negative the longer students are in school and as they progress to higher grade levels, even with the positive class-type intervention represented by the S class type. In this analysis, students in the S class type in grade 2 and grade 3 of a small school do better than students in the S class type for the same grades in a large school, particularly in mathematics. Students in the S class type in kindergarten and grade 1 of a large school tend to do better than students in the S class type for the same grades in a small school, particularly in reading.

Table 18 presents the t-test and the Signs test of direction for the difference in the test-score class means in reading and mathematics for the R class type ($\geq$22 students) for matched pairs of the five large inner-city schools and the five small inner-city schools.

Table 18: Difference in Test-score Class Means of Regular Class Type for Matched Pairs of the Five Large Inner-city Schools and the Five Small Inner-city Schools

Grade	n^a	Reading M	Reading SD	Mathematics M	Mathematics SD
		SAT			
K					
Large	8	432.1	23.5	477.0	35.7
Small	2	416.5	19.1	480.9	70.0
		+15.6		-3.9	
1					
Large	8	478.7	12.8	493.6	12.4
Small	5	479.4	27.8	513.9	33.2
		-.7		-20.3	
2					
Large	10	548.2	15.1	555.0	25.5
Small	4	552.2	18.5	560.8	21.4
		-4.0		-5.8	
3					
Large	5	588.1	21.7	590.5	17.3
Small	3	596.8	26.1	601.8	29.7
		-8.7		-11.3	
		BSF			
K					
Large	8	---	---	---	---
Small	2	---	---	---	---
1					
Large	8	21.6	2.9	33.9	3.3
Small	5	24.5	5.3	37.0	3.2
		-2.9		-3.1	
2					
Large	10	34.3	5.4	49.9	4.2
Small	4	32.3	4.5	46.0	3.8
		+2.0		+3.9	
3					
Large	5	28.7	5.2	42.6	5.8
Small	3	30.7	2.5	48.2	2.0
		-2.0		-5.6	

Note. Signs test: 11 of 14 negative differences, $p \leq .10$. SAT=Stanford Achievement Test. BSF=Basic Skills First test. BSF not administered in kindergarten.

[a]n=number of class means with enrollment ≥ 22.

The test-score class means for the R class type show 11 of 14 negative differences for the five versus five inner-city group. Using the Signs test to determine any statistical significance in the direction of the differences, the number of negative differences is statistically significant ($p \leq .10$). The differences are all negative at grade 1 and grade 3 (eight of eight, Signs test $p \leq .05$). The number of negative differences for mathematics is six of seven, but this is not statistically significant (Signs test NS). There are no differences that are statistically significant for the t-test.

These results for the five versus five inner-city group contrast with the t-test and the Signs test results for the test-score class means of the 18 versus 17 group, and the 12 versus 12 group. Like the correlation results for the R class type, these results of the t-test and the Signs test on the test-score class means for large and small inner-city schools indicate a negative effect of large school size on student achievement. The negative correlations reported earlier for the entire Project STAR database indicate a negative effect of large school size on student achievement in reading and mathematics for the "typical" school situation in grades K through 3 represented by the R class type. In this analysis, students in the R class type of a small inner-city school do better than students in the R class type in a large inner-city school, particularly at grade 1 and grade 3 and for mathematics.

Table 19 presents the t-test and the Signs test of direction for the difference in the test-score class means in reading and mathematics for the RA class type for matched pairs of the five large inner-city schools and the five small inner-city schools.

Table 19: Difference in Test-score Class Means of Regular with Aide Class Type for Matched Pairs of the Five Large Inner-city Schools and the Five Small Inner-city Schools

Grade	n^a	Reading M	Reading SD	Mathematics M	Mathematics SD
		SAT			
K					
Large	9	432.2	22.0	471.6	26.5
Small	2	448.6	63.5	498.2	116.4
		-16.4		-26.6	
1					
Large	5	489.6	19.1	515.8	32.5
Small	2	502.6	40.7	517.0	33.5
		-13.0		-1.2	
2					
Large	9	559.0	17.6	557.8	23.0
Small	4	554.1	20.4	560.7	30.1
		+4.9		-2.9	
3					
Large	6	587.8	4.8	593.8	10.0
Small	5	593.3	9.5	597.6	17.8
		-5.5		-3.8	
		BSF			
K					
Large	9	---	---	---	---
Small	2	---	---	---	---
1					
Large	5	25.9	3.4	37.4	4.1
Small	2	21.9	2.5	34.8	2.1
		+4.0		+2.6	
2					
Large	9	36.4	5.2	50.3	6.1
Small	4	34.4	5.4	51.0	3.4
		+2.0		-.7	
3					
Large	6	28.5	1.9	43.7	2.4
Small	5	29.7	1.8	47.1	3.9
		-1.2		-3.4	

Note. Signs test: 10 of 14 negative differences, not statistically significant.
SAT=Stanford Achievement Test. BSF=Basic Skills First test. BSF not administered in kindergarten.

[a]n=number of class means with enrollment $\geq$22.

The test-score class means for the RA class type show ten of 14 negative differences between matched pairs of the five large inner-city schools and the five small inner-city schools. Using the Signs test to determine any statistical significance in the direction of the differences, the number of negative differences is not statistically significant (NS). There is no apparent pattern of differences across the grade levels for reading. All four of the differences at grade 3 are negative and the number of negative differences in mathematics is six of seven. However, this number of negative differences is not statistically significant (Signs test NS). There are no statistically significant differences for the t-test.

The negative correlations for student achievement in reading and mathematics with large school size reported earlier for the entire Project STAR database, and the t-test and the Signs test on the differences for test-score class means for the 18 versus 17 group and the 12 versus 12 group, indicate a negative effect of large school size on student achievement in mathematics in grades K through 3 for the "typical" class-type intervention represented by the RA class type. These results show a tendency in that direction, but do not support that conclusion at a statistically significant level (six of seven negative differences, Signs test NS). Like the results for the 12 versus 12 group, the results for the five versus five inner-city group do not support the conclusion of a negative effect of large school size on student achievement in reading. However, four of seven differences in test-score class means in reading for the inner-city schools are negative in contrast to the four of six positive differences with one tie for the 12 versus 12 group. (See Table 13.) In this analysis, the advantage for students in the RA class type in the small inner-city schools

over students in the RA class type in the large inner-city schools appears to narrow for grade 1 and grade 2 and then begins to expand somewhat at grade 3.

Table 20 presents a summary of significance for the t-test and the sign for difference between the test-score class means for the three class types in matched pairs of the five large inner-city schools and the five small inner-city schools.

Table 20: Significance and Sign for Difference in Test-score Class Means of the Same Class Type in Matched Pairs of the Five Large Inner-city Schools and the Five Small Inner-city Schools

	SAT		BSF	
Grade	Reading	Mathematics	Reading	Mathematics
		Small class type		
K	NS (+)	NS (-)	---	---
1	NS (+)	NS (+)	NS (+)	NS (+)
2	NS (-)	NS (-)	NS (-)	NS (-)
3	NS (-)	NS (-)	NS (-)	.01 (-)
		Regular class type		
K	NS (+)	NS (-)	---	---
1	NS (-)	NS (-)	NS (-)	NS (-)
2	NS (-)	NS (-)	NS (+)	NS (+)
3	NS (-)	NS (-)	NS (-)	NS (-)
		Regular with aide class type		
K	NS (-)	NS (-)	---	---
1	NS (-)	NS (-)	NS (+)	NS (+)
2	NS (+)	NS (-)	NS (+)	NS (-)
3	NS (-)	NS (-)	NS (-)	NS (-)

Note. Signs test: 30 of 42 negative differences, $p \leq .01$. SAT=Stanford Achievement Test. BSF=Basic Skills First test. BSF not administered in kindergarten. NS=not statistically significant

A Signs test shows the negative effect of large school size as greater on the R class type (11 of 14 negative differences, Signs test $p \leq .10$) than on the RA class type (ten of 14 negative differences, Signs test NS) and the S class type (nine of 14 negative differences, Signs test NS). The total negative differences across the three class types is statistically significant (30 of 42, $p \leq .01$) with 17 of 21 negative differences for mathematics across the three class types (Signs test $p \leq .01$). The total negative differences across the three class types for reading is 13 of 21 (Signs test NS).

The Project STAR study examined class-type effect over a four year period of time. The longitudinal study showed that students in the S class type did statistically better ($p \leq .05$ or better) than did students in the R or RA class types. See Appendix A for major student achievement results from the Project STAR study. The test-score class means of the S class type are the highest of the three class types for both the five large inner-city schools (14 of 14) and the five small inner-city schools (ten of 14). The test-score class means of the RA class type are the second highest most often for the five large inner-city schools (11 of 14) while the test-score class means of the R class type are the second highest most often for the five small inner-city schools (seven of 14). See Appendix C, Table C-19, for a summary of test-score class means for the three class types in the five versus five inner-city group.

Table 21 presents a summary of the significant for the t-test and the sign for difference between the test-score class means for combinations of the S class type with the R and RA class types for the five large inner-city schools and the five small inner-city schools.

Table 21: Significance and Sign for Differences in Test-score Class Means Between the Small Class Type and the Regular and Regular with Aide Class Types in Matched Pairs of the Five Large Inner-city Schools and the Five Small Inner-city Schools

	SAT		BSF	
Grade	Reading	Mathematics	Reading	Mathematics
LS/S vs. LS/R				
K	NS (+)	NS (+)	---	---
1	.005 (+)	.05 (+)	.001 (+)	.005 (+)
2	.05 (+)	NS (+)	.01 (+)	NS (+)
3	NS (+)	NS (+)	NS (+)	NS (+)
LS/S vs. LS/RA				
K	NS (+)	NS (+)	---	---
1	NS (+)	NS (+)	NS (+)	NS (+)
2	NS (+)	NS (+)	NS (+)	NS (+)
3	NS (+)	NS (+)	NS (+)	NS (+)
SS/S vs. SS/R				
K	NS (+)	NS (+)	---	---
1	NS (+)	NS (+)	NS (+)	NS (+)
2	NS (+)	NS (+)	.05 (+)	.05 (+)
3	NS (+)	NS (+)	NS (+)	NS (+)
SS/S vs. SS/RA				
K	NS (-)	NS (-)	---	---
1	NS (-)	NS (-)	NS (+)	NS (+)
2	NS (+)	NS (+)	NS (+)	NS (+)
3	.10 (+)	NS (+)	NS (+)	NS (+)

Note. LS=large school. SS=small school. S=small class type. R=regular class type. RA=regular with aide class type. SAT=Stanford Achievement Test. BSF=Basic Skills First test. BSF not administered in kindergarten. NS=not statistically significant.

The positive differences between the test-score class means of the S class type versus the test-score class means of the R and RA class types in reading and mathematics are statistically significant (t-test) for several grade levels in both the five large inner-city schools and the five small inner-city schools. The number of positive differences is also statistically significant for three of four comparisons (14 of 14, 15 of 14, and 14 of 14 positive differences, Signs test $p \leq .0001$) and approaches statistical significance on the

fourth comparison (10 of 14 positive differences, Signs test NS). See Appendix C, Tables C-39 through C-42, for the t-test and the Signs test results for these comparisons.

Although the results shown in Table 21 are not statistically significant (t-test) for every grade level and subject area, they support the Project STAR findings of a statistically significant positive effect on student achievement by the S class type. The t-test results show that for small inner-city schools the statistically significant effect on student achievement by the S class type occurs at grade 2 and grade 3, while for the large inner-city schools the statistically significant positive effect on student achievement by the S class type occurs primarily at grade 1 and also in grade 2 for reading for the comparison of the S and R class types.

Two of eight positive differences at grade 2 and grade 3 between the test-score class means of the S class type versus the test-score class means of the R class type in small schools are statistically significant (t-test) and all eight of the differences are positive (Signs test $p \leq .05$). One of eight positive differences at grade 2 and grade 3 between the test-score class means of the S class type versus the test-score class means of the RA class type is statistically significant (t-test) and all eight of the differences are positive (Signs test $p \leq .05$). These results suggest that small school size has a positive effect on inner-city school student achievement in the R and RA class types that to some degree can compare with the positive effect of the S class type on inner-city school student achievement in kindergarten and grade 1, particularly the RA class type. In addition, the results show that the S class type counters the negative effect of large school size on student achievement for the R and RA class types in grades K through 3, particular

the R class type in grade 1 and grade 2 and somewhat more for reading which represents the "typical" school situation.

Table 22 presents a summary of the significance for the t-test and the sign for difference between the test-score class means for other selected combinations of the three class types with school size in matched pairs of the five large inner-city schools and the five small inner-city schools. See Appendix C, Tables C-20 through C-24, for the t-test and the Signs test results for the selected combinations.

The test-score class means for the LS/S class type versus the SS/ R class type show 11 of 14 positive differences. Using the Signs test to determine any statistical significance in the direction of the differences, the number of positive differences is statistically significant (Signs test $p \leq .10$). Three of the positive differences in test-score class means are statistically significant (t-test) with two of those three differences occurring in reading: grade 1 SAT reading, $p \leq .10$, ES=.81; grade 2 BSF reading, $p \leq .01$, ES=1.31; and grade 2 BSF mathematics, $p \leq .05$, ES=1.45. These results compares with the similar analysis of the test-score class means for the 18 versus 17 group and the 12 versus 12 group where the number of positive differences are statistically significant (14 of 14 and 14 of 14, Signs test $p \leq .0001$) with five and three positive differences respectively that are statistically significant (t-test).

These results for test-score class means for the LS/S class type versus SS/RA class type show eight of 14 positive differences. The number of positive differences is not statistically significant (Signs test NS). One of the positive differences in test-score class means is statistically significant (t-test): grade 2 BSF reading, $p \leq .10$, ES=.70. These

Table 22: Significance and Sign for Difference in Test-score Class Means Between Other Selected Combinations of Class Types in Matched Pairs of the Five Large Inner-city Schools and the Five Small Inner-city Schools

	SAT		BSF	
Grade	Reading	Mathematics	Reading	Mathematics
LS/S vs. SS/R				
K	NS (+)	NS (+)	---	---
1	.10 (+)	NS (+)	NS (+)	NS (+)
2	NS (+)	NS (+)	.10 (+)	.05 (+)
3	NS (+)	NS (-)	NS (-)	NS (-)
LS/S vs. SS/RA				
K	NS (-)	NS (-)	---	---
1	NS (-)	NS (-)	NS (+)	NS (+)
2	NS (+)	NS (+)	.10 (+)	NS (+)
3	NS (+)	NS (+)	NS (-)	NS (-)
LS/RA vs. SS/R				
K	NS (+)	NS (-)	---	---
1	NS (+)	NS (+)	NS (+)	NS (+)
2	NS (+)	NS (-)	NS (+)	NS (+)
3	NS (-)	NS (-)	NS (-)	.05 (-)
LS/RA vs. LS/R				
K	NS (+)	NS (-)	---	---
1	NS (+)	NS (+)	.05 (+)	NS (+)
2	NS (+)	NS (+)	NS (+)	NS (+)
3	NS (-)	NS (+)	NS (-)	NS (+)
SS/RA vs. SS/R				
K	NS (+)	NS (+)	---	---
1	NS (+)	NS (+)	NS (-)	NS (-)
2	NS (+)	NS (-)	NS (+)	.10 (+)
3	NS (-)	NS (-)	NS (-)	NS (-)

Note. LS=large school. SS=small school. S=small class type. R=regular class type. RA=regular with aide class type. SAT=Stanford Achievement Test. BSF=Basic Skills First test. BSF not administered in kindergarten. NS=not statistically significant.

results contrast with the similar analysis for the 18 versus 17 group and the 12 versus 12 group where the number of positive differences are both statistically significant (13 of 14, Signs test $p \leq .005$ and 10 of 13 with one tie, Signs test $p \leq .10$). However, these results compare with those of the other two analyses where only one of the differences in test-score class means is statistically significant (t-test).

These results on the t-test and the Signs test combined with the negative correlations for student achievement with large school size reported earlier for the R and RA class types, and the similar analysis for the 18 versus 17 group along with the analysis of the 12 versus 12 group, indicate that the positive effect of the S class type reported by the Project STAR study counters to some degree the negative effect of large school size on student achievement in reading and mathematics. For the five versus five inner-city group, this occurs particularly for the comparison with students in the "typical" school situation in grades K through 3 represented by the R class type. Students in the S class type also do better than those in the RA class type for the five versus five inner-city group. The number of positive differences is not statistically significant and only one of the differences is statistically significant (t-test). In this analysis, the positive effect of the S class type in countering the negative effect of large school size on student achievement still remains greater for reading, as is the case in the analysis of the test-score class means for the 18 versus 17 group and the 12 versus 12 group. The number of positive differences for reading is ten of 14 (Signs test NS) and the number of positive differences for mathematics is nine of 14 (Signs test NS). Three of the four statistically significant differences (t-test) in test-score class means are in reading.

The differences in test-score class means between the R and RA class types in the various combinations for large school size and small school size show the test-score class means for the RA class type are higher in most cases. Most of the differences are positive between LS/RA class type versus LS/R class type (11 of 14, Signs test $p \leq .10$) and between LS/RA class type versus SS/R class type (eight of 14, Signs test NS). The

number of positive and negative differences for SS/RA class type versus SS/R class type is not statistically significant (seven of 14, Signs test NS). The statistically significant differences (t-test) for test-score class means are between LS/RA class type versus SS/R class type in grade 3 BSF mathematics ($p \leq .05$, ES=-.54), between LS/RA class type versus LS/R class type in grade 1 BSF reading ($p \leq .05$, ES=1.48), and between SS/RA class type versus SS/R class type in grade 2 BSF mathematics ($p \leq .10$, ES=1.32).

These results on the t-test and the Signs test combined with the negative correlations for student achievement with large school size reported earlier for both the R and RA class types indicate that the RA class-type effect counters to some degree, although not as much as the S class-type effect, the negative effect of large school size on student achievement in reading and mathematics. This occurs for the comparison with students in the "typical" school situation in grades K through 3 represented by the R class type.

These results for the SS/RA class type versus SS/R class type for the five versus five inner-city group show seven of 14 positive differences (Signs test NS) in test-score class means. This contrasts with differences for the 18 versus 17 group and the 12 versus 12 group which each showed 13 of 14 positive differences for this combination (Signs test $p \leq .005$). These results indicate that the positive effect of small school size may be greater for the inner-city schools when comparing the R and RA class types.

Table 23 presents the t-test and the Signs test of direction for the difference in the test-score class means in reading and mathematics for the S class type ($\leq$17 students) for matched pairs of the five large rural schools and the five small rural schools.

Table 23: Difference in Test-score Class Means of Small Class Type for Matched Pairs of the Five Large Rural Schools and the Five Small Rural Schools

Grade	n^a	Reading M	Reading SD	Mathematics M	Mathematics SD
		SAT			
K					
Large	9	443.1	22.7	490.5	30.7
Small	5	441.0	15.7	499.3	24.3
		+2.1		-8.8	
1					
Large	9	542.7	40.5	535.9	22.4
Small	5	520.1	21.4	538.2	14.4
		+22.6		-2.3	
2					
Large	9	597.3	21.6	594.4	25.0
Small	7	591.5	17.2	582.9	21.8
		+5.8		+11.5	
3					
Large	10	634.4	18.4	628.7	24.4
Small	9	619.2	17.3	623.1	14.7
		+15.2*		+5.6	
		BSF			
K					
Large	9	---	---	---	---
Small	5	---	---	---	---
1					
Large	9	27.1	3.3	38.9	3.3
Small	5	27.5	2.6	40.6	2.1
		-.4		-1.7	
2					
Large	9	40.6	2.0	53.2	2.8
Small	7	40.7	3.8	53.9	2.6
		-.1		-.7	
3					
Large	10	34.2	1.7	52.1	4.9
Small	9	32.2	3.1	52.3	2.8
		+2.0**		-.2	

Note. Signs test: 7 of 14 negative differences, not statistically significant. SAT=Stanford Achievement Test. BSF=Basic Skills First test. BSF not administered in kindergarten.

[a]n=number of class means with enrollment ≤ 17.

*$p \leq .10$ based on t-test; t=-1.85, df=17. **$p \leq .10$ based on t-test; t=-1.79, df=17.

The test-score class means for the S class type show seven negative differences and seven positive differences for five versus five rural group. Using the Signs test to determine any statistical significance in the direction of the differences, both the number of negative differences and the number of positive differences are not statistically significant (seven of 14 NS). There are no apparent patterns of differences in test-score class means at any of the grade levels. Two positive differences are statistically significant for the t-test: grade 3 SAT reading, $p \leq .10$, ES=.87; and grade 3 BSF reading, $p \leq .10$, ES=.65. No differences for grades K through 2 are statistically significant (t-test).

These results contrast with the correlation results reported earlier for the S class type in the entire Project STAR database, and the t-test and the Signs test of test-score class means for the 18 versus 17 group, for the 12 versus 12 group, and for the five versus five inner-city group. All of these results indicate that the effect of large school size on student achievement in reading and mathematics for grades K through 3 becomes negative the longer students are in school and as they progress to higher grade levels, even with the positive class-type intervention represented by the S class type. In those results, students in the S class type in grade 2 and grade 3 of a small school do better than students in the S class type for the same grades in a large school, particularly in mathematics. In this analysis of the five versus five rural group, students in the S class type in grade 1, grade 2 and grade 3 of a large rural school do as well or better than students in the S class type for the same grades in a small rural school, particularly in reading.

Table 24 presents the t-test and the Signs test of direction for the difference in the test-score class means in reading and mathematics for the R class type ($\geq$22 students) for matched pairs of the five large rural schools and the five small rural schools.

The test-score class means for the R class type show ten of 14 positive differences for the five versus five rural group. Using the Signs test to determine any statistical significance in the direction of the differences, the number of positive differences is not statistically significant (Signs test NS). Six of seven differences are positive for reading, but this is not statistically significant (Signs test NS). Seven of eight differences are positive for grade 2 and grade 3 which is statistically significant (Signs test $p \leq .10$). However, there is only one test-score class mean for grade 3 small schools. No differences are statistically significant for the t-test.

The negative correlations reported earlier for the entire Project STAR database indicate a negative effect of large school size on student achievement in reading and mathematics for the "typical" school situation in grades K through 3 represented by the R class type. These results for the five versus five rural group correspond with the t-test and the Signs test results for the test-score class means of the 18 versus 17 group, and the 12 versus 12 group in not concluding a negative effect of large school size on student achievement at a statistically significant level. The major difference is in the number of positive differences (ten of 14) for the five versus five rural group. This number of positive differences approaches significance on the Signs test.

The negative correlations for the entire Project STAR database and the t-test and the Signs test results for the five versus five inner-city group indicate a negative effect

Table 24: Difference in Test-score Class Means of Regular Class Type for Matched Pairs of the Five Large Rural Schools and the Five Small Rural Schools

Grade	n^a	Reading		Mathematics	
		M	SD	M	SD
		SAT			
K					
Large	4	441.8	31.6	484.7	42.3
Small	2	437.0	18.5	494.6	6.2
		+4.8		-9.9	
1					
Large	6	512.0	24.5	525.3	14.2
Small	4	510.2	15.6	525.2	14.6
		+1.8		+.1	
2					
Large	7	596.9	21.4	599.0	20.4
Small	5	587.0	16.5	589.3	19.0
		+9.9		+9.7	
3					
Large	6	625.8	15.5	629.7	24.0
Small	1	613.3	---	610.2	---
		+12.5		+19.5	
		BSF			
K					
Large	4	---	---	---	---
Small	2	---	---	---	---
1					
Large	6	24.3	2.2	37.6	2.9
Small	4	25.6	3.1	39.7	2.4
		-1.3		-2.1	
2					
Large	7	40.8	3.0	54.3	2.2
Small	5	40.2	2.2	52.0	2.6
		+.6		+2.3	
3					
Large	6	33.3	1.7	52.7	3.2
Small	1	31.8	---	53.0	---
		+1.5		-.3	

Note. Signs test: 10 of 14 positive differences, not statistically significant.
SAT=Stanford Achievement Test. BSF=Basic Skills First test. BSF not administered in kindergarten.

[a]n=number of class means with enrollment $\geq$22.

of large school size on student achievement in reading and mathematics for the "typical" school situation in grades K through 3 represented by the R class type. These results for the five versus five rural group contrast with those results, particularly at grade 2 and grade 3 where large school size has a positive effect (seven of eight positive differences, Signs test $p \leq .10$). The negative effect of large school size is not supported at a statistically significant level for the five versus five rural group in the database. In this analysis, students in the R class type of a large rural school tend to do better than students in the R class type of a small rural school, particular in reading.

Table 25 presents the t-test and the Signs test of direction for the difference in the test-score class means in reading and mathematics for the RA class type for matched pairs of the five large rural schools and the five small rural schools.

The test-score class means for the RA class type show ten of 14 negative differences for the five versus five rural group. Using the Signs test to determine any statistical significance in the direction of the differences, the number of negative differences is not statistically significant (NS). All four of the differences at grade 3 are negative and the number of negative differences for grade 2 and grade 3 is six of eight. However, these numbers of differences are not statistically significant (Signs test NS) No differences are statistically significant (t-test).

The negative correlations for student achievement with large school size reported earlier for the entire Project STAR database, and the t-test and the Signs test on the differences for test-score class means for the 18 versus 17 group and for the 12 versus 12 group, indicate a negative effect of large school size on student achievement in

Table 25: Difference in Test-score Class Means of Regular with Aide Class Type for Matched Pairs of the Five Large Rural Schools and the Five Small Rural Schools

Grade	n^a	Reading		Mathematics	
		M	SD	M	SD
		SAT			
K					
Large	7	441.2	26.5	477.2	38.7
Small	2	442.8	1.2	501.5	8.8
		-.6		-24.3	
1					
Large	5	529.3	31.1	532.8	30.9
Small	4	526.7	3.8	531.2	10.0
		+2.6		+1.6	
2					
Large	8	596.0	18.4	588.7	15.1
Small	5	590.7	14.7	590.4	21.9
		+5.3		-1.7	
3					
Large	8	622.9	7.4	623.7	18.8
Small	3	623.5	21.6	640.1	43.5
		-.6		-16.4	
		BSF			
K					
Large	7	---	---	---	---
Small	2	---	---	---	---
1					
Large	5	26.4	3.0	37.7	3.9
Small	4	26.8	.5	39.4	.7
		-.4		-1.7	
2					
Large	8	40.3	3.2	53.9	2.7
Small	5	41.1	2.0	53.3	1.7
		-.8		+.6	
3					
Large	8	33.1	1.9	52.0	3.2
Small	3	33.6	2.2	53.0	4.5
		-.5		-1.0	

Note. Signs test: 10 of 14 negative differences, not statistically significant. SAT=Stanford Achievement Test. BSF=Basic Skills First test. BSF not administered in kindergarten.

[a]*n*=number of class means with enrollment ≥22.

mathematics in grades K through 3 for the "typical" class-type intervention represented by the RA class type. Like the results for the 12 versus 12 group and the five versus five inner-city group, the results for the five versus five rural group do not support the conclusion of a negative effect of large school size on student achievement in reading for the RA class type. In this analysis, there appears to be no advantage for students in the RA class type in the small rural schools over students in the RA class type in the large rural schools.

Table 26 presents a summary of significance for the t-test and the sign of differences between test-score class means for the three class types in matched pairs of the five large rural schools and the five small rural schools.

A Signs test shows no statistically significant effect of large school size on the R class type (ten of 14 positive differences, NS). The S class type differences are evenly split between negative and positive (seven of 14, Signs test NS) and the RA class type has ten of 14 negative differences (Signs test NS). The total number of positive differences across the three class types is not statistically significant (22 of 42, NS). The 12 of 21 negative differences for mathematics and the 13 of 21 positive differences for reading across the three class types are not statistically significant (Signs test NS).

The Project STAR study examined class-type effect over a four year period of time. The longitudinal study showed that students in the S class type did statistically better ($p \leq .05$ or better) than did student is the R or RA class types. See Appendix A for major student achievement results from the Project STAR study. The test-score class means of the S class type are the highest of the three class types for the five large rural

Table 26: Significance and Sign for Difference in Test-score Class Means of the Same Class Type in Matched Pairs of the Five Large Rural Schools and the Five Small Rural Schools

	SAT		BSF	
Grade	Reading	Mathematics	Reading	Mathematics
		Small class type		
K	NS (+)	NS (-)	---	---
1	NS (+)	NS (-)	NS (-)	NS (-)
2	NS (+)	NS (+)	NS (-)	NS (-)
3	.10 (+)	NS (+)	.10 (+)	NS (-)
		Regular class type		
K	NS (+)	NS (-)	---	---
1	NS (+)	NS (+)	NS (-)	NS (-)
2	NS (+)	NS (+)	NS (+)	NS (+)
3	NS (+)	NS (+)	NS (+)	NS (-)
		Regular with aide class type		
K	NS (-)	NS (+)	---	---
1	NS (+)	NS (+)	NS (-)	NS (-)
2	NS (+)	NS (-)	NS (-)	NS (+)
3	NS (-)	NS (-)	NS (-)	NS (-)

Note. Signs test: 22 of 42 positive differences, not statistically significant. SAT=Stanford Achievement Test. BSF=Basic Skills First test. BSF not administered in kindergarten. NS=not statistically significant.

schools (nine of 14). The RA class type is the highest of the three class types for the five small rural schools (nine of 14). The test-score class means of the S class type are the second highest most often for the five small rural schools (seven of 14), while the test-score class means of both the R and RA class types are the second highest most often for the five large rural schools (five of 14). See Appendix C, Table C-25, for a summary of

test-score class means for the three class types in matched pairs of the five versus five rural group.

Table 27 presents a summary of the significant for the t-test and the sign for difference between the test-score class means for combinations of the S class type with the R and RA class types for the five large rural schools and the five small rural schools.

The positive differences between the test-score class means of the S class type versus the R and RA class types are statistically significant or approach statistical significance on the Signs test for the five large rural schools (nine of 14 positive differences, NS; 13 of 14 positive differences, $p \leq .005$). The positive or negative differences between the test-score class means of the S versus the R and RA class types for the five small rural schools are also statistically significant or approach statistical significance (12 of 14 positive differences, Signs test $p \leq .05$; nine of 14 negative differences, Signs test NS). See Appendix C, Tables C-43 through C-46 for t-test and the Signs test results for these comparisons.

Although the results shown in Table 27 are not statistically significant (t-test) for every grade level and subject area, they support the Project STAR findings of a statistically significant positive effect on student achievement by the S class type compared to the RA class type in large rural schools and to the R class type in small rural schools. They do not support the findings at a statistically significant level for the comparison of the S class type to the R class type in large rural schools and to the RA class type in the small rural schools.

Table 27: Significance and Sign for Differences in Test-score Class Means Between the Small Class Type and the Regular and Regular with Aide Class Types in Matched Pairs of the Five Large and Five Small Rural Schools

	SAT		BSF	
Grade	Reading	Mathematics	Reading	Mathematics
LS/S vs. LS/R				
K	NS (+)	NS (+)	---	---
1	NS (+)	NS (+)	.10 (+)	NS (+)
2	NS (+)	NS (-)	NS (-)	NS (-)
3	NS (+)	NS (-)	NS (+)	NS (-)
LS/S vs. LS/RA				
K	NS (+)	NS (+)	---	---
1	NS (+)	NS (+)	NS (+)	NS (+)
2	NS (+)	NS (+)	NS (+)	NS (-)
3	NS (+)	NS (+)	NS (+)	NS (+)
SS/S vs. SS/R				
K	NS (+)	NS (+)	---	---
1	NS (+)	NS (+)	NS (+)	NS (+)
2	NS (+)	NS (-)	NS (+)	NS (+)
3	NS (+)	NS (+)	NS (+)	NS (-)
SS/S vs. SS/RA				
K	NS (-)	NS (-)	---	---
1	NS (-)	NS (+)	NS (+)	NS (+)
2	NS (+)	NS (-)	NS (-)	NS (+)
3	NS (-)	NS (-)	NS (-)	NS (-)

Note. LS=large school. SS=small school. S=small class type. R=regular class type. RA=regular with aide class type. SAT=Stanford Achievement Test. BSF=Basic Skills First test. BSF not administered in kindergarten. NS=not statistically significant.

These results suggest that the small school size has a positive effect on rural school student achievement that to some degree can compare with the positive effect of the S class type on student achievement in grades K through 3 when compared to the RA class type. The negative effect of large school size on the "typical" school situation represented by the R class type is not evident in this analysis when comparing the R class type in a large rural school to the S class type. The students in the RA class type tend to do better in the small rural school when compared to the S class type.

Table 28 presents a summary of the significance for the t-test and the sign for difference between the test-score class means for other selected combinations of the three class types with school size in the five large rural schools and the five small rural schools. See Appendix C, Tables C-21 through C-25, for t-test and the Signs test results of the selected combinations.

The test-score class means for the LS/S class type versus the SS/R class type show 12 of 14 positive differences. Using the Signs test to determine any statistical significance in the direction of the differences, the number of positive differences is statistically significant ($p \leq .05$). No positive differences are statistically significant (t-test). This result compares with the similar analysis of the 18 versus 17 group, the 12 versus 12 group, and the five versus five inner-city group where the number of positive differences are statistically significant (14 of 14 and 14 of 14, Signs test $p \leq .0001$ and 11 of 14, Signs test $p \leq .10$).

These results for test-score class means for the LS/S class type versus SS/RA class type show eight of 14 positive differences. Using the Signs test, the number of positive differences is not statistically significant (NS). No positive differences in test-score class means are statistically significant (t-test). These results compare with the similar analysis of the five versus five inner-city group where the number of positive differences are not statistically significant (eight of 14, Signs test NS). These results contrast with the similar analysis of the 18 versus 17 group and the 12 versus 12 group where the number of positive differences are both statistically significant (13 of 14, Signs test $p \leq .005$ and ten of 13, Signs test $p \leq .10$). Likewise, these results contrast with all three

Table 28: Significance and Sign for Difference in Test-score Class Means Between Other Selected Combinations of Class Types in Matched Pairs of the Five Large Rural Schools and the Five Small Rural Schools

	SAT		BSF	
Grade	Reading	Mathematics	Reading	Mathematics
LS/S vs. SS/R				
K	NS (+)	NS (-)	---	---
1	NS (+)	NS (+)	NS (+)	NS (+)
2	NS (+)	NS (+)	NS (+)	NS (+)
3	NS (+)	NS (+)	NS (+)	NS (-)
LS/S vs. SS/RA				
K	NS (+)	NS (-)	---	---
1	NS (+)	NS (+)	NS (+)	NS (-)
2	NS (+)	NS (+)	NS (-)	NS (-)
3	NS (+)	NS (-)	NS (+)	NS (-)
LS/RA vs. SS/R				
K	NS (+)	NS (-)	---	---
1	NS (+)	NS (+)	NS (+)	NS (-)
2	NS (+)	NS (-)	NS (+)	NS (+)
3	NS (+)	NS (+)	NS (+)	NS (-)
LS/RA vs. LS/R				
K	NS (-)	NS (-)	---	---
1	NS (+)	NS (+)	NS (+)	NS (+)
2	NS (-)	NS (-)	NS (-)	NS (-)
3	NS (-)	NS (-)	NS (-)	NS (-)
SS/RA vs. SS/R				
K	NS (+)	NS (+)	---	---
1	NS (+)	NS (+)	NS (+)	NS (-)
2	NS (+)	NS (+)	NS (+)	NS (+)
3	NS (+)	NS (+)	NS (+)	NS (+)

Note. LS=large school. SS=small school. S=small class type. R=regular class type. RA=regular with aide class type. SAT=Stanford Achievement Test. BSF=Basic Skills First test. BSF not administered in kindergarten. NS=not statistically significant.

of the similar analyses where each had one of the differences in test-score class means which is statistically significant (t-test).

These results on the t-test and the Signs test combined with the negative correlations for student achievement with larger schools-size reported earlier for the R and RA class types, and the similar analysis for the 18 versus 17 group long with the analysis

of the 12 versus 12 group and the five versus five inner-city group, indicate that the positive effect of the S class type reported by the Project STAR study counters to some degree the negative effect of large school size on student achievement in reading and mathematics. For the five versus five rural group, this occurs particularly for the comparison with students in the "typical" school situation in grades K through 3 represented by the R class type. Students in the S class type also do better than those in the RA class type for the five versus five rural group. However, the number of positive differences between S class type and RA class type is not statistically significant and no differences are statistically significant (t-test). In this analysis of the positive effect of the S class type in countering the negative effect of large school size on student achievement, the positive effect still remains greater for reading, as was the case in the analysis of the test-score class means for the 18 versus 17 group along with the 12 versus 12 group and the five versus five inner-city group . In fact, for rural schools there is a significant difference. The number of positive differences for reading is statistically significant (13 of 14, Signs test $p \leq .005$), while for mathematics the number of positive differences is not statistically significant (seven of 14, Signs test NS). No differences for test-score class means are statistically significant (t-test).

The difference in test-score class means between the R and RA class types in the various combinations for large school size and small school size show that the test-score class means for the RA class type are higher in many cases except in large school size. Most of the differences are positive between LS/RA class type versus SS/ R class type (ten of 14, Signs test NS) and there is a statistically significant number of positive

differences between SS/RA class type versus SS/R class type (13 of 14, Signs test $p \leq .005$). The number of negative differences for LS/RA class type versus LS/R class type is not statistically significant (ten of 14, Signs test NS); however, this represents a large change from the small school comparison of the R and RA class types. No differences for test-score class means for any of the class-type combinations for large school size and small school size are statistically significant (t-test).

These results on the Signs test combined with the negative correlations for student achievement with large school size reported earlier for both the R and RA class types indicate that the RA class-type effect does not counter the negative effect of large school size on student achievement in reading and mathematics as does the S class type. In fact, the R class type does better, although not statistically significant, in the large school size for rural schools. These results compare somewhat with the differences for the 12 versus 12 group, and contrast with the results for the 18 versus 17 group and the five versus five inner-city group. These results indicate a positive effect for the RA class type compared to the R class type in small rural schools and a positive effect of school size for the R class type compared with the RA class type in large rural schools.

OVERVIEW OF RESULTS

The above section of Chapter IV, beginning on page 48, details the statistical treatment of results from this study of school-size effect and the interaction of school size and class type on student achievement in reading and mathematics. As indicated in the introduction to this chapter, the study involved several steps in the analysis of data from the extant database. Table 29 presents the overview of school size and class type

comparisons used to analyze the differences in test-score class means for the various large school and small school groups defined in this study.

Table 29: Overview of School Size and Class Type Comparisons in the Study

Class type comparison	School size comparison		
	LS	SS	LS vs. SS
S, R & RA	—	—	LS vs. SS
S vs. S	—	—	LS/S vs. SS/S
R vs. R	—	—	LS/R vs. SS/R
RA vs. RA	—	—	LS/RA vs. SS/RA
S vs. R	LS/S vs. LS/R	SS/S vs. SS/R	LS/S vs. SS/R
S vs. RA	LS/S vs. LS/RA	SS/S vs. SS/RA	LS/S vs. SS/RA
RA vs. R	LS/RA vs. LS/R	SS/RA vs. SS/R	LS/RA vs. SS/R

Note: S=small class type (≤17), R=regular class type (≥22), RA=regular with aide class type (≥22), LS=large school (>670), SS=small school (<470)

By using the school-size and class-type comparisons shown above, a number of statistically significant differences in test-score class means were found at various grade levels for reading and mathematics within the four different groups of large and small schools. Additional significant results were found when determining any statistically significant direction (Signs test) of the differences for the test-score class means for each of the three class types within the school groups. Table 30 presents the summary of the Signs test of differences in test-score class means by class type for all the school group comparisons in this study.

Table 30: Summary of Signs Test of Differences in Test Score Class Means of the School Group Comparisons for Grades K through 3

	18 large	17 small	18 vs. 17	12 large	12 small	12 vs. 12	5 large inner-city	5 small inner-city	5 vs. 5 inner-city	5 large rural	5 small rural	5 vs. 5 rural
S, R & RA	—	—	.01(-)*1	—	—	.05(-)*2	—	—	.01(-)*2	—	—	NS(+)
S vs. S	—	—	NS(-)*3	—	—	.05(-)*3	—	—	NS(-)*3	—	—	NS(0)
R vs. R	—	—	NS(-)	—	—	NS(0)	—	—	.10(-)*4	—	—	NS(+)*5
RA vs. RA	—	—	005(-)	—	—	NS(-)*1	—	—	NS(-)	—	—	NS(-)
S vs. R	.0001(+)	.005(+)	.0001(+)	.0001(+)	.0001(+)	.0001(+)	.0001(+)	.0001(+)	.10(+)	NS(+)	.05(+)	.05(+)
S vs. RA	.0001(+)	NS(+)	.005(+)	.0001(+)	.05(+)	.10(+)	.0001(+)	NS(+)	NS(+)	.005(+)	NS(-)	NS(+)
RA vs. R	.05(+)	.005(+)	.10(+)	NS(+)	.005(+)	NS(+)	.10(+)	NS(0)	NS(+)	NS(-)	.005(+)	NS(+)

Note: S=small class type (≤17), R=regular class type (≥22), RA=regular with aide class type (≥22); large school >670, small school <470.

*1mathematics p≤.05(-). *2mathematics p≤.01(-). *3grades 2 & 3 p≤.05(-). *4grades 1 & 3 p≤.05(-). *5grades 2 & 3 p≤.10(+).

CHAPTER V

SUMMARY, CONCLUSIONS, RECOMMENDATIONS AND DISCUSSION

I. SUMMARY

The problem investigated in this study concerned the effect of school size on student achievement in reading and mathematics for grades K through 3, and the differences in the effect of school size on student achievement across three class types: small (S), regular (R), and regular with aide (RA). The Pearson product-moment correlation, t-test, and Signs test were applied to the test-score class means on the Stanford Achievement Test (SAT) and Basic Skills First (BSF) test for reading and mathematics of students from 76 schools. The test scores of students that were used are part of an extant database from a statewide, longitudinal study of the effect of class type on student achievement (Project STAR) conducted in 79 Tennessee elementary schools during 1985-89. At the end of the longitudinal study 76 schools remained in the database.

The test-score class means used for this study of school size were limited to classes from the 76 schools remaining in the database with enrollment $\leq$17 for the S class type and $\geq$22 for the R and the RA class types. These enrollment criteria were applied to ensure that only test scores from classes which met the three class-type definitions were used. In addition to investigating the entire extant database of the 76 schools, several comparison groups of large and small schools in the database were studied.

The comparison groups of schools in this study included the 18 largest schools and the 17 smallest schools (18 versus 17 group), matched pairs of 12 large schools and

12 small schools (12 versus 12 group), matched pairs of five large inner-city schools and five small inner-city schools (five versus five inner-city group), and matched pairs of five large rural schools and five small rural schools (five versus five rural group) in the database. The schools in these comparison groups had student enrollments of <470 for the small schools and >670 for the large schools. The following questions were examined and are presented accompanied by a summary of the findings from the analysis of data for the study.

Does the Project STAR database contain the school-size effect on student achievement reported in the literature and prior research?

The findings of this study showed a negative relationship between school size and student achievement in grades K through 3. The application of the Pearson product-moment correlation and the Signs test to determine any statistically significant direction in the correlations between the test-score class means of grades K through 3 and school enrollment for the three class types combined from the entire Project STAR database showed negative correlations for large school size with student achievement in reading and mathematics, as measured by standardized test scores (Signs test $p \leq .005$, see Table C-2). One-half of the individual negative correlations were statistically significant at either the $p \leq .05$ or $p \leq .01$ levels, with most of these occurring in mathematics.

In analyzing each of the three class types separately, a large number of negative correlations for large school size with student achievement in reading and mathematics was also evident. The number of negative correlations was statistically significant for the "typical" school situation represented by the R class type in grades K

through 3 (Signs test $p \leq .05$, see Table 2), for the "typical" class-type intervention represented by the RA class type in grades K through 3 (Signs test $p \leq .0001$, see Table 3), and for the S class type intervention in grade 2 and grade 3 (Signs test $p \leq .05$, see Table 1). All of the individual negative correlations were in the small to medium range of magnitude (Cohen, 1988) with some of the negative correlations being statistically significant at the $p \leq .05$ or $p \leq .01$ levels.

The number of negative correlations for large school size with test-score class means in grades K through 3 was largest for the RA class type (14 of 14, Signs test $p \leq .0001$, see Table 3) and the negative correlation with the greatest magnitude was in mathematics for the R class type in grade 1 and was statistically significant at the $p \leq .01$ level (see Table 2). The number of negative correlations for large school size with student achievement was slightly larger for mathematics than for reading (19 versus 17) across the three class types. The correlations were consistently negative for both reading and mathematics in grade 2 and grade 3 across the three class types (23 of 24, Signs test $p \leq .0001$, see Tables 1, 2 and 3).

When test-score class means of the three class types were combined, the number of negative correlations for large school size with test-score class means was larger for schools located in inner-city and suburban areas, particularly for mathematics in grades K through grade 3 of inner-city schools, and for mathematics in grade 1, grade 2 and grade 3 and reading in grade 2 and grade 3 of suburban schools (see Table 4). The negative correlations for both reading and mathematics of inner-city schools also increased in magnitude by grade 3.

When the three class types were combined, there was little correlation, either negative or positive, for large school size with test-score class means for schools located in rural areas (see Table 4). Positive correlations for large school size with test-score class means occurred for schools located in urban areas in grades K through 2. However, the positive correlations decreased and became slightly negative for reading in grade 3 and decreased in magnitude as well for mathematics.

What is the effect of small school size and large school size on student achievement in reading and mathematics for grades K through 3?

To analyze the extant database further, a sub-sample of large schools (enrollment >670) and small schools (enrollment <470) was identified. The negative effect of large school size in terms of the direction of difference in test-score class means of reading and mathematics was statistically significant across the three class types combined for the 18 versus 17 group (Signs test $p \leq .01$, see Table 8), the 12 versus 12 group (Signs test $p \leq .05$, see Table 14), and the five versus five inner-city group of schools (Signs test $p \leq .01$, see Table 20) in the sub-sample.

When mathematics was taken by itself, the negative effect of large school size in terms of the direction of difference in test-score class means was statistically significant for the 18 versus 17 group (Signs test $p \leq .05$, see Table 8), the 12 versus 12 group (Signs test $p \leq .01$, see Table 14), and the five versus five inner-city group of schools (Signs test $p \leq .01$, see Table 20). There was no statistical significance for reading in terms of the direction of difference in test-score class means for any of these three groups. Likewise, there was no statistically significant effect in terms of the direction of difference in test-

score class means across the three class types combined for the five versus five rural group of schools (Signs test NS, see Table 26) in the sub-sample.

There was a trend toward a positive effect of large rural school size that approached significance. The trend toward a positive effect was greater for the R class type with reading showing the most positive differences (see Table 24), while there was a trend toward a negative effect of large rural school size that approached significance for the RA class type (see Table 25). There was also a slight trend toward a positive effect of large rural school size for the S class type in reading, which in grade 3 became statistically significant (see Table 23).

The S class type test-score class means for reading and mathematics were the highest of the three class types in the large rural schools. The RA class type test-score class means were the highest of the three class types for the small rural schools with the S class type test-score class means being second highest (see Table C-25).

The negative effect of large school size in terms of the direction of difference in test-score class means was greatest for the RA class type in the 18 versus 17 group (Signs test $p \leq .005$, see Table 7), the S class type in the 12 versus 12 group (Signs test $p \leq .05$, see Table 11), and the R class type in the five versus five inner-city group of schools (Signs test $p \leq .10$, see Table 18). There was only a trend toward a negative effect for the RA class type in the five versus five rural group of schools (Signs test NS, see Table 25).

What is the effect of the interaction of class type with school size on student achievement in reading and mathematics for grades K through 3?

The negative effect of large school size on the S class type in terms of the direction of the difference in test-score class means was statistically significant (Signs test $p \leq .05$, see Tables 5, 11 and 17) in grade 2 and grade 3 for all of the large school and the small school group comparisons of this study except the five versus five rural group of schools. In the rural school group there was a trend for the S class type to do better in the larger schools than in the smaller schools, but the direction was not statistically significant (Signs test NS, see Table 23). In all the group comparisons, the trend toward a negative effect of large school size for the S class type in grades K through 3 occurred particularly in mathematics. In the rural school group the trend was for the S class type to do better in reading in the larger schools, but again the direction was not statistically significant.

For the R class type in large schools, the direction of the difference in test-score class means of reading and mathematics was not statistically significant (Signs test) in grades K through 3 for three of the four large school and small school group comparisons. The five versus five inner-city group showed that the R class type did better in the small inner-city schools (Signs test $p \leq .10$, see Table 18).

For the RA class type in large schools, the negative direction of the difference in test-score class means of reading and mathematics was statistically significant for the 18 versus 17 group (Signs test $p \leq .05$, see Table 7). The other three groups of schools, the 12 versus 12 group, the five versus five inner-city group, and the five versus five rural group, showed a trend toward a negative difference in test-score class means between large schools and small schools which approached statistical significance

The S class type had the highest test-score class means overall of the three class types for reading and mathematics for both large schools and small schools in all four of the large school and small school group comparisons, except for small schools in the five versus five rural group (see Tables C-7, C-13, C-19, and C-25). In the small rural schools, the RA class type had the highest test-score class means and the S class type had the second highest. The RA class type had the second highest test-score class means overall in reading and mathematics for both large schools and small schools in all four of the large school and small school comparisons except for the five versus five rural group. In the five versus five rural group, the RA class type tied for second with the R class type in the large schools and, as noted above, was the highest for the small schools.

When comparing the direction of the differences in test-score class means of the three class types, small school size had a positive effect on the R and the RA class types, particularly in kindergarten and grade 1. The positive effect of small school size on these two class types compared with the positive effect of the S class type in the 18 versus 17 group, the 12 versus 12 group, and the five versus five inner-city group (see Tables 9, 15, and 21). In rural schools, small school size did not have the same effect on the R and RA class types (see Table 27). In kindergarten and grade 1 there was no apparent school-size effect direction, while in grade 2 and grade 3 large school size showed a positive effect direction which was statistically significant for the R class type (Signs test $p \leq .10$, see Table 24) and the negative effect direction of large school size on the RA class type at these same grades approached significance (Signs test NS, see Table 25).

The S class type countered the negative effect of large school size when the test-score class means were compared to the R and the RA class types in grades K through 3 for the large school and small school comparisons, except for the five versus five rural group where there was a trend toward a positive effect of larger schools on the R class type which contrasted with a trend toward a negative effect on the RA class type. However, in the case of the rural school group the S class type still has the highest test-score class means of the three class types.

In the 18 versus 17 group, the S class type countered the trend toward a negative effect of larger schools in grades K through 3 for the R class type and for the RA class type. This occurred for both reading and mathematics and was somewhat greater for reading (see Table 9). In the 12 versus 12 group, the S class type countered the trend toward a negative effect of larger schools for the R class type in kindergarten and grade 1 and for the RA class type in grades K through 3. This occurred particularly for the R class type in grade 1 for both reading and mathematics (see Table 15). In the five versus five inner-city group, the S class type countered the negative effect of larger schools in grades K through 3 for the R and the RA class types, particularly for the R class type in grade 1 and grade 2 and somewhat more for reading than mathematics (see Table 21). In the five versus five rural group, the S class type countered the trend toward a negative effect of larger schools in grades K through 3 for the RA class type (see Table 27).

The RA class type countered to some degree the negative effect of large school size when the test-score class means were compared to the R class type in grades K through 3 for the large school and small school comparisons, except for the five versus

five rural group where there was a trend toward a positive effect of larger schools for the R class type (see Tables 9, 15, 21 and 27). The RA class type did statistically significantly better than the R class type in small rural schools (Signs test $p \leq .01$, see Table C-30); however, the R class type did better, approaching significance, in large rural schools except at grade 1 (see Table C-29). While the S class type had the highest test-score class means overall, the RA class type tended to score higher than the R class type in all the group comparisons except in the large rural schools (see Tables C-7, C-13, C-19 and C-25).

In the 18 versus 17 group, the RA class type did statistically significantly better than the R class type in grade 1, grade 2 and grade 3 for both large and small schools, particularly in reading (Signs test $p \leq .05$ and $p \leq .005$, see Tables C-11 and C-12). In the 12 versus 12 group, the RA class type did statistically significantly better than the R class type in grades K through 3 for the small schools and approached statistical significance for the large schools, particularly in reading (Signs test $p \leq .05$, see Tables C-17 and C-18). In the five versus five inner-city group, the RA class type in large schools did statistically significantly better than the R class type for grades K through 3 (Signs test, $p < .10$, see Table C-23), but not in small schools (Signs test NS, see Table C-24). This suggested a positive effect of small schools in inner-city settings, particularly when this finding of a negative effect of larger schools regarding the RA and R class types was compared with the negative effect of larger schools on the S class type. The S class type had the highest test-score class means of the three class types in the large and small schools for the five versus five inner-city group.

II. CONCLUSIONS

From the findings in this study we can conclude the following:

1. There is a negative relationship between school size and student achievement in grades K through 3, except in rural schools.
2. The negative relationship between urban, suburban and inner-city school size and student achievement in grades K through 3 is more evident as students progress in school in these grades.
3. Large school size has a negative effect on inner-city school student achievement in grades K through 3.
4. School size does not have a significant effect on rural school student achievement in grades K through 3.
5. The S class type counters the negative effect of large school size on student achievement in grades K through 3 better than the RA class type.
6. Small school size is more important to student achievement in mathematics and the S class type is more important to student achievement in reading for grades K through 3.
7. School size alone does not appear to account for the negative effect of large schools on student achievement in grades K through 3.
8. The negative effect of large school size on student achievement in both reading and mathematics for grades K through 3 becomes more evident for all class types as students progress in school in these grades

III. RECOMMENDATIONS

Based on the findings and conclusions of this study concerning the effect of school size on student achievement and the differences in the effect of school size on student achievement in grades K through 3 for the three class types: small (S), regular (R), and regular with aide (RA), the following recommendations are made for consideration in school policy development and program implementation:

1. The evaluation, approval and funding of schools should include small school-size and class-type enrollment as important considerations for supporting student achievement.
2. The enrollment of students in inner-city schools should include consideration of the advantages of small school size and class type to support student achievement.
3. The enrollment of students in rural schools should include consideration of small class-type enrollment to support student achievement.
4. The design, construction and renovation of schools should include consideration of beneficial school-size and class-type enrollment to support student achievement.
5. The preparation and professional development of school leaders (teachers, supervisors, principals, superintendents and board members) should include an understanding of the effects of school-size and class-type enrollment on student achievement.
6. The management system for schools with large existing facilities and teacher-student ratios should include consideration of enrollment and instructional strategies that develop feelings of "smallness" among students and faculty.

The following recommendations are made for further investigation of the effect of school size and the interaction of school-size effect and class-type effect on the achievement of students:

1. An analysis should be conducted of school-size effect and the interaction of school-size effect and class-type effect on student achievement in the Project STAR extant database that compares students who were in a specific class type during grades K through 3 with those students who entered a particular school and class type in grades 1, 2 or 3.
2. An analysis should be conducted of school-size effect on student achievement in the Lasting Benefits Study (Project STAR students in grades 4, 5 and 6, in middle school and in high school after returning to the R class type).
3. An analysis should be conducted of the effect of the principal on student achievement and the interaction of principal effect and school-size effect in the Project STAR extant database.
4. A study should be conducted to further analyze the difference in the effect of school size on student achievement in grades K through 3 of rural and inner-city schools.
5. A study should be conducted that analyzes data on promotion and retention rates, student suspensions and expulsions, and school drop-out rates related to the size of school enrollment in all Tennessee public schools.
6. A study should be conducted which analyzes the *Tennessee Value Added Assessment System* data regarding student gains on the *Tennessee Comprehensive Assessment Program* (TCAP) standardized tests given in grades 2 through 8 and grade 10, the

subject area tests in grades 9 through 12, and the writing assessment in grades 4, 8, and 11 related to the size of school enrollment in all Tennessee schools.

7. A study should be conducted that analyzes the answers given by students to research questions on the TCAP standardized tests related to the size of school enrollment and writing (e.g. homework, reading and writing time, education and career goals, computer and calculator use, school safety).

IV. DISCUSSION

The findings from this study suggest that considerations of class type may be more important than school size in rural schools. This may be the case due to staff and curriculum under-utilization in small schools noted by other researchers (Lunenberg & Ornstein, 1991) which can include less supervision and administrative support as well as fewer resources to implement the established curricula due to budget limitations at the school or school system level. Other community factors associated with school location (e.g. family stability, economic status of the community, family and community education levels) may be adversely influencing student achievement. These community factors combined with staff and curriculum under-utilization in a rural area may be overcoming the advantage that a small school size appears to produce in less isolated geographic areas.

It also appears that student achievement in small rural schools benefits from using either the S or RA class types instead of the "typical" class-type situation represented by the R class type. The S class type may also be an important consideration for student achievement in large rural schools, particularly for kindergarten and grade 1

and in reading. Overall the S class type scores in this study were the highest of the three class types in large rural schools. Even though student achievement in the R class type appears to improve in a large rural school compared to a small rural school, student achievement for students in the RA class type appears to decrease in a large rural school, thus student achievement in large rural schools appear to benefit most by the use of the S class type.

In inner-city schools, those schools located in metropolitan cities with more than half of their students on free or reduced-price lunch, the effect of large school size on student achievement is apparently different. In inner-city schools, both small school size and the S class type appear to be important considerations in improving student achievement in reading and mathematics. Since many schools in inner-city areas are already large due to population density and in some cases local desegregation plans, the use of enrollment and instructional strategies such as school-within-a-school, same homerooms for multiple years, multiage groups, team teaching and advisement, small group cooperative learning, peer tutoring, technology facilitated instruction and tutoring, and day-long/year-long school schedules may be necessary to develop feelings of "smallness" among students and faculty. These strategies to achieve feelings of "smallness" in large schools may be important for schools in other locations as well.

A preliminary comparison of the test-score class means of the inner-city schools group in this study, which had predominantly minority (African-American) students, and the rural schools group, which had predominantly white students, shows that small school size apparently contributes to a narrowing of the minority-white gap. The

tendency for small schools to narrow the gap was somewhat less for the R class type than for S and RA class types. The S class type scores were the highest of the three class types, thus narrowing the gap most effectively. This preliminary finding supports the conclusions of the Project STAR research regarding the effectiveness of the small class type in improving minority student achievement, particularly in inner-city schools (Word et al., 1990). Overall, small school size appears to contribute positively to narrowing the gap for low income, minority students which comprise the majority of enrollment in inner-city schools.

Student achievement for urban schools, those schools located in towns over 2,500 outside of metropolitan areas, may also be more positively effected by large school size; however, the data for this study could not be analyzed further for urban schools due to the limited number of urban schools available in the database for the large school (>670) and small school (<470) group comparisons. The correlation analysis of the entire database in this study suggested a strong positive relationship between large school size and student achievement for urban schools in kindergarten and grade 1 which diminished and became somewhat negative by grade 3, particularly in reading (see Table 4).

Urban schools are typically located in small cities which would be expected to have many positive community support factors (e.g. family stability, economic status of community, family and community education levels) that may be contributing to the initial higher student achievement for large schools. However, it appears that as students progress during grades K through 3 in large urban schools, the size of the school may have a negative influence on student achievement that overcomes the expected positive

community support factors. Students in urban schools may not be immediately affected by large school size because of the positive community factors, but the size of school apparently has a cumulative negative effect as students progress in school during grades K through 3. This cumulative negative effect appears to be evident throughout the analysis of the extant database of this study for schools in all locations, except rural schools.

The data in this study for schools in suburban settings, those schools located in outlying areas of metropolitan cities, could not be analyzed further due to the same database limitations noted above for urban schools. The correlation analysis of the entire database suggested a trend toward a slight negative relationship between large school size and student achievement for suburban schools beyond kindergarten, particularly for mathematics in grades 1 through 3 and for both reading and mathematics in grade 2 and grade 3.

The positive influence of community factors related to size of school in a suburban area may be somewhat similar to that of urban schools in the early grades Apparently as students progress from grades K through 3 in large suburban schools the size of the school may have a negative influence on student achievement that overcomes the expected positive community support factors. However, the trend toward a negative effect was slight enough to suggest that large school size as defined in this study may not be a major influence on student achievement in suburban schools. This finding appears to correspond to findings of Freidkin and Neochochea (1988) of a small positive effect for students in large, high-SES schools which contrasted with a strong, negative effect for students in large, low-SES schools.

In conclusion, when the negative correlations and the Signs tests of this study which showed a negative effect (inner-city schools group) or no effect (18 vs. 17 group, 12 vs. 12 group, and rural schools group) of large school size on the R class type are combined with the statistically significant negative effect of large school size on the S class type and the statistically significant higher test-score class means of the S class type over the R class type, this researcher is led to speculate that school size alone may not account for the negative effect of large schools on student achievement except in inner-city schools. The class type in which the students are enrolled apparently affects achievement in combination with school size and school location, and there may be other intervening variables such as principal effects and community factors other than SES that should be considered when studying the effect of school size on student achievement.

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APPENDICES

APPENDIX A

Analysis of Variance for Cognitive Outcomes, STAR, Grades 1, 2, & 3, Sig. Levels p≤.05 or greater are Tabled. (All levels are ≤.)

Effect/[a] Grade		Reading			Mathematics		
		Multi-variate[b]	SAT Read	BSF Read	Multi-variate[b]	SAT Math	BSF Math
Location (Loc)	K	.01	.02	N/A	.01	.05	N/A
	1	.01	.06		.05		
	2	.001	.001	.001		.001	.001
	3	.001	.001	.001	.001	.001	.001
Race (R)	1	.001	.001	.001	.001	.001	.001
	2	.001	.001	.001	.001	.001	.001
Type (T)	K	.05	.001	N/A	.05	.02	N/A
	1	.001	.001	.001	.001	.001	.05
	2	.001	.001	.05	.001	.001	.05
	3	.001	.001	.001	.001	.001	.001
Train (TR)	2						
Loc X Race	1	.05	.05				
	2						
Loc X Type	K						
	1	All N/S. The class-size effect is found equally in all					
	2	locations--Inner City, Suburban, Urban, and Rural schools.					
	3						
Race X Type	1	.05	.05	.01			
	2						
LocxRxT	1	.05	.01				
	2						
LocxTRxT	2	.05	.01	.05	.05	.05	.01

Note: Only statistically significant (p≤ . 05) results are shown.

[a] The non-orthogonal design required tests in several orders (Finn & Bock, 1985). Results were obtained as follows: each main effect was tested eliminating both other main effects: Loc x race tested eliminating main effects and loc x type; loc x type tested eliminating main effects and loc x race; race x type tested eliminating main effects and other two-way interactions, and loc x race x type tested eliminating all else (Finn & Achilles, 1989).

[b] Obtained from F-approximation from Wilks' likelihood ratio. Essentially, no statistically significant differences were obtained on the self-concept and/or motivation (SCAMIN) measures.

SOURCE: Word et al., 1990, p. 185 (Tech. Rep.) and p.14 (Final Summary Rep.).

Small-Class Advantage by Race[a]

	White		Minority	
Measure	Mean difference	Effect size[b]	Mean difference	Effect size[b]
Word study skills	7.9	.16	14.1	.32
SAT reading	8.6	.15	16.1	.35
BSF reading[c]	4.8%	.10	17.3%	.35
SAT mathematics	9.0	.22	11.6	.31
BSF mathematics[c]	3.1%	.09	7.0%	.16

[a] Each value is Small-(Regular+Aide)/2; means from Table 4.

[b] Mean differences divided by the standard deviation for all white students or all minority students in regular classes.

[c] BSF results tabled are average percentage passing. Statistical analyses were performed using log-adds transformation.

For all five measures, the advantage of being in a small class is greater for minority students than for whites. For example, the small-class advantage for white students is 8.6 points (.15s) on the SAT reading scale. In contrast, minorities in small classes outperformed their peers by an average of 16.7 points (.35s), more than twice the effect size for whites.

SOURCE: Finn and Achilles, 1990, p. 567

Scaled Score Differences between Small and Regular and between Regular/Aide and Regular Classes Grades K, 1, 2, and 3, Project STAR, 1985-1989

	Small - Regular				Regular/Aide - Regular			
	K	G1	G2	G3	K	G1	G2	G3
Total Reading	6.3	16.5	11.1	9.7	4.3	7.6	1.9	-0.4
Total Mathematics	6.9	13.2	9.3	8.1	-.03	4.2	1.2	-1.6
Total Listening	---	8.6	6.8	2.7	---	3.4	1.0	-4.4

SOURCE: Word et al., 1990, p. 100 (Tech. Rep.).

Effect Size by Grade for Small and Regular/Aides in Reading and Math

Test and Comparison	Kindergarten	Grade 1	Grade 2	Grade 3	Average of All Grades
Small and Regular					
Total Reading	.21*	.34*	.26*	.24*	.26
Total Math	.17*	.33*	.23*	.21*	.23
Regular/Aide and Regular					
Total Reading	.05	.15*	.11	.05	.09
Total Math	.02	.11*	.05	.03	.05

Note. Effect size is the difference between the treatment group mean (the small class or the regular-aide class) and the control group mean (regular class) divided by the standard deviation of the control group. This expresses the experimental effect in standard deviation units. An effect size of less than .25 is considered small, an effect size of .25 to .5 is considered moderate, and an effect size of greater than .5 is considered large.

*Significance at $p<.01$

SOURCE: Word et al., 1990, p. 176 (Tech. Rep.).

Effect Sizes for Small Classes by Grade, SES, and Achievement Level Reading and Math

	Small-Regular Effect Size			
Test and Group	**Kindergarten**	**Grade 1**	**Grade 2**	**Grade 3**
Reading				
All	.21	.34	.26	.24
High SES	.19	.32	.20	.21
Low SES	.23	.35	.33	.25
Bottom quartile, previous year	---	.26	.12	.12
Math				
All	.17	.33	.23	.21
High SES	.20	.34	.21	.20
Low SES	.14	.30	.22	.18
Bottom quartile, previous year	---	.09	.25	.23

Low socioeconomic students scored lower than high SES students on the average, but there were many exceptions. To study the effect of small classes on low academic achievers, the scores of students in the bottom quartile were compared to their scores at the end of the next year to determine if a small class helped them more than a regular class.

The effect sizes for the lower quartile students were below the overall effect sizes for reading at each grade, and for math at Grade 1. At Grades 2 and 3 math effect sizes were about the same for the lower quartile and all students (see Table 7).

These results indicate that there is no differential effect of a small class that favors low achieving or low SES students over average students or high SES students. The class size effect is "across the board" for all students.

SOURCE: Word et al., 1990, p. 191 (Tech. Rep.) and p.23 (Final Summary Rep.).

Summary of Estimates of Small Class Effect Sizes on Total Reading and Total Math, Grades K-3 Project STAR, 1985-1989

	Group	Kindergarten	Grade 1	Grade 2	Grade 3
Total	White	.18	.25	.19	.17
Reading	Minority	.25	.52	.42	.32
	ALL	.21	.34	.26	.24
Total	White	.20	.25	.19	.17
Mathematics	Minority	.09	.38	.27	.22
	ALL	.15	.33	.23	.21

Differences in Average Percent Passing BSF Test of Reading and Math Between Small Classes and Other STAR Classes, Grades 1, 2, and 3

	Group	Grade 1	Grade 2	Grade 3
BSF -	White	4.8%	1.6%	4.0%
Reading	Minority	17.3%	12.7%	9.3%
	ALL	9.6%	6.9%	7.2%
BSF -	White	3.1%	1.2%	4.4%
Mathematics	Minority	7.0%	9.9%	8.3%
	ALL	5.9%	4.7%	6.7%

The design and magnitude of Tennessee's randomized class size experiment (STAR) allow researchers to make, with high levels of confidence, statements about class-size effects. Here are some examples of prior reports. "This research leaves no doubt that small classes have an advantage over larger classes in reading and mathematics in the early primary grades" (Finn and Achilles, 1989:21). "This experiment yields an unambiguous answer to the question of the existence of a class-size effect, as well as estimates of the magnitudes of the effect for early primary grades" (p. 22). "These data confirm that a small-class effect, while not immense, is found in two basic subject areas, at four grade levels, and in all four school settings. . . Few, if any, other classroom-level interventions have been identified that have a consistent impact of this sort" (Finn et al., 1989: 15-16).

SOURCE: Word et al., 1990, p. 196 (Tech. Rep.) and p. 30 (Final Summary Rep.).

Plan for Distribution of Students and Classes in Within-School Design: Project STAR (1985-1986)

Design Type	Enrollment (ADM)	Classes (N)	Class Types	Extra Room Needed
One	57-67	(3)	S,R,R/A	No
Two	68-78	(4)	S,S,R,R/A	Yes
Three	79-92	(4)	S,R,R/A,R/A or S,R,R,R/A	No
Four	93-109	(5)	S,S,R,R,R/A or S,S,R,R/A,R/A	Yes
Five	110-134	(6)	S,S,R,R,R/A,R/A	Yes
Six	135+	(7+)	Individually Designed	Yes

S=Small Class (1:13-17); R=Regular Class (1:22-25);
RA=Regular Class with a Full-time Teacher Aide (1:22-25)

The plan described in Table 2 was used to govern the selection of class condition throughout the study. Once assigned to a class type a student was to remain in the assigned class type as long as he/she was in the project. Due primarily to teacher-identified discipline problems and some parent complaints, the STAR consortium had to revise this procedure after the kindergarten year. Since there were no differences on any measure for students in regular and regular with aide classes, students who had been in these class types in kindergarten were reassigned randomly within the two class types for first grade. The external advisory committee informed STAR that this interchanging could create problems in conducting longitudinal analysis. Therefore, first grade was the only grade in which students in regular and regular with aide classes were permitted to interchange. No further changes were made after first grade.

SOURCE: Word et al., 1990, p. 11 (Tech. Rep.) and p.7 (Final Summary Rep.).

Selection of Project Schools

The legislation specified that the project should include "inner-city, suburban, urban, and rural schools" to assess the effects of class size in different school locations. No existing designation of schools used the categories specified above, so the consortium developed designations using various criteria.

Inner-city and **suburban** schools were all located in metropolitan areas. Schools that had more than half of their students on free or reduced cost lunch (indicative of a low-income family background) were tentatively defined as **inner-city**. Schools in the outlying areas of metropolitan cities were classified as **suburban**.

In non-metropolitan areas, schools were classified as **urban** or **rural** depending on the location of the school. If located in a town of over 2,500 and serving primarily an urban population (the census definition of urban), the school was classified as **urban**. All other schools were classified as **rural**. All classifications were checked with local school officials to see if they agreed with the designation of their school.

SOURCE: Word et al., 1990, p. 5 (Tech. Rep.).

Project STAR Schools by School Type
Kindergarten Through Grade 3 (1985-1989)

	Kindergarten	Grade 1	Grade 2	Grade 3
Inner-city	17	15	15	15
Suburban	16	15	15	15
Rural	38	38	38	38
Urban	8	8	7	7
Total	**79**	**76**	**75**	**75**

In kindergarten there were 17 inner-city schools and 16 suburban schools drawn from four metropolitan areas: Knoxville, Nashville, Memphis, and Chattanooga. Fifteen of the 17 inner-city schools were located in Memphis. There were 8 urban schools that served non-metropolitan cities and large towns (for example, Manchester and Maryville). There were 38 rural schools

Schools were spread across the state, not clustered in one section. The Commissioner of Education invited all Tennessee school systems to participate and sent guidelines for participation to each local system. These guidelines indicated that the state would cover additional costs for project teachers and teacher aides, but that local systems would furnish any additional classroom space needed. The project schools would not receive any special considerations other than class size—the students would use the regular district or school curriculum, supplies, texts, etc. There should be no major changes in process, organization, etc., other than class sizes. Schools should plan to remain in the project for four years; the project would start in kindergarten in 1985-86 and follow students successively through grades one, two and three.

SOURCE: Word et al., 1990, p. 6 (Tech. Rep.) and p.4 (Final Summary Rep.).

Number of Schools and Students by Location
Kindergarten through Third Grade (1985-1989)

	Kindergarten (1985-86)		Grade 1 (1986-87)		Grade 2 (1987-88)		Grade 3 (1988-89)	
Location	Students	Schools	Students	Schools	Students	Schools	Students	Schools
Rural	2918	39	3240	38	3168	38	3239	38
Urban	568	8	686	8	482	7	506	7
Suburban	1414	16	1589	15	1711	15	1722	15
Inner-city	1428	17	1380	15	1485	15	1336	15
Total	**6328**	**79**	**6835**	**76**	**6846**	**75**	**6804**	**75**

SOURCE: Word et al., 1990, p. 15 (Tech. Rep.).

STAR Average Daily Membership (ADM) of Students by Number of Schools and by Grade* (1986-89)

ADM	Number of Schools		
	1st Grade	2nd Grade	3rd Grade
Under 400 Students	10	8	7
401-500 Students	16	13	12
501-600 Students	15	22	24
601-700 Students	20	17	17
701-1,000 Students	15	15	15
Total Number of Schools	**76**	**75**	**75**

*This information was not collected during kindergarten (1985).

SOURCE: Word et al., 1990, p. 24 (Tech. Rep.).

Percent of Students on Free/Reduced Lunch
by Number of Schools and by Grade
Project STAR (1985-89)

Percent of Students on Free/Reduced Lunch	Number of Schools			
	Kindergarten	1st Grade	2nd Grade	3rd Grade
50% Or Less	55	46	49	44
More Than 50%	24	30	26	31
Total Number of Schools	**79**	**76**	**75**	**75**

SOURCE: Word et al., 1990, p. 25 (Tech. Rep.).

Analysis of Variance Source Table

	Source of Variation	Error Term
	Fixed effects:	
	Location	Schools
	Class Type	Location X Class Type
	Schools X Class Types	
Random Effects:		
	Schools	
	Schools X Class Types	
	Classes	
	Students	

Methodology (Primary Analysis)

Project STAR's primary analysis consisted of a cross-sectional analysis of data from all students participating in project classes at each grade level, and two longitudinal analyses. For the latter, data were analyzed for students who were in the project in the same class type for four consecutive years (K-1-2-3). Analyses-of-variance procedures were employed to address the major questions of the study as follows:

(1) **Class Type** (Small/Regular/Aide) was assumed to be fixed dimension; mean differences among class types comprise the most important question of the investigation.

(2) **School Type** (Inner-city/Urban/Suburban/Rural) was assumed to be a fixed dimension, crossed with class type.

(3) **Schools** were treated as a random dimension, nested within locations, but crossed with class type, since all three class types were present in each school. This is an important aspect of the design to account for the influence of shared conditions on all project classes within a school.

(4) **Classes** were treated as a random dimension when there were more than one class of a given type within a particular school.

(5) **Students** were treated as a random sample, nested within each class.

SOURCE: Word et al., 1990, p. 19 (Tech. Rep.) and p.8 (Final Summary Rep.).

Tests

a. Stanford Achievement Test (SAT)

Students were tested each spring on the dates specified by the state. In each grade, the appropriate level of SAT was administered to all Project STAR students and to students in 21 comparison schools. The norm-referenced SATs cover reading, math, spelling, listening, and in the higher grades science and social science, and provide subscores for both reading and math (The Psychological Corporation, Hartcourt Brace Jovanovich, Inc., 1985).

b. Tennessee's Basic Skills First Test (BSF)

The state developed Basic Skills Criterion Tests for the third, sixth and eighth grades in reading and math in 1984. Because the SAT does not cover all of the curriculum taught, and the curriculum does not cover everything that is tested, Project STAR contracted with the State Testing Service to develop STAR Criterion Tests in reading and math to cover BSF learning objectives in grades one and two. These tests were similar to the already developed third grade test. The BSF learning objectives were the criteria tested. The untimed tests consist of multiple choice items, four items per objective, and are designed so that they can be administered in about an hour (Tennessee Department of Education, 1987).

SOURCE: Word et al., 1990, p. 15 (Tech. Rep.).

APPENDIX B

Table B-1: School Enrollment in Project STAR Schools

ID	Grades[a]	1986	1987	1988	1989	Average[b]
200078	K-5	330	306	330	405	343
400030	K-8	620	612	582	593	602
500093	K-8	564	610	640	621	609
500110	K-8	471	496	530	507	501
520010	K-5	521	475	525	534	514
1200015	K-5	645	626	605	614	623
1300045	K-4	444	484	430	406	441
1300117	K-4	662	654	556	551	606
1400005	K-8	650	650	640	624	641
1600040	K-6	396	389	398	418	400
1610005	K-6	419	447	417	412	424
1620020	K-5	344	356	293	323	329
1800020	K-5	618	652	657	648	644
1800035	K-8	591	589	610	643	608
1900015	K-4	501	546	557	569	543
1900130	K-4	1050	862	1034	947	973
1900140	K-6	448	491	493	523	489
1900600	K-6	519	572	605	594	573
2000010	K-3	340	371	330	345	347
2300035	K-6	663	763	785	796	752
2500060	K-8	669	769	686	648	693
2730015	K-5	632	535	0[c]	0[c]	584
3300050	K-6	645	675	670	665	664
3300085	K-6	621	655	701	681	665
3300230	K-6	528	511	515	505	515
3400020	K-7	510	519	523	564	529
3600030	K-6	458	460	471	476	466
3600045	K-6	602	605	581	583	593
4300025	K-3	512	550	500	490	513
4500015	K-5	690	647	622	603	641
4500060	K-8	608	619	644	615	622
4710005	K-5	428	460	446	450	446
4710125	K-5	395	389	400	413	399
4710250	K-5	389	405	470	470	434
4710267	K-5	603	481	564	536	546
5000045	K-6	500	494	495	521	503
5000060	K-8	640	641	632	626	635
5100007	K-4	668	679	679	675	675
5310030	K-5	350	582	570	574	519
5500040	K-4	628	663	606	584	620

Table B-1 (cont'd)

ID	Grades[a]	1986	1987	1988	1989	Average[b]
5600015	1-4	0[c]	584	556	557	566
5800050	K-6	531	540	533	547	538
6000059	K-6	763	770	792	795	780
6000090	K-6	506	510	513	487	504
6300020	K-6	637	668	706	616	657
6600045	K-6	556	567	520	503	537
6800015	K-8	389	400	549	585	481
6900010	K-6	434	476	442	436	447
7200040	K-8	1138	1131	1000	1009	1070
7910005	K-6	850	822	800	722	799
7910065	K-6	854	852	832	830	842
7910135	K-6	749	727	740	686	726
7910153	K-6	772	817	752	762	776
7910155	K-6	521	553	544	488	527
7910205	K-6	499	487	437	420	461
7910260	K-6	616	641	604	663	631
7910265	K-6	660	605	615	554	609
7910320	K-6	888	903	823	760	844
7910365	K-6	373	341	356	355	356
7910395	K-6	840	810	819	795	816
7910425	K-6	785	759	485	778	777
7910445	K-6	416	397	372	355	385
4910560	K-6	479	444	436	428	447
7910595	K-6	600	675	678	767	680
7910597	K-6	555	636	497	525	553
7910620	K-6	893	825	856	784	840
7910750	K-6	470	550	525	540	521
7910785	K-6	680	760	848	732	755
8500005	K-6	575	687	674	666	651
8600040	K-8	468	432	460	480	460
9000025	K-5	685	638	664	628	654
9000060	K-4	742	746	759	803	763
9100005	K-4	395	445	398	429	417
9300035	K-6	567	575	560	535	560
9400076	K-5	709	507	590	627	608
9500020	K-6	805	869	943	988	901
Total		44272	44914	45993	44387	44891

Note. Project STAR began with 79 schools. At the end of the study the 76 schools included in this table remained in the database

[a]Grade span for the school. [b]Average annual enrollment during the four year study.

[c]School not in Project STAR for this year.

Table B-2: Average Four Year School Enrollment of Smallest and Largest Schools in Project STAR, 1985-89

Smallest Schools[a]	Largest Schools[b]
329	675
343	680
347	693
356	726
385	752
399	755
400	763
417	776
424	777
434	780
441	799
446	816
447	840
447	842
460	844
461	901
466	973
	1070

[a]Enrollment <470, n=17. [b]Enrollment >670, n=18.

Table B-3: Distribution of Class Enrollment in Project STAR Classes by Grade by Class Type

	K			1			2			3		
n[a]	S	R	RA	S	R	RA	S	R	RA	S	R	RA
Range for small class type												
11										2		
12	8			2			3			2		
13	19			14			16			15		
14	22			18			27			17		
15	23		1	31			32			31		
16	31	1		16	1		29	1		31		1
17	24	4	1	33	1		19			27		
Out of range												
18		1	2	6	2		6			10	1	
19		7	6	3	4	3	1	3	3	5		4
20		6	6	1	10	6		2	1		9	13
21		14	12		18	18		7	11		11	12
Range for both regular and regular with aide class types												
22		20	20		27	15		23	21		13	16
23		16	21		19	20		20	21		10	14
24		19	14		16	11		22	25		15	14
25		6	6		7	9		9	15		16	15
26		4	3		5	9		6	7		5	12
27		1	6		2	4		4	1		5	8
28			1		1	2		1	0		2	6
29					1	2		2	2		2	2
30					1	1						
Total classes[b]												
	127	99	99	124	115	100	133	100	107	140	89	117

Note. S=small class type; R=regular class type; RA=regular with aide class type.

[a]n=number of students enrolled in class. [b]Total classes is the number of classes by grade for class type.

Table B-4: Distribution of Class Enrollment for the 17 Smallest Schools by Grade by Class Type

	K			1			2			3		
n[a]	S	R	RA	S	R	RA	S	R	RA	S	R	RA
Range for small class type												
11										2		
12	1			1			2			1		
13	6			3			1			3		
14	3			4			8			3		
15	5		1	3			8			4		
16	4				1		2	1		8		
17	3	1		6	1		2			5		
Out of range												
18			1	2	1							
19		3	2		1	1			1	2		
20			1			1					2	
21		3	3		2			2	2		4	4
Range for both regular and regular with aide class types												
22		3	2		3	2		5	3		2	3
23		1	4		1	5		3	4		2	2
24		4	2		4	3		2	4		1	2
25		1			2	2		1	2		1	3
26			1		1	2						2
27						1		1			1	1
28					1	1			1			1
29												
30												
Total classes[b]												
	22	16	17	19	18	18	23	15	17	28	13	18
Total enrollment[c]												
	322	347	364	290	401	427	335	337	393	426	290	426

Note. S=small class type; R=regular class type; RA=regular with aide class type.

[a]n=number of students enrolled in class. [b]Total classes is the number of classes by grade for class type. [c]Total enrollment is the total number of students by grade enrolled in each class type (sum of each n multiplied by number of classes for class type).

Table B-5: Distribution of Class Enrollment for the 18 Largest Schools by Grade by Class Type

	K			1			2			3		
n[a]	S	R	RA	S	R	RA	S	R	RA	S	R	RA
					Range for small class type							
11												
12	2			1						1		
13	2			3			3			5		
14	7			4			8			1		
15	10			13			11			8		
16	9			7			13			8		1
17	7			9			3			10		
					Out of range							
18			1	1						3		
19					1	1			1	2		2
20		1	1		6						3	1
21		7	4		8	10			3		2	3
					Range for both regular and regular with aide class types							
22		8	7		10	9		8	5		4	4
23		4	5		9	5		4	6		3	3
24		1	5		3	2		9	13		5	5
25		2	4		1	3		8	7		5	5
26		4	2		2	3		2	1		2	3
27		1	2			1					1	3
28								1			2	4
29								1			2	1
30												
					Total classes[b]							
	37	28	31	38	40	34	38	33	36	38	29	35
					Total enrollment[c]							
	561	640	717	585	883	770	575	793	843	601	697	839

Note. S=small class type; R=regular class type; RA=regular with aide class type.

[a]n=number of students enrolled in class. [b]Total classes is the number of classes by grade for class type. [c]Total enrollment is the total number of students by grade enrolled in each class type (sum of each n multiplied by number of classes for class type).

Table B-6: Kindergarten Distribution of Class Enrollment for the 17 Smallest and the 18 Largest Schools by Class Type

	Smallest schools[a]			Largest schools[b]		
n[c]	S	R	RA	S	R	RA
			Range for small class type			
11						
12	1			2		
13	6			2		
14	3			7		
15	5		1	10		
16	4			9		
17	3	1		7		
			Out of range			
18			1			1
19		3	2			
20			1		1	1
21		3	3		7	4
			Range for both regular and regular with aide class types			
22		3	2		8	7
23		1	4		4	5
24		4	2		1	5
25		1			2	4
26			1		4	2
27					1	2
28						
29						
30						
			Total classes[d]			
	22	16	17	37	28	31
			Total enrollment[e]			
	322	347	364	561	640	717

Note. S=small class type; R=regular class type; RA=regular with aide class type.

[a]Enrollment <470. [b]Enrollment >670. [c]*n*=number of students enrolled in class. [d]Total classes is the number of classes by school size for class type. [e]Total enrollment is the total number of students by school size enrolled in each class type (sum of each *n* multiplied by number of classes for class type).

Table B-7: First Grade Distribution of Class Enrollment for the 17 Smallest and the 18 Largest Schools by Class Type

	Smallest schools[a]			Largest schools[b]		
n[c]	S	R	RA	S	R	RA
	Range for small class type					
11						
12	1			1		
13	3			3		
14	4			4		
15	3			13		
16		1		7		
17	6	1		9		
	Out of range					
18	2	1		1		
19		1	1		1	1
20			1		6	
21		2			8	10
	Range for both regular and regular with aide class types					
22		3	2		10	9
23		1	5		9	5
24		4	3		3	2
25		2	2		1	3
26		1	2		2	3
27			1			1
28		1	1			
29						
30						
	Total classes[d]					
	19	18	18	38	40	34
	Total enrollment[e]					
	290	401	427	585	883	771

Note. S=small class type; R=regular class type; RA=regular with aide class type.

[a]Enrollment <470. [b]Enrollment >670. [c]*n*=number of students enrolled in class. [d]Total classes is the number of classes by school size for class type. [e]Total enrollment is the total number of students by school size enrolled in each class type (sum of each *n* multiplied by number of classes for class type).

Table B-8: Second Grade Distribution of Class Enrollment for the 17 Smallest and the 18 Largest Schools by Class Type

	Smallest schools[a]			Largest schools[b]		
n[c]	S	R	RA	S	R	RA
	Range for small class type					
11						
12	2					
13	1			3		
14	8			8		
15	8			11		
16	2	1		13		
17	2			3		
	Out of range					
18						
19			1			1
20						
21		2	3			3
	Range for both regular and regular with aide class types					
22		5	3		8	5
23		3	4		4	6
24		2	4		9	13
25		1	2		8	7
26					2	1
27		1				
28			1		1	
29					1	
30						
	Total classes[d]					
	23	15	18	38	33	36
	Total enrollment[e]					
	335	337	414	575	793	843

Note. S=small class type; R=regular class type; RA=regular with aide class type.

[a]Enrollment <470. [b]Enrollment >670. [c]*n*=number of students enrolled in class. [d]Total classes is the number of classes by school size for class type. [e]Total enrollment is the total number of students by school size enrolled in each class type (sum of each *n* multiplied by number of classes for class type).

Table B-9: Third Grade Distribution of Class Enrollment for the 17 Smallest and 18 Largest Schools by Class Type

	Smallest schools[a]			Largest schools[b]		
n[c]	S	R	RA	S	R	RA
			Range for small class type			
11	2					
12	1			1		
13	3			5		
14	3			1		
15	4			8		
16	8			8		1
17	5			10		
			Out of range			
18				3		
19	2			2		2
20		2			3	1
21		4	4		2	3
			Range for both regular and regular with aide class types			
22		2	3		4	4
23		2	2		3	3
24		1	2		5	5
25		1	3		5	5
26			2		2	3
27		1	1		1	3
28			1		2	4
29					2	1
30						
			Total classes[d]			
	28	13	18	38	29	35
			Total enrollment[e]			
	426	290	426	601	697	839

Note. S=small class type; R=regular class type; RA=regular with aide class type.

[a]Enrollment <470. [b]Enrollment >670. [c]*n*=number of students enrolled in class. [d]Total classes is the number of classes by school size for class type. [e]Total enrollment is the total number of students by school size enrolled in each class type (sum of each *n* multiplied by number of classes for class type).

Table B-10: Kindergarten Distribution of Class Enrollment for Small, Regular and Regular with Aide Class Type in the 18 Largest and 17 Smallest Schools

	Class enrollment																			
n^a	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30
Smallest schools																				
329					1	1					1				1					
343						1			2											
347			1		1							2								
356			1								1									
385							1						2							
399					1									2						
400			1								2									
417				1										1		1				
424			1						1			1								
434				1	1							1	1							
441						1	1							2						
446							1						1	1						
447				1							1		1							
447		1	1		1				1											
460			1				1	1												
461					1				1		1									
466						1				1		1								
Largest schools																				
675				2							1	1		1						
680				2				1			1									
693		1		1								1	1							
726							2								1	2				
752				1								2								
755					1	1					1		2							
763		1	2								3	1								
776							1				3									
777					3		1					1	2	1						
780					1	1					1		2							
799					1	1										1	2			
816						1	1					1				2				
840				2											3	1	1			
842						2					1	2		1						
844					1	1				2		3								
901					2							1	1	1						
973						1	2				1			1	2					
1070					1	1						1	1	1						

Note. Distribution shows the number of classes at each class enrollment size for each school.

[a] n=school average enrollment for the four years of the Project STAR study.

Table B-11: First Grade Distribution of Class Enrollment for Small, Regular and Regular with Aide Class Type in the 18 Largest and 17 Smallest Schools

	Class enrollment																			
n^a	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30
Smallest Schools																				
329			1								1		1							
343							1											2		
347								1				1	2							
356		1				1			1											
385							1								2					
399							1							2						
400			1										1	1						
417				2										2						
424				1								2								
434							1	1				1								
441							1									2	1			
446				1	1				1				1							
447					1						1				1					
447							2							1						
460			1							1			1							
461					1							1		1						
466								1							1	1				
Largest Schools																				
675				2									2	1	1					
680						1			1	1		1								
693					2							1	1							
726					2						1	1	1			1				
752						1				1	1	1								
755						1	1					1		1		1				
763					3							3	1							
776			1					1			2		1							
777							2					3			1					
780				1	1						1	1	1	1						
799						1	1		1	1	2									
816							2			1			1			1				
840					2							3	2							
842					1	1						1		1	2					
844		1		1	1						3		1							
901							2									2	1			
973						2	1			2	5	2								
1070			2								3	1								

Note. Distribution shows the number of classes at each class enrollment size for each school.

[a] n=school average enrollment for the four years of the Project STAR study.

Table B-12: Second Grade Distribution of Class Enrollment for Small, Regular and Regular with Aide Class Type in the 18 Largest and 17 Smallest Schools

	Class enrollment																			
n^a	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30
Smallest Schools																				
329				1	1							1								
343					1										1	1				
347					1	1							1	1						
356						1									1		1			
385						1					1		1							
399							1							2						
400					1									1		1				
417		1	1								1		1							
424				1	1						1									
434				1	1							1		1						
441				1							2		1							
446		1		1								1	1							
447				1								2	1							
447				1		1			1			1								
460				1									1	1						
461							1										1		1	
466					2							2								
Largest Schools																				
675					1	1						3	1							
680					1	1			1		1	1								
693			1	1								1	1							
726					1		1					1		1	2					
752						1						3								
755							1									2	2			
763						3						1	2	1						
776						2							1	1	1					
777					1	1							1	2						
780						1	1							1	2					
799			1		1							1		1				1	1	
816				3									1		2	1				
840				1	1							1	1		2		1			
842					1	1								2	2					
844			1		2										2	2				
901					1	1							1			3				
973				2	1									2	4	2				
1070				1		1									3					

Note. Distribution shows the number of classes at each class enrollment size for each school.

[a] n=school average enrollment for the four years of the Project STAR study

Table B-13: Third Grade Distribution of Class Enrollment for Small, Regular and Regular with Aide Class Type in the 18 Largest and 17 Smallest Schools

	Class enrollment																			
n^a	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30
Smallest Schools																				
329							1		1					1						
343						1									1		1			
347							2									1	1			
356				2								1								
385						1						1		1						
399					1							1	1							
400	2										2									
417					1	1									2					
424				1	1								1							
434		1	1							1	1									
441					1							1	1	1						
446					2						2									
447			1								2	1								
447							1		1									1		
460			1							1	1									
461						1							1			1				
466					1	1	1								1					
Largest Schools																				
675					1	2						1	2	1						
680							1		1							2	1			
693					2								2							
726			2			1			1	1	1									
752					1								1	2						
755						1								1	2	1				
763						3								2	2					
776					1	1												2	1	
777				1	1						1	1		1						
780					1		1							2		1				
799							1		1							1			2	
816		1	1						1	1	1	1								
840								2		2	2									
842							2					3		1						
844			2		1						1	2	1							
901							1	1										4		
973							3								3		3			
1070						1	1								3					

Note. Distribution shows the number of classes at each class enrollment size for each school.

[a] n=school average enrollment for the four years of the Project STAR study.

Table B-14: Kindergarten Distribution of Class Enrollment for the 17 Smallest Schools

n[a]	S	R	RA
	Range for small class type		
11			
12	1		
13	6		
14	3		
15	5		1
16	4		
17	3	1	
	Out of range		
18			1
19		3	2
20			1
21		3	3
	Range for both regular and regular with aide class types		
22		3	2
23		1	4
24		4	2
25		1	
26			1
27			
28			
29			
30			
	Total classes[b]		
	22	16	17
	Total enrollment[c]		
	322	347	364

Note. S=small class type; R=regular class type; RA=regular with aide class type.

[a]*n*=number of students enrolled in class. [b]Total classes is the number of classes for class type. [c]Total enrollment is the total number of students enrolled in each class type (sum of each *n* multiplied by number of classes for class type).

Table B-15: Kindergarten Distribution of Class Enrollment for the 18 Largest Schools

n[a]	S	R	RA
	Range for small class type		
11			
12	2		
13	2		
14	7		
15	10		
16	9		
17	7		
	Out of range		
18			1
19			
20		1	1
21		7	4
	Range for both regular and regular with aide class types		
22		8	7
23		4	5
24		1	5
25		2	4
26		4	2
27		1	2
28			
29			
30			
	Total classes[b]		
	37	28	31
	Total enrollment[c]		
	561	640	717

Note. S=small class type; R=regular class type; RA=regular with aide class type.

[a]*n*=number of students enrolled in class. [b]Total classes is the number of classes for class type. [c]Total enrollment is the total number of students enrolled in each class type (sum of each *n* multiplied by number of classes for class type).

Table B-16: First Grade Distribution of Class Enrollment for the 17 Smallest Schools

n[a]	S	R	RA
	Range for small class type		
11			
12	1		
13	3		
14	4		
15	3		
16		1	
17	6	1	
	Out of range		
18	2	1	
19		1	1
20			1
21		2	
	Range for both regular and regular with aide class types		
22		3	2
23		1	5
24		4	3
25		2	2
26		1	2
27			1
28		1	1
29			
30			
	Total classes[b]		
	19	18	18
	Total enrollment[c]		
	290	401	427

Note. S=small class type; R=regular class type; RA=regular with aide class type.

[a]*n*=number of students enrolled in class. [b]Total classes is the number of classes for class type. [c]Total enrollment is the total number of students enrolled in each class type (sum of each *n* multiplied by number of classes for class type).

Table B-17: First Grade Distribution of Class Enrollment for the 18 Largest Schools

n[a]	S	R	RA
	Range for small class type		
11			
12	1		
13	3		
14	4		
15	13		
16	7		
17	9		
	Out of range		
18	1		
19		1	1
20		6	
21		8	10
	Range for both regular and regular with aide class types		
22		10	9
23		9	5
24		3	2
25		1	3
26		2	3
27			1
28			
29			
30			
	Total classes[b]		
	38	40	34
	Total enrollment[c]		
	585	883	770

Note. S=small class type; R=regular class type; RA=regular with aide class type.

[a]*n*=number of students enrolled in class. [b]Total classes is the number of classes for class type. [c]Total enrollment is the total number of students enrolled in each class type (sum of each *n* multiplied by number of classes for class type).

Table B-18: Second Grade Distribution of Class Enrollment for the 17 Smallest Schools

n[a]	S	R	RA
	Range for small class type		
11			
12	2		
13	1		
14	8		
15	8		
16	2	1	
17	2		
	Out of range		
18			
19			1
20			
21		2	3
	Range for both regular and regular with aide class types		
22		5	3
23		3	4
24		2	4
25		1	
26			2
27		1	
28			
29			1
30			
	Total classes[b]		
	23	15	18
	Total enrollment[c]		
	335	337	417

Note. S=small class type; R=regular class type; RA=regular with aide class type.

[a]*n*=number of students enrolled in class. [b]Total classes is the number of classes for class type. [c]Total enrollment is the total number of students enrolled in each class type (sum of each *n* multiplied by number of classes for class type).

Table B-19: Second Grade Distribution of Class Enrollment for the 18 Largest Schools

n[a]	S	R	RA
	Range for small class type		
11			
12			
13	3		
14	8		
15	11		
16	13		
17	3		
	Out of range		
18			
19			1
20			
21			3
	Range for both regular and regular with aide class types		
22		8	5
23		4	6
24		9	13
25		8	7
26		2	1
27			
28		1	
29		1	
30			
	Total classes[b]		
	38	33	36
	Total enrollment[c]		
	575	793	843

Note. S=small class type; R=regular class type; RA=regular with aide class type.

[a]*n*=number of students enrolled in class. [b]Total classes is the number of classes for class type. [c]Total enrollment is the total number of students enrolled in each class type (sum of each *n* multiplied by number of classes for class type).

Table B-20: Third Grade Distribution of Class Enrollment for the 17 Smallest Schools

n[a]	S	R	RA
	Range for small class type		
11	2		
12	1		
13	3		
14	3		
15	4		
16	8		
17	5		
	Out of range		
18			
19	2		
20		2	
21		4	4
	Range for both regular and regular with aide class types		
22		2	3
23		2	2
24		1	2
25		1	3
26			2
27		1	1
28			1
29			
30			
	Total classes[b]		
	28	13	18
	Total enrollment[c]		
	426	290	426

Note. S=small class type; R=regular class type; RA=regular with aide class type.

[a]*n*=number of students enrolled in class. [b]Total classes is the number of classes for class type. [c]Total enrollment is the total number of students enrolled in each class type (sum of each *n* multiplied by number of classes for class type).

Table B-21: Third Grade Distribution of Class Enrollment for the 18 Largest Schools

n[a]	S	R	RA
	Range for small class type		
11			
12	1		
13	5		
14	1		
15	8		
16	8		1
17	10		
	Out of range		
18	3		
19	2		2
20		3	1
21		2	3
	Range for both regular and regular with aide class types		
22		4	4
23		3	3
24		5	5
25		5	5
26		2	3
27		1	3
28		2	4
29		2	1
30			
	Total classes[b]		
	38	29	35
	Total enrollment[c]		
	601	697	839

Note. S=small class type; R=regular class type; RA=regular with aide class type.

[a]*n*=number of students enrolled in class. [b]Total classes is the number of classes for class type. [c]Total enrollment is the total number of students enrolled in each class type (sum of each *n* multiplied by number of classes for class type).

Table B-22: Enrollment and Demographics of the18 Largest Schools by Grade

ID[a]	Enroll-ment[b]		% Non-free lunch[c]			% Non-white[d]				% Female[e]			
			1	2	3	K	1	2	3	K	1	2	3
Inner-city													
7910005	799	K-6	4	6	5	100	100	100	100	52	45	52	49
7910065	842	K-6	5	0	2	100	100	100	100	50	47	49	43
7910135	726	K-6	0	3	3	100	100	100	100	44	49	50	53
7910320	844	K-6	8	11	13	100	100	100	100	53	54	57	51
7910395	816	K-6	8	5	4	100	100	100	100	44	49	47	53
7910425	777	K-6	13	13	13	100	100	100	100	49	47	45	42
7910620	840	K-6	16	12	13	100	100	100	100	58	55	52	54
Suburban													
1900130	973	K-4	60	63	60	44	41	42	45	45	46	46	50
7910153	776	K-6	50	63	64	100	100	100	100	56	55	64	61
7910785	755	K-6	56	57	53	89	93	93	93	53	49	50	47
9500020	901	K-6	97	90	95	5	5	5	4	42	40	40	38
7910595	680	K-6	60	52	47	98	97	100	100	64	52	50	46
Rural													
2300035	752	K-6	57	57	58	14	18	13	13	48	53	49	54
6000059	780	K-6	58	58	63	31	33	28	26	46	46	49	49
7200040	1070	K-8	63	67	65	7	7	6	7	52	48	47	48
2500060	693	K-8	24	22	28	0	0	0	0	59	55	53	55
5100007	675	K-4	66	68	66	2	2	1	1	41	47	49	48
Urban													
9000060	763	K-4	65	60	61	3	4	5	3	46	45	50	53

Note. The 18 largest schools have enrollments >670.

[a]ID is the school identification code for the Project STAR study. [b]Enrollment is the average annual enrollment for the four years of the Project STAR study. [c]%Non-free lunch is the percentage of students not eligible for free or reduced price lunches under the USDA school lunch program. %Non-free lunch data not collected for kindergarten. [d]%Non-white is the percentage of students enrolled who are non-white. [e]% Female is the percentage of students enrolled who are female.

Table B-23: Enrollment and Demographics of the 17 Smallest Schools by Grade

ID[a]	Enrollment[b]		% Non-free lunch[c]			% Non-white[d]				% Female[e]			
			1	2	3	K	1	2	3	K	1	2	3
Inner-city													
4710125	399	K-5	6	5	5	100	100	100	100	29	30	26	28
7910365	356	K-6	7	6	6	100	100	100	100	50	62	50	54
7910445	385	K-6	9	15	7	100	100	100	100	52	48	48	47
7910560	447	K-6	2	3	2	100	100	100	100	54	55	60	69
7910205	461	K-6	7	9	6	100	100	100	100	49	44	43	45
Suburban													
4710005	446	K-5	76	81	66	8	9	10	8	42	44	41	41
4710250	434	K-5	84	87	80	3	4	4	2	47	49	43	41
Rural													
1300045	441	K-4	50	DNR[f]	54	0	0	0	0	38	42	44	40
1600040	400	K-6	72	67	61	4	5	3	3	46	52	51	48
2000010	347	K-3	41	50	49	1	4	1	1	53	48	46	44
3600030	466	K-6	54	51	53	10	12	12	14	45	49	50	44
6900010	447	K-6	33	27	36	0	0	0	0	48	44	43	43
8600040	460	K-8	61	51	56	2	4	11	4	38	43	44	47
9100005	417	K-4	61	60	54	0	0	0	0	52	51	48	49
Urban													
200078	343	K-5	25	24	29	44	43	42	37	35	37	49	46
1610005	424	K-6	81	82	83	6	5	4	4	52	50	54	56
1620020	329	K-5	23	30	20	10	12	15	9	49	47	53	53

Note. The 17 smallest schools have enrollments <470.

[a]ID is the school identification code for the Project STAR study [b]Enrollment is the average annual enrollment for the four years of the Project STAR study. [c]%Non-free lunch is the percentage of students not eligible for free or reduced price lunches under the USDA school lunch program. %Non-free lunch data not collected for kindergarten. [d]%Non-white is the percentage of students enrolled who are non-white. [e]% Female is the percentage of students enrolled who are female. [f]DNR means the data was not recorded.

Table B-24: Enrollment and Demographics of 12 Large Schools for Matched Pairs

ID[a]	Grade span[b]	Four year average			
		Enrollment[c]	% Non-free lunch[d]	% Non-white[e]	% Female[f]
		Inner-city			
7910320	K-6	844	11	100	54
7910065	K-6	842	2	100	47
7910620	K-6	840	14	100	55
7910395	K-6	816	6	100	48
7910005	K-6	799	5	100	50
		Suburban			
9500020	K-6	901	94	5	40
		Rural			
7200040	K-8	1070	65	7	49
6000059	K-6	780	60	30	48
2300035	K-6	752	57	15	51
2500060	K-8	693	24	0	55
5100007	K-4	675	66	2	47
		Urban			
9000060	K-4	763	62	4	49

Note. The 12 large schools for matched pairs have school enrollments >670.

[a]ID is the school identification code for the Project STAR study. [b]Grade span is the grade levels in the school. [c]Enrollment is the average annual enrollment for the four years of the Project STAR study. [d]%Non-free lunch is the percentage of students not eligible for free or reduced price lunches under the USDA school lunch program. [e]%Non-white is the percentage of students enrolled who are non-white. [f]% Female is the percentage of students enrolled who are female.

Table B-25: Enrollment and Demographics of 12 Small Schools for Matched Pairs

ID[a]	Grade span[b]	Four year average			
		Enrollment[c]	% Non-free lunch[d]	% Non-white[e]	% Female[f]
		Inner-city			
7910365	K-6	356	6	100	54
4710125	K-5	399	5	100	28
7910445	K-6	385	10	100	49
7910205	K-6	461	7	100	44
7910560	K-6	447	2	100	60
		Suburban			
4710250	K-5	434	84	3	45
		Rural			
8600040	K-8	460	56	5	43
3600030	K-6	466	53	13	47
1600040	K-6	400	67	4	49
6900010	K-6	447	32	0	45
9100005	K-4	417	62	0	50
		Urban			
1610005	K-6	429	82	5	53

Note. The 12 small schools for matched pairs have school enrollments <470.

[a]ID is the school identification code for the Project STAR study. [b]Grade span is the grade levels in the school. [c]Enrollment is the average annual enrollment for the four years of the Project STAR study. [d]%Non-free lunch is the percentage of students not eligible for free or reduced price lunches under the USDA school lunch program. [e]%Non-white is the percentage of students enrolled who are non-white. [f]% Female is the percentage of students enrolled who are female.

APPENDIX C

Table C-1: Pilot Study of Correlation Between Test-score Class Means for First Grade Regular Class Type and School Enrollment

	SAT		BSF	
n^a	Reading	Mathematics	Reading	Mathematics
78	-.1609	-.2609*	-.2179	-.3014**

Note. SAT=Stanford Achievement Test. BSF=Basic Skills First test.

[a]*n*=number of class means with enrollment ≥22 for regular class type.

*p≤.05. **p≤.01

Table C-2: Pilot Study of Correlation Between Test-score Class Means of Small, Regular and Regular with Aide Class Types Combined and School Enrollment

		SAT		BSF	
Grade	n^a	Reading	Mathematics	Reading	Mathematics
K	264	.0529	-.0419	---	---
1	266	-.0911	-.1254*	-.0323	-.1365*
2	300	-.1748**	-.1674**	-.1050	-.1307*
3	267	-.1202*	-.0923	-.0964	-.1604**

Note. Signs test: 13 of 14 negative correlations, $p \leq .005$. SAT=Stanford Achievement Test. BSF=Basic Skills First test. BSF not administered in kindergarten.

[a]*n*=number of test score class means with enrollment ≤ 17 for small class type and ≥ 22 for regular and regular with aide class types.

*$p \leq .05$. **$p \leq .01$.

Table C-3: Correlation Between Test-score Class Means of Small, Regular and Regular with Aide Class Types and School Enrollment for Inner-city Schools

Grade	n[a]	SAT		BSF	
		Reading	Mathematics	Reading	Mathematics
		Small class type			
K	26	.1216	.0712	---	---
1	25	.2432	.0623	.2025	.1254
2	27	.0503	.0183	.1546	-.0722
3	20	-.0622	-.1745	-.1699	-.4436
		Regular class type			
K	16	.3572	.0948	---	---
1	19	-.1266	-.4702*	-.3136	-.4849*
2	20	-.1562	-.1333	.1895	.3059
3	12	-.3156	-.3530	-.2707	-.4636
		Regular with aide class type			
K	17	-.1317	-.2075	---	---
1	11	-.2974	-.1458	.4905	.2864
2	20	-.0825	-.1226	.0367	-.0887
3	15	-.0847	-.0413	-.1630	-.4149
		Class types combined			
K	59	.0804	-.0243	---	---
1	55	.0203	-.1340	.4480	-.0498
2	67	-.0470	-.0810	.0991	.0192
3	47	-.1111	-.1514	-.1882	-.4160**

Note. SAT=Stanford Achievement Test. BSF=Basic Skills First test. BSF not administered in kindergarten.

[a]n=number of test score class means with enrollment $\leq$17 for small class type and $\geq$22 for regular and regular with aide class types.

*p$\leq$.05. **p$\leq$.01.

Table C-4: Correlation Between Test-score Class Means of Small, Regular and Regular with Aide Class Types and School Enrollment for Suburban Schools

Grade	n^a	SAT		BSF	
		Reading	Mathematics	Reading	Mathematics
		Small class type			
K	30	.2733	.2131	---	---
1	25	.2415	-.0084	.3683	-.0111
2	28	.0168	-.1329	-.0986	-.1928
3	25	-.0547	-.0811	.0277	- 0036
		Regular class type			
K	13	.4871	.1110	---	---
1	15	-.0371	.0234	-.0145	.0629
2	23	-.1764	-.1842	-.2201	-.2257
3	19	-.1736	-.1315	-.1029	-.2325
		Regular with aide class type			
K	19	.2336	.3768	---	---
1	18	.0176	-.0615	-.0386	-.1562
2	23	-.1898	-.1296	.0374	-.0418
3	21	.0565	.0735	.2866	.3473
		Class types combined			
K	62	.2884*	.2183	---	---
1	58	.1005	-.0070	.1621	-.0314
2	74	-.1177	-.1724	-.0999	-.1715
3	65	-.0709	-.0738	.0788	.0427

Note. SAT=Stanford Achievement Test. BSF=Basic Skills First test. BSF not administered in kindergarten.

[a]*n*=number of test score class means with enrollment $\leq$17 for small class type and $\geq$22 for regular and regular with aide class types.

*p$\leq$.05.

Table C-5: Correlation Between Test-score Class Means of Small, Regular and Regular with Aide Class Types and School Enrollment for Rural Schools

Grade	n[a]	SAT		BSF	
		Reading	Mathematics	Reading	Mathematics
		Small class type			
K	58	.0311	.0278	---	---
1	51	.0680	-.0354	-.0916	-.2193
2	57	.0237	.0570	-.0933	-.1076
3	63	-.0133	-.0252	.0020	-.1068
		Regular class type			
K	33	-.0170	-.1498	---	---
1	37	-.0337	-.1750	-.0963	-.1546
2	38	.3251*	.3247	.3708*	.3761*
3	29	.2824	.2432	.1600	.2537
		Regular with aide class type			
K	31	.0141	-.1860	---	---
1	33	-.1821	-.0620	-.0654	-.0853
2	40	-.1138	-.1048	-.1495	-.0332
3	39	.0163	.1867	.0750	.1488
		Class types combined			
K	122	.0102	-.0722	---	---
1	125	-.0231	-.0803	-.0834	-.1590
2	135	0237	.0765	-.0060	.0135
3	131	.0394	.0883	.0362	.0375

Note. SAT=Stanford Achievement Test. BSF=Basic Skills First test. BSF not administered in kindergarten.

[a]n=number of test score class means with enrollment $\leq$17 for small class type and $\geq$22 for regular and regular with aide class types.

*$p \leq .05$.

Table C-6: Correlation Between Test-score Class Means of Small, Regular and Regular with Aide Class Types and School Enrollment for Urban Schools

Grade	n^a	SAT		BSF	
		Reading	Mathematics	Reading	Mathematics
		Small class type			
K	13	.5794*	.3542	---	---
1	12	.3405	.3222	.1136	.0911
2	12	-.0602	-.2302	-.1446	-.4487
3	11	-.0274	.0761	.0238	.2728
		Regular class type			
K	4	.9847*	.7251	---	---
1	7	.7301	.6831	.7113	.4769
2	5	.8007	.2070	.8502	.8022
3	5	.8211	.7414	.4894	.0805
		Regular with aide class type			
K	4	.9316	-.2157	---	---
1	9	.2203	.4144	.0721	.1777
2	7	.3180	.7118	-.0930	.2781
3	8	-.2408	.0658	-.5307	-.1282
		Class types combined			
K	21	.5743**	.3686	---	---
1	28	.3853*	.4372*	.2444	.2001
2	24	.2701	.1186	.1396	-.0279
3	24	-.0076	.1231	-.0817	.1187

Note. SAT=Stanford Achievement Test. BSF=Basic Skills First test. BSF not administered in kindergarten.

[a]*n*=number of test score class means with enrollment $\leq$17 for small class type and $\geq$22 for regular and regular with aide class types.

*p$\leq$.05. **p$\leq$.01

Table C-7: Comparison of Test-score Class Means for Small, Regular, and Regular with Aide Class Types for the 18 Largest and 17 Smallest Schools

Grade	n[a]	SAT		BSF	
		Reading	Mathematics	Reading	Mathematics
		Small class type			
K					
Large	38	442.4[b]	490.1[b]	---	---
Small	22	436.3	485.2	---	---
1					
Large	36	529.1[b]	534.0[b]	28.0[b]	39.6[b]
Small	17	513.1	530.6	27.0[c]	39.8[c]
2					
Large	38	585.1[b]	579.9[b]	39.8[b]	52.2[b]
Small	24	590.9[c]	588.6[c]	40.6[c]	54.4[c]
3					
Large	33	620.1[b]	620.2[b]	32.8[b]	50.6[b]
Small	26	622.5[c]	625.1[c]	33.1[c]	52.5[c]
		Regular class type			
K					
Large	20	438.2	483.3	---	---
Small	9	433.0	489.3[c]	---	---
1					
Large	24	499.0	513.9	24.2	36.5
Small	13	501.0	522.1	25.1	38.2
2					
Large	33	571.6	570.1	37.8	51.1
Small	13	573.0	574.2	37.2	49.6
3					
Large	23	607.4	610.0	31.5	48.4
Small	6	603.6	605.2	31.6	49.7

Table C-7 (cont'd)

Grade	n[a]	SAT		BSF	
		Reading	Mathematics	Reading	Mathematics
		Regular with aide class type			
K					
Large	25	434.2	474.0	---	---
Small	9	438.5[c]	488.3	---	---
1					
Large	21	510.5	523.2	25.91	38.0
Small	15	527.8[c]	530.9[c]	25.94	38.9
2					
Large	32	575.9	571.2	38.2	51.4
Small	15	581.1	578.1	38.8	52.4
3					
Large	28	612.8	614.6	32.2	49.8
Small	15	612.9	613.9	32.0	50.1

Note. Signs test: small school/small class type 10 of 14 positive differences, not statistically significant; large school/small class type 14 of 14 positive differences, $p \leq .0001$; small class type 24 of 28 positive differences, $p \leq .01$. SAT=Stanford Achievement Test. BSF=Basic Skills First test. BSF not administered in kindergarten.

[a]n=number of class means with enrollment ≤ 17 for small class type and ≥ 22 for regular and regular with aide class types. [b]Highest class means for grade in large schools. [c]Highest class means for grade in small schools.

Table C-8: Difference in Test-score Class Means for Small Class Type for the 18 Largest Schools and Regular Class Type for the 17 Smallest Schools

Grade	n[a]	Reading M	Reading SD	Mathematics M	Mathematics SD
		SAT			
K					
LS/S	38	442.4	20.5	490.1	29.4
SS/R	9	433.0	19.3	489.3	32.7
		+9.4		+.8	
1					
LS/S	36	529.1	32.8	534.0	26.2
SS/R	13	501.0	29.5	522.1	26.4
		+28.1*[1]		+11.9	
2					
LS/S	38	585.1	28.2	579.9	25.9
SS/R	13	573.0	22.7	574.2	20.4
		+12.1		+5.7	
3					
LS/S	33	620.1	22.3	620.2	22.0
SS/R	6	603.6	18.3	605.2	19.2
		+16.5*[2]		+5.7	
		BSF			
K					
LS/S	38	---	---	---	---
SS/R	9	---	---	---	---
1					
LS/S	36	28.0	2.5	39.6	2.9
SS/R	13	25.1	3.8	38.2	2.8
		+2.9*[3]		+1.4	
2					
LS/S	38	39.8	3.1	52.2	3.5
SS/R	13	37.2	4.6	49.6	3.9
		+2.6*[4]		+2.6*[5]	
3					
LS/S	33	32.8	3.1	50.6	4.9
SS/R	6	31.6	1.9	49.7	2.9
		+1.2		+.9	

Note. Signs test: 14 of 14 positive differences, $p \leq .0001$. LS/S=large school, small class type. SS/R=small school, regular class type. SAT=Stanford Achievement Test. BSF=Basic Skills First test. BSF not administered in kindergarten.

[a]n=number of class means with enrollment ≤ 17 for small class type and ≥ 22 for regular class type.

*[1]$p \leq .01$ based on t-test; t=2.72, df=47. *[2]$p \leq .10$ based on t-test; t=1.71, df=37. *[3]$p \leq .05$ based on t-test; t=3.08, df=47. *[4]$p \leq .10$ based on t-test; t=2.29, df=49. *[5]$p \leq .05$ based on t-test; t=2.6, df=49.

Table C-9: Difference in Test-score Class Means for Small Class Type for the 18 Largest Schools and Regular with Aide Class Type for the 17 Smallest Schools

Grade	n[a]	Reading M	Reading SD	Mathematics M	Mathematics SD
		SAT			
K					
LS/S	38	442.4	20.5	490.1	29.4
SS/RA	9	438.5	24.9	488.3	43.5
		+3.9		+1.8	
1					
LS/S	36	529.1	32.8	534.0	26.2
SS/RA	15	527.8	28.3	530.9	24.3
		+1.3		+3.1	
2					
LS/S	38	585.1	28.2	579.9	25.9
SS/RA	15	581.1	22.6	578.1	25.2
		+4.0		+1.8	
3					
LS/S	33	620.1	22.3	620.0	22.0
SS/RA	15	612.9	18.3	613.9	25.9
		+7.2		+6.1	
		BSF			
K					
LS/S	38	---	---	---	---
SS/RA	9	---	---	---	---
1					
LS/S	36	28.0	2.5	39.6	2.9
SS/RA	15	25.9	2.4	38.9	2.7
		+2.1*		+.7	
2					
LS/S	38	39.8	3.1	52.2	3.5
SS/RA	15	38.8	4.0	52.4	2.5
		+1.0		-.2	
3					
LS/S	33	32.8	3.1	50.6	4.9
SS/RA	15	32.0	2.7	50.1	3.9
		+.8		+.5	

Note. Signs test: 13 of 14 positive differences, $p \leq .005$. LS/S=large school, small class type. SS/RA=small school, regular with aide class type. SAT=Stanford Achievement Test. BSF=Basic Skills First test. BSF not administered in kindergarten.

[a]n=number of class means with enrollment ≤ 17 for small class type and ≥ 22 for regular with aide class type.

*$p \leq .01$ based on t-test; t=2.62, df=49.

Table C-10: Difference in Test-score Class Means for Regular with Aide Class Type for the 18 Largest Schools and Regular Class Type for the 17 Smallest Schools

Grade	n^a	Reading		Mathematics	
		M	SD	M	SD
		SAT			
K					
LS/RA	25	434.2	21.3	474.0	30.2
SS/R	9	433.0	19.3	489.3	32.7
		+1.2		-15.3	
1					
LS/RA	21	510.5	30.6	523.2	26.2
SS/R	13	501.0	29.5	522.1	26.4
		+9.5		+1.1	
2					
LS/RA	32	575.9	23.9	571.2	22.2
SS/R	13	573.0	22.7	574.2	20.4
		+2.9		-3.0	
3					
LS/RA	28	612.8	15.8	614.6	17.8
SS/R	6	603.6	18.3	605.2	19.2
		+9.2		+9.4	
		BSF			
K					
LS/RA	25	---	---	---	---
SS/R	9	---	---	---	---
1					
LS/RA	21	25.9	2.6	38.0	3.1
SS/R	13	25.1	3.8	38.2	2.8
		+.8		-.2	
2					
LS/RA	32	38.2	4.2	51.4	4.3
SS/R	13	37.2	4.6	49.6	3.9
		+1.0		+1.8	
3					
LS/RA	28	32.2	2.6	49.8	4.0
SS/R	6	31.6	1.9	49.7	2.9
		+.6		+.1	

Note. Signs test: 11 of 14 positive differences, $p \leq .10$. LS/RA=large school, regular with aide class type. SS/R=small school, regular class type. SAT=Stanford Achievement Test. BSF=Basic Skills First test. BSF not administered in kindergarten.

[a]*n*=number of class means with enrollment ≥22.

Table C-11: Difference in Test-score Class Means for Regular with Aide and Regular Class Types for the 18 Largest Schools

Grade	n^a	Reading M	Reading SD	Mathematics M	Mathematics SD
		SAT			
K					
LS/RA	25	434.2	21.3	474.0	30.2
LS/R	20	438.2	23.0	483.3	37.1
		-4.0		-9.3	
1					
LS/RA	21	510.5	30.6	523.2	26.2
LS/R	24	499.0	30.6	513.9	27.0
		+11.5		+9.3	
2					
LS/RA	32	575.9	23.9	571.2	22.2
LS/R	33	571.6	25.3	570.1	25.3
		+4.3		+1.1	
3					
LS/RA	28	612.8	15.8	614.6	17.6
LS/R	23	607.4	21.7	610.0	23.5
		+5.4		+4.6	
		BSF			
K					
LS/RA	25	---	---	---	---
LS/R	20	---	---	---	---
1					
LS/RA	21	25.9	2.6	38.0	3.1
LS/R	24	24.2	3.1	36.5	3.5
		+1.7*		+1.5	
2					
LS/RA	32	38.2	4.2	51.4	4.3
LS/R	33	37.8	4.6	51.1	3.7
		+.4		+.3	
3					
LS/RA	28	32.2	2.6	49.8	4.0
LS/R	23	31.5	3.3	48.4	5.2
		+.7		+1.4	

Note. Signs test: 12 of 14 positive differences, $p \leq .05$. LS/RA=large school, regular with aide class type. LS/R=large school, regular class type. SAT=Stanford Achievement Test. BSF=Basic Skills First test. BSF not administered in kindergarten.

[a] n=number of class means with enrollment ≥ 22.

*$p \leq .05$ based on t-test; t=-2.02, df=43.

Table C-12: Difference in Test-score Class Means for Regular with Aide and Regular Class Types for the 17 Smallest Schools

Grade	n[a]	Reading M	Reading SD	Mathematics M	Mathematics SD
		SAT			
K					
SS/RA	9	438.5	24.9	488.3	43.5
SS/R	9	433.0	19.3	489.3	32.7
		+5.5		-1.0	
1					
SS/RA	15	527.8	28.3	530.9	24.3
SS/R	13	501.0	29.5	522.1	26.4
		+26.8*		+8.8	
2					
SS/RA	15	581.1	22.6	578.1	25.2
SS/R	13	573.0	22.7	574.2	20.4
		+8.1		+3.9	
3					
SS/RA	15	612.9	18.3	613.9	25.9
SS/R	6	603.6	18.3	605.2	19.2
		+9.3		+8.7	
		BSF			
K					
SS/RA	9	---	---	---	---
SS/R	9	---	---	---	---
1					
SS/RA	15	25.9	2.4	38.9	2.7
SS/R	13	25.1	3.8	38.2	2.8
		+.8		+.7	
2					
SS/RA	15	38.8	4.0	52.4	2.5
SS/R	13	37.2	4.6	49.6	3.9
		+1.6		+2.8**	
3					
SS/RA	15	32.0	2.7	50.1	3.9
SS/R	6	31.6	1.9	49.7	2.9
		+.4		+.4	

Note. Signs test: 13 of 14 positive differences, $p \leq .005$. SS/RA=small school, regular with aide class type. SS/R=small school, regular class type. SAT=Stanford Achievement Test. BSF=Basic Skills First test. BSF not administered in kindergarten.

[a]n=number of class means with enrollment ≥ 22.

*$p \leq .05$ based on t-test; t=-2.46, df=26. **$p \leq .05$ based on t-test; t=-2.29, df=26.

Table C-13: Comparison of Test-score Class Means for Small, Regular, and Regular with Aide Class Types for the Matched Pairs of 12 Large and 12 Small Schools

Grade	n[a]	SAT		BSF	
		Reading	Mathematics	Reading	Mathematics
		Small class type			
K					
Large	24	443.9[b]	490.5[b]	---	---
Small	14	440.0	496.1[c]	---	---
1					
Large	25	525.8[b]	530.7[b]	27.3[b]	39.2[b]
Small	12	513.7	534.2[c]	27.5[c]	40.0[c]
2					
Large	26	582.1[b]	577.1[b]	39.4[b]	52.1[b]
Small	17	588.1[c]	584.4[c]	40.4[c]	54.0[c]
3					
Large	22	619.7[b]	618.0[b]	32.4[b]	49.9[b]
Small	19	621.5[c]	627.3[c]	32.8[c]	52.8[c]
		Regular class type			
K					
Large	14	437.7	482.3	---	---
Small	5	428.1	487.9	---	---
1					
Large	17	503.4	515.9	23.8	36.4
Small	10	498.7	523.0	25.4	38.5
2					
Large	21	573.6	573.2	37.9	51.7
Small	10	575.2	577.0	37.2	49.8
3					
Large	15	611.7	613.4	31.9	48.8
Small	4	600.9	603.9	31.0	49.4

Table C-13 (cont'd)

Grade	n[a]	SAT		BSF	
		Reading	Mathematics	Reading	Mathematics
		Regular with aide class type			
K					
Large	18	437.1	476.6	---	---
Small	6	442.7[c]	495.0	---	---
1					
Large	14	517.3	528.3	26.2	38.3
Small	8	528.7[c]	531.1	25.9	38.4
2					
Large	21	579.5	574.6	38.5	52.0
Small	10	575.8	576.9	38.1	52.1
3					
Large	18	610.3	612.2	31.39	49.2
Small	9	607.0	615.4	31.38	49.4

Note. Signs test: small school/small class type 12 of 14 positive differences, $p \leq .05$; large school/small class type 14 of 14 positive differences, $p \leq .0001$; small class type 26 of 28 positive differences, $p \leq .01$. SAT=Stanford Achievement Test. BSF=Basic Skills First test. BSF not administered in kindergarten.

[a]n=number of class means with enrollment ≤ 17 for small class type and ≥ 22 for regular and regular with aide class types. [b]Highest class means for grade in large schools. [c]Highest class means for grade in small schools.

Table C-14: Difference in Test-score Class Means for Small Class Type for the 12 Large Schools and Regular Class Type for the 12 Small Schools of Matched Pairs

Grade	n[a]	Reading M	Reading SD	Mathematics M	Mathematics SD
		SAT			
K					
LS/S	24	443.9	22.0	490.5	31.8
SS/R	5	428.1	17.1	487.9	35.8
		+15.8		+2.6	
1					
LS/S	25	525.8	31.3	530.7	25.1
SS/R	10	498.7	34.2	523.0	27.5
		+27.1*[1]		+7.7	
2					
LS/S	26	582.1	23.3	577.1	23.9
SS/R	10	575.2	25.4	577.0	22.7
		+6.9		+.1	
3					
LS/S	22	619.7	23.9	618.0	24.5
SS/R	4	600.9	22.9	603.9	24.6
		+18.8		+14.1	
		BSF			
K					
LS/S	24	---	---	---	---
SS/R	5	---	---	---	---
1					
LS/S	25	27.3	2.6	39.2	2.9
SS/R	10	25.4	4.2	38.5	3.1
		+1.9*[2]		+.7	
2					
LS/S	26	39.4	2.7	52.1	3.4
SS/R	10	37.2	5.2	49.8	4.3
		+2.2		+2.3*[3]	
3					
LS/S	22	32.4	3.3	49.9	5.5
SS/R	4	31.0	2.1	49.4	2.9
		+1.4		+.5	

Note. Signs test: 14 of 14 positive differences, $p \leq .0001$. LS/S=large school, small class type. SS/R=small school, regular class type. SAT=Stanford Achievement Test. BSF=Basic Skills First test. BSF not administered in kindergarten.

[a]n=number of class means with enrollment ≤ 17 for small class type and ≥ 22 for regular class type.

*[1]$p \leq .05$ based on t-test; t=2.17, df=33. *[2]$p \leq .10$ based on t-test; t=1.65, df=33 *[3]$p \leq .10$ based on t-test; t=1.69, df=34.

Table C-15: Difference in Test-score Class Means for Small Class Type for the 12 Large Schools and Regular with Aide Class Type for the 12 Small Schools of Matched Pairs

Grade	n^a	Reading		Mathematics	
		M	SD	M	SD
		SAT			
K					
LS/S	24	443.9	22.0	490.5	31.8
SS/RA	6	442.7	29.3	495.0	53.1
		+1.2		-4.5	
1					
LS/S	25	525.8	34.2	530.7	25.1
SS/RA	8	528.7	28.5	531.1	20.6
		-2.9		-.4	
2					
LS/S	26	582.1	23.3	577.1	23.9
SS/RA	10	575.8	24.2	576.9	27.4
		+6.3		+.2	
3					
LS/S	22	619.7	23.9	618.0	24.5
SS/RA	9	607.0	20.6	615.4	33.5
		+12.7		+2.6	
		BSF			
K					
LS/S	24	---	---	---	---
SS/RA	6	---	---	---	---
1					
LS/S	25	27.3	2.6	39.2	2.9
SS/RA	8	25.9	2.9	38.4	2.6
		+1.4		+.8	
2					
LS/S	26	39.4	2.7	52.1	3.4
SS/RA	10	38.1	4.7	52.1	2.6
		+1.3		0	
3					
LS/S	22	32.4	3.3	49.9	5.5
SS/RA	9	31.4	2.6	49.4	4.6
		+1.0		+.5	

Note. Signs test: 10 of 13 positive differences and 1 tie, $p \leq .10$. LS/S=large school, small class type. SS/RA=small school, regular with aide class type. SAT=Stanford Achievement Test. BSF=Basic Skills First test. BSF not administered in kindergarten.

[a]*n*=number of class means with enrollment ≤17 for small class type and ≥22 for regular with aide class type.

Table C-16: Difference in Test-score Class Means for Regular with Aide Class Type for the 12 Large Schools and Regular Class Type for 12 Small Schools of Matched Pairs

Grade	n^a	Reading		Mathematics	
		M	SD	M	SD
		SAT			
K					
LS/RA	18	437.1	22.4	476.6	30.4
SS/R	5	428.1	17.1	487.9	35.8
		+9.0		-11.3	
1					
LS/RA	14	517.3	29.9	528.3	27.4
SS/R	12	498.7	31.3	523.0	27.5
		+18.6		+5.3	
2					
LS/RA	21	579.5	25.9	574.6	24.3
SS/R	10	575.2	25.4	577.0	22.7
		+4.3		-2.4	
3					
LS/RA	18	610.3	17.5	612.2	19.5
SS/R	4	600.9	22.9	603.9	24.6
		+9.4		+8.3	
		BSF			
K					
LS/RA	18	---		---	
SS/R	5	---		---	
1					
LS/RA	14	26.2	2.6	38.3	3.5
SS/R	10	25.4	4.2	38.5	3.1
		+.8		-.2	
2					
LS/RA	21	38.5	4.3	52.0	4.5
SS/R	10	37.2	5.2	49.8	4.3
		+1.3		+2.2	
3					
LS/RA	18	31.4	2.7	49.2	4.8
SS/R	4	31.0	2.1	49.4	2.9
		+.4		-.2	

Note. Signs test: 10 of 14 positive differences, not statistically significant. LS/RA=large school, regular with aide class type. SS/R=small school, regular class type. SAT=Stanford Achievement Test. BSF=Basic Skills First test. BSF not administered in kindergarten.

[a]n=number of class means with enrollment $\geq$22.

Table C-17: Difference in Test-score Class Means for Regular with Aide and Regular Class Types for the 12 Large Schools of Matched Pairs

Grade	n[a]	Reading M	Reading SD	Mathematics M	Mathematics SD
		SAT			
K					
LS/RA	18	437.1	22.4	476.6	30.4
LS/R	14	437.7	24.2	482.3	34.2
		-.6		-5.7	
1					
LS/RA	14	517.3	29.9	528.3	27.4
LS/R	17	503.4	32.4	515.9	27.1
		+13.9		+12.4	
2					
LS/RA	21	579.5	25.9	574.6	24.3
LS/R	21	573.6	29.5	573.2	28.8
		+5.9		+1.4	
3					
LS/RA	18	610.3	17.5	612.2	19.5
LS/R	15	611.7	23.1	613.4	24.9
		-1.4		-1.2	
		BSF			
K					
LS/RA	18	---		---	
LS/R	14	---		---	
1					
LS/RA	14	26.2	2.6	38.3	3.5
LS/R	17	23.8	3.5	36.4	3.7
		+2.4*		+1.9	
2					
LS/RA	21	38.5	4.3	52.0	4.5
LS/R	21	37.9	5.3	51.7	3.8
		+.6		+.3	
3					
LS/RA	18	31.4	2.7	49.2	4.8
LS/R	15	31.9	3.7	48.8	6.1
		-.5		+.4	

Note. Signs test: 9 of 14 positive differences, not statistically significant. LS/RA=large school, regular with aide class type. LS/R=large school, regular class type. SAT=Stanford Achievement Test. BSF=Basic Skills First test. BSF not administered in kindergarten.

[a]n=number of class means with enrollment $\geq$22.

*$p \leq .05$ based on t-test; t=2.12, df=29.

Table C-18: Difference in Test-score Class Means for Regular with Aide and Regular Class Types for 12 Smallest Schools of Matched Pairs

Grade	n^a	Reading M	Reading SD	Mathematics M	Mathematics SD
		SAT			
K					
SS/RA	6	442.7	29.3	495.0	53.1
SS/R	5	428.1	17.1	487.9	35.8
		+14.6		+7.1	
1					
SS/RA	8	528.7	28.5	531.1	20.6
SS/R	10	498.7	31.3	523.0	27.5
		+30.0*		+8.1	
2					
SS/RA	10	575.8	24.2	576.9	27.4
SS/R	10	575.2	25.4	577.0	22.7
		+.6		-.1	
3					
SS/RA	9	607.0	20.6	615.4	33.5
SS/R	4	600.9	22.9	603.9	24.6
		+6.1		+11.5	
		BSF			
K					
SS/RA	6	---	---	---	---
SS/R	5	---	---	---	---
1					
SS/RA	8	25.9	2.9	38.4	2.6
SS/R	10	25.4	4.2	38.5	3.1
		+.5		-.1	
2					
SS/RA	10	38.1	4.7	52.1	2.6
SS/R	10	37.2	5.2	49.8	4.3
		+.9		+2.3	
3					
SS/RA	9	31.4	2.6	49.40	4.6
SS/R	4	31.0	2.1	49.39	2.6
		+.4		+.01	

Note. Signs test: 12 of 14 positive differences, $p \leq .05$. SS/RA=small school, regular with aide class type. SS/R=small school, regular class type. SAT=Stanford Achievement Test. BSF=Basic Skills First test. BSF not administered in kindergarten.

[a] n=number of class means with enrollment ≥ 22.

*$p \leq .05$ based on t-test; t=-2.10, df=16.

Table C-19: Comparison of Test-score Class Means for Small, Regular, and Regular with Aide Class Types for the Matched Pairs of Five Large and Five Small Inner-city Schools

Grade	n^a	SAT		BSF	
		Reading	Mathematics	Reading	Mathematics
		Small class type			
K					
Large	10	435.7[b]	482.6[b]	---	---
Small	6	432.6	485.3	---	---
1					
Large	11	501.8[b]	516.0[b]	27.1[b]	38.9[b]
Small	5	488.0	514.9	26.8[c]	38.5[c]
2					
Large	12	564.5[b]	562.1[b]	38.2[b]	51.5[b]
Small	6	568.0[c]	567.6[c]	38.3[c]	52.9[c]
3					
Large	8	599.7[b]	600.5[b]	29.2[b]	44.6[b]
Small	6	607.5[c]	613.4[c]	31.9[c]	51.1[c]
		Regular class type			
K					
Large	8	432.1	477.0	---	---
Small	2	416.5	480.9	---	---
1					
Large	8	478.7	493.6	21.6	33.9
Small	5	479.4	513.9	24.5	37.0
2					
Large	10	548.2	555.0	34.3	49.9
Small	4	552.2	560.8	32.3	46.0
3					
Large	5	588.1	590.5	28.7	42.6
Small	3	596.8	601.8	30.7	48.2

Table C-19 (cont'd)

Grade	n[a]	SAT		BSF	
		Reading	Mathematics	Reading	Mathematics
		Regular with aide class type			
K					
Large	9	432.2	471.6	---	---
Small	2	448.6[c]	498.2[c]	---	---
1					
Large	5	489.6	515.8	25.9	37.4
Small	2	502.6[b]	517.0[c]	21.9	34.8
2					
Large	9	559.0	557.8	36.4	50.3
Small	4	554.1	560.7	34.4	51.0
3					
Large	6	587.8	593.8	28.5	43.7
Small	5	593.3	597.6	29.7	47.1

Note. Signs test: small school/small class type 10 of 14 positive differences, not statistically significant; large school/small class type 14 of 14 positive differences, $p \leq .0001$; small class type 24 of 28 positive differences, $p \leq .01$. SAT=Stanford Achievement Test. BSF=Basic Skills First test. BSF not administered in kindergarten.

[a]n=number of class means with enrollment ≤ 17 for small class type and ≥ 22 for regular and regular with aide class types. [b]Highest class means for grade in large schools. [c]Highest class means for grade in small schools.

Table C-20: Difference in Test-score Class Means for Small Class Type for the Five Large Inner-city and Regular Class Type for the Five Small Inner-city Schools of Matched Pairs

Grade	n[a]	Reading M	Reading SD	Mathematics M	Mathematics SD
		SAT			
K					
LS/S	10	435.7	21.7	482.6	37.6
SS/R	2	416.5	19.1	480.9	70.0
		+19.2		+1.7	
1					
LS/S	11	501.8	15.8	516.0	23.2
SS/R	5	479.4	27.8	513.9	33.2
		+22.4*[1]		+2.1	
2					
LS/S	12	564.5	14.0	562.1	17.3
SS/R	4	552.2	18.5	560.8	21.4
		+12.3		+1.3	
3					
LS/S	8	599.7	22.2	600.5	22.0
SS/R	3	596.8	26.1	601.8	29.7
		+2.9		-1.3	
		BSF			
K					
LS/S	10	---	---	---	---
SS/R	2	---	---	---	---
1					
LS/S	11	27.1	2.6	38.9	3.2
SS/R	5	24.5	5.3	37.0	3.2
		+2.6		+1.9	
2					
LS/S	12	38.2	3.1	51.5	4.2
SS/R	4	32.3	4.5	46.0	3.8
		+5.9*[2]		+5.5*[3]	
3					
LS/S	8	29.2	3.6	44.6	3.8
SS/R	3	30.7	2.5	48.2	2.0
		-1.5		-3.6	

Note. Signs test: 11 of 14 positive differences, $p \leq .10$. LS/S=large school, small class type. SS/R=small school, regular class type. SAT=Stanford Achievement Test. BSF=Basic Skills First test. BSF not administered in kindergarten

[a]n=number of class means with enrollment ≤ 17 for small class type and ≥ 22 for regular class type.

*[1]$p \leq .10$ based on t-test; t=2.08, df=14. *[2]$p \leq .01$ based on t-test; t=2.96, df=14. *[3]$p \leq .05$ based on t-test; t=2.32, df=14.

Table C-21: Difference in Test-score Class Means for Small Class Type for the Five Large Inner-city Schools and Regular with Aide Class Type for the Five Small Inner-city Schools of Matched Pairs

Grade	n^a	Reading		Mathematics	
		M	SD	M	SD
		SAT			
K					
LS/S	10	435.7	21.7	482.6	37.6
SS/RA	2	448.6	63.5	498.2	116.4
		-12.9		-15.6	
1					
LS/S	11	501.8	15.8	516.0	23.2
SS/RA	2	502.6	40.7	517.0	33.5
		-.8		-1.0	
2					
LS/S	12	564.5	14.0	562.1	17.3
SS/RA	4	554.1	20.4	560.7	30.1
		+10.4		+1.4	
3					
LS/S	8	599.7	22.2	600.5	22.0
SS/RA	5	593.3	9.5	597.6	19.9
		+6.4		+2.9	
		BSF			
K					
LS/S	10	---	---	---	---
SS/RA	2	---	---	---	---
1					
LS/S	11	27.1	2.6	38.9	3.2
SS/RA	2	21.9	2.5	34.8	2.1
		+5.2		+4.1	
2					
LS/S	12	38.2	3.1	51.5	4.2
SS/RA	4	34.4	5.4	51.0	3.4
		+3.8*		+.5	
3					
LS/S	8	29.2	3.6	44.6	3.8
SS/RA	5	29.7	1.8	47.1	3.9
		-.5		-2.5	

Note. Signs test: 8 of 14 positive differences, not statistically significant. LS/S=large school, small class type. SS/RA=small school, regular with aide class type. SAT=Stanford Achievement Test. BSF=Basic Skills First test. BSF not administered in kindergarten.

[a]n=number of class means with enrollment $\leq$17 for small class type and $\geq$22 for regular class type.

*$p \leq .10$ based on t-test; t=1.77, df=14.

Table C-22: Difference in Test-score Class Means for Regular with Aide Class Type for the Five Large Inner-city Schools and Regular Class Type for the Five Small Inner-city Schools of Matched Pairs

Grade	n^a	Reading		Mathematics	
		M	SD	M	SD
		SAT			
K					
LS/RA	9	432.2	22.0	471.6	26.5
SS/R	2	416.5	19.1	480.9	70.0
		+15.7		-9.3	
1					
LS/RA	5	489.6	19.1	515.8	32.5
SS/R	5	479.4	27.8	513.9	33.2
		+10.2		+1.9	
2					
LS/RA	9	559.0	17.6	557.8	23.0
SS/R	4	552.2	18.5	560.8	21.4
		+6.8		-3.0	
3					
LS/RA	6	587.8	4.8	593.8	10.0
SS/R	3	596.8	26.1	601.8	29.7
		-9.0		-8.0	
		BSF			
K					
LS/RA	9	---	---	---	---
SS/R	2	---	---	---	---
1					
LS/RA	5	25.9	3.4	37.4	4.1
SS/R	5	24.5	5.3	37.0	3.2
		+1.4		+.4	
2					
LS/RA	9	36.4	5.2	50.3	6.1
SS/R	4	32.8	4.5	46.0	3.8
		+3.6		+4.3	
3					
LS/RA	6	28.5	1.9	43.7	2.4
SS/R	3	30.7	2.5	48.2	2.0
		-2.2		-4.5*	

Note. Signs test: 8 of 14 positive differences, not statistically significant. LS/RA=large school, regular with aide class type. SS/R=small school, regular class type. SAT=Stanford Achievement Test. BSF=Basic Skills First test. BSF not administered in kindergarten.

[a]n=number of class means with enrollment $\geq$22.

*$p \leq .05$ based on t-test; t=-2.76, df=7.

Table C-23: Difference in Test-score Class Means for Regular with Aide and Regular Class Types for the Five Large Inner-city Schools of Matched Pairs

Grade	n^a	Reading M	Reading SD	Mathematics M	Mathematics SD
		SAT			
K					
LS/RA	9	432.2	22.0	471.6	26.5
LS/R	8	432.1	23.5	477.0	35.7
		+.1		-5.4	
1					
LS/RA	5	489.6	19.1	515.8	32.5
LS/R	8	478.7	12.8	493.6	12.4
		+10.9		+22.2	
2					
LS/RA	9	559.0	17.6	557.8	23.0
LS/R	10	548.2	15.1	555.0	25.5
		+10.8		+2.8	
3					
LS/RA	6	587.8	4.8	593.8	10.0
LS/R	5	588.1	21.7	590.5	17.3
		-.3		+3.3	
		BSF			
K					
LS/RA	9	---	---	---	---
LS/R	8	---	---	---	---
1					
LS/RA	5	25.9	3.4	37.4	4.1
LS/R	8	21.6	2.9	33.9	3.3
		+4.3*		+3.5	
2					
LS/RA	9	36.4	5.2	50.3	6.1
LS/R	10	34.3	5.4	49.9	4.2
		+2.1		+.4	
3					
LS/RA	6	28.5	1.9	43.7	2.4
LS/R	5	28.7	5.2	42.6	5.8
		-.2		+1.1	

Note. Signs test: 11 of 14 positive differences, $p \leq .10$. LS/RA=large school, regular with aide class type. LS/R=large school, regular class type. SAT=Stanford Achievement Test. BSF=Basic Skills First test. BSF not administered in kindergarten.

[a]n=number of class means with enrollment ≥ 22.

*$p \leq .05$ based on t-test; t=-2.43, df=11.

Table C-24: Difference in Test-score Class Means for Regular with Aide and Regular Class Types for the Five Small Inner-city Schools of Matched Pairs

Grade	n[a]	Reading		Mathematics	
		M	SD	M	SD
		SAT			
K					
SS/RA	2	448.2	63.5	498.2	116.4
SS/R	2	416.5	19.1	480.9	70.0
		+31.7		+17.3	
1					
SS/RA	2	502.6	40.7	517.0	33.5
SS/R	5	479.4	27.8	513.9	33.2
		+23.2		+3.1	
2					
SS/RA	4	554.1	20.4	560.7	30.1
SS/R	4	552.2	18.5	560.8	21.4
		+1.9		-.1	
3					
SS/RA	5	593.3	9.5	597.6	19.9
SS/R	3	596.8	26.1	601.8	29.7
		-3.5		-4.2	
		BSF			
K					
SS/RA	2	---	---	---	---
SS/R	2	---	---	---	---
1					
SS/RA	2	21.9	2.5	34.8	4.1
SS/R	5	24.5	5.3	37.0	3.2
		-2.6		-2.2	
2					
SS/RA	4	34.4	5.4	51.0	3.4
SS/R	4	32.3	4.5	46.0	3.8
		+2.1		+5.0*	
3					
SS/RA	5	29.7	1.8	47.1	3.9
SS/R	3	30.7	2.5	48.2	2.0
		-1.0		-1.1	

Note. Signs test: 7 of 14 positive differences, not statistically significant. SS/RA=small school, regular with aide class type. SS/R=small school, regular class type. SAT=Stanford Achievement Test. BSF=Basic Skills First test. BSF not administered in kindergarten.

[a]n=number of class means with enrollment $\geq$22.

*$p \leq .10$ based on t-test; t=-1.92, df=6.

Table C-25: Comparison of Test-score Class Means for Small, Regular, and Regular with Aide Class Types for Matched Pairs of the Five Large and Five Small Rural Schools

Grade	n[a]	SAT		BSF	
		Reading	Mathematics	Reading	Mathematics
Small class type					
K					
Large	9	443.1[b]	490.5[b]	---	---
Small	5	441.0	499.3	---	---
1					
Large	9	542.7[b]	535.9[b]	27.1[b]	38.9[b]
Small	5	520.1	538.2[c]	27.5[c]	40.6[c]
2					
Large	9	597.3[b]	594.4	40.6	53.2
Small	7	591.5[c]	582.9	40.7	53.9[c]
3					
Large	10	634.4[b]	628.7	34.2[b]	52.1
Small	9	619.2	623.1	32.2	52.3
Regular class type					
K					
Large	4	441.8	487.7	---	---
Small	2	437.0	494.6	---	---
1					
Large	6	512.0	525.3	24.3	37.6
Small	4	510.2	525.2	25.6	39.7
2					
Large	7	596.9	599.0[b]	40.8[b]	54.3[b]
Small	5	589.0	589.3	40.2	52.0
3					
Large	6	625.8	629.7[b]	33.3	52.7[b]
Small	1	613.3	610.2	31.8	53.0[c]

Table C-25 (cont'd)

Grade	n[a]	SAT		BSF	
		Reading	Mathematics	Reading	Mathematics
		Regular with aide class type			
K					
Large	7	441.2	477.2	---	---
Small	2	442.8[c]	501 5[c]	---	---
1					
Large	5	529.3	532.8	26.4	37.7
Small	4	526.7[c]	531.2	26.8	39.4
2					
Large	8	596.0	588.7	40.3	53.9
Small	5	590.7	590.4[c]	41.1[c]	53.3
3					
Large	8	622.9	623.7	33.1	52.0
Small	3	623.5[c]	640.1[c]	33.6[c]	53.0[c]

Note. Signs test: small school/regular with aide class type 9 of 14 positive differences, not statistically significant; large school/small class type 9 of 14 positive differences, not statistically significant; small class type 14 of 28 positive differences, not statistically significant. SAT=Stanford Achievement Test. BSF=Basic Skills First test. BSF not administered in kindergarten.

[a]n=number of class means with enrollment $\leq$17 for small class type and $\geq$22 for regular and regular with aide class types. [b]Highest class means for grade in large schools. [c]Highest class means for grade in small schools.

Table C-26: Difference in Test-score Class Means for Small Class Type for the Five Large Rural Schools and Regular Class Type for the Five Small Rural Schools of Matched Pairs

Grade	n^a	Reading M	Reading SD	Mathematics M	Mathematics SD
		SAT			
K					
LS/S	9	443.1	22.7	490.5	30.7
SS/R	2	437.0	18.5	494.6	6.2
		+6.1		-4.1	
1					
LS/S	9	542.7	40.5	535.9	22.4
SS/R	4	510.2	15.6	525.2	14.6
		+32.5		+10.7	
2					
LS/S	9	597.3	21.6	594.4	25.0
SS/R	5	588.0	16.5	589.3	19.0
		+9.3		+5.1	
3					
LS/S	10	634.4	18.4	628.7	24.4
SS/R	1	613.3	0	610.2	0
		+21.1		+18.5	
		BSF			
K					
LS/S	9	---	---	---	---
SS/R	2	---	---	---	---
1					
LS/S	9	27.1	3.3	38.9	3.3
SS/R	4	25.6	3.1	39.7	2.4
		+1.5		-.8	
2					
LS/S	9	40.6	2.0	53.2	2.8
SS/R	5	40.2	2.2	52.0	2.6
		+.4		+1.2	
3					
LS/S	10	34.2	1.7	52.1	4.9
SS/R	1	31.8	0	53.0	0
		+2.4		-.9	

Note. Signs test: 11 of 14 positive differences, $p \leq .10$. LS/S=large school, small class type. SS/R=small school, regular class type. SAT=Stanford Achievement Test. BSF=Basic Skills First test. BSF not administered in kindergarten.

[a]n=number of class means with enrollment ≤ 17 for small class type and ≥ 22 for regular class type.

Table C-27: Difference in Test-score Class Means for Small Class Type for the Five Large Rural Schools and Regular with Aide Class Type for the Five Small Rural Schools of Matched Pairs

Grade	n^a	Reading		Mathematics	
		M	SD	M	SD
		SAT			
K					
LS/S	9	443.1	22.7	490.5	30.7
SS/RA	2	442.8	1.2	501.5	8.8
		+.3		-11.0	
1					
LS/S	9	542.7	40.5	535.9	22.4
SS/RA	4	526.7	3.8	531.2	10.0
		+16.0		+4.7	
2					
LS/S	9	597.3	21.6	594.4	25.0
SS/RA	5	590.7	14.7	590.4	21.9
		+6.6		+4.0	
3					
LS/S	10	634.4	18.4	628.7	24.4
SS/RA	3	623.5	21.6	640.1	43.5
		+10.9		-11.4	
		BSF			
K					
LS/S	9	---	---	---	---
SS/RA	2	---	---	---	---
1					
LS/S	9	27.1	3.3	38.9	3.3
SS/RA	4	26.8	.5	39.4	.7
		+.3		-.5	
2					
LS/S	9	40.6	2.0	53.2	2.8
SS/RA	5	41.1	2.0	53.3	1.7
		-.5		-.1	
3					
LS/S	10	34.2	1.7	52.1	4.9
SS/RA	3	33.6	2.2	53.0	4.5
		+.6		-.9	

Note. Signs test: 8 of 14 positive differences, not statistically significant. LS/S=large school, small class type. SS/RA=small school, regular with aide class type. SAT=Stanford Achievement Test. BSF=Basic Skills First test. BSF not administered in kindergarten.

[a]n=number of class means with enrollment $\leq$17 for small class type and $\geq$22 for regular with aide class type.

Table C-28: Difference in Test-score Class Means for Regular with Aide Class Type for the Five Large Rural Schools and Regular Class Type for the Five Small Rural Schools of Matched Pairs

Grade	n[a]	Reading M	Reading SD	Mathematics M	Mathematics SD
		SAT			
K					
LS/RA	7	441.2	26.5	477.2	38.7
SS/R	2	437.0	18.5	494.6	6.2
		+4.2		-17.4	
1					
LS/RA	5	529.3	31.1	532.8	30.9
SS/R	4	510.2	15.6	525.2	14.6
		+19.1		+7.6	
2					
LS/RA	8	596.0	18.4	588.7	15.1
SS/R	5	587.0	16.5	589.3	19.0
		+9.0		-.6	
3					
LS/RA	8	622.9	7.4	623.7	18.8
SS/R	1	613.3	0	610.2	0
		+9.6		+13.5	
		BSF			
K					
LS/RA	7	---	---	---	---
SS/R	2	---	---	---	---
1					
LS/RA	5	26.4	3.0	37.7	3.9
SS/R	4	25.6	3.1	39.7	2.4
		+.8		-2.0	
2					
LS/RA	8	40.3	3.2	53.9	2.7
SS/R	5	40.2	2.2	52.0	2.6
		+.1		+1.9	
3					
LS/RA	8	33.1	1.9	52.0	3.2
SS/R	1	31.8	0	53.0	0
		+1.3		-1.0	

Note. Signs test: 10 of 14 positive differences, not statistically significant. LS/RA=large school, regular with aide class type. SS/R=small school, regular class type. SAT=Stanford Achievement Test. BSF=Basic Skills First test. BSF not administered in kindergarten.

[a]n=number of class means with enrollment $\geq$22.

Table C-29: Difference in Test-score Class Means for Regular with Aide and Regular Class Types for the Five Large Rural Schools of Matched Pairs

Grade	n^a	Reading		Mathematics	
		M	SD	M	SD
		SAT			
K					
LS/RA	7	441.2	26.5	477.2	38.7
LS/R	4	441.8	31.6	484.7	42.3
		-.6		-7.5	
1					
LS/RA	5	529.3	31.1	532.8	30.9
LS/R	6	512.0	24.5	525.3	14.2
		+17.3		+7.5	
2					
LS/RA	8	596.0	18.4	588.7	15.1
LS/R	7	596.9	21.4	599.0	20.4
		-.9		-10.3	
3					
LS/RA	8	622.9	7.4	623.7	18.8
LS/R	6	625.8	15.5	629.7	24.0
		-2.9		-6.0	
		BSF			
K					
LS/RA	7	---	---	---	---
LS/R	4	---	---	---	---
1					
LS/RA	5	26.4	3.0	37.7	3.9
LS/R	6	24.3	2.2	37.6	2.9
		+2.1		+.1	
2					
LS/RA	8	40.3	3.2	53.9	2.7
LS/R	7	40.8	3.0	54.3	2.2
		-.5		-.4	
3					
LS/RA	8	33.1	1.9	52.0	3.2
LS/R	6	33.3	1.7	52.7	3.2
		-.2		-.7	

Note. Signs test: 10 of 14 negative differences, not statistically significant. LS/RA=large school, regular with aide class type. LS/R=large school, regular class type. SAT=Stanford Achievement Test. BSF=Basic Skills First test. BSF not administered in kindergarten.

[a]*n*=number of class means with enrollment ≥22.

Table C-30: Difference in Test-score Class Means for Regular with Aide and Regular Class Types for the Five Small Rural Schools of Matched Pairs

Grade	n^a	Reading		Mathematics	
		M	SD	M	SD
		SAT			
K					
SS/RA	2	442.8	1.2	501.5	8.8
SS/R	2	437.0	18.5	494.6	6.2
		+5.8		+6.9	
1					
SS/RA	4	526.7	3.8	531.2	10.0
SS/R	4	510.2	15.6	525.2	14.6
		+16.5		+6.0	
2					
SS/RA	5	590.7	14.7	590.4	21.9
SS/R	5	587.0	16.5	589.3	19.0
		+3.7		+1.1	
3					
SS/RA	3	623.5	21.6	640.1	43.5
SS/R	1	613.3	---	610.2	---
		+10.2		+29.9	
		BSF			
K					
SS/RA	2	---	---	---	---
SS/R	2	---	---	---	---
1					
SS/RA	4	26.8	.5	39.4	.7
SS/R	4	25.6	3.1	39.7	2.4
		+1.2		-.3	
2					
SS/RA	5	41.1	2.0	53.3	1.7
SS/R	5	40.2	2.2	52.0	2.6
		+.9		+1.3	
3					
SS/RA	3	33.6	2.2	53.0	4.5
SS/R	1	31.8	---	53.0	---
		+1.8		0	

Note. Signs test: 12 of 13 positive differences and 1 tie, $p \leq .01$. SS/RA=small school, regular with aide class type. SS/R=small school, regular class type. SAT=Stanford Achievement Test. BSF=Basic Skills First test. BSF not administered in kindergarten.

[a]n=number of class means with enrollment ≥ 22.

Table C-31: Difference in Test-score Class Means for Small and Regular Class Types for the 18 Largest Schools

Grade	n[a]	Reading M	Reading SD	Mathematics M	Mathematics SD
		SAT			
K					
LS/S	38	442.4	20.5	490.1	29.4
LS/R	20	438.2	23.0	483.3	37.1
		+4.2		+6.8	
1					
LS/S	36	529.1	32.7	534.0	26.2
LS/R	24	499.0	30.0	514.0	27.0
		+30.1*[1]		+20.0*[2]	
2					
LS/S	38	585.1	28.2	579.9	26.0
LS/R	33	571.6	25.3	570.1	25.3
		+13.5*[3]		+9.8	
3					
LS/S	33	620.1	22.3	620.2	22.0
LS/R	23	607.4	21.7	610.0	23.5
		+12.7*[4]		+10.2*[5]	
		BSF			
K					
LS/S	38	---	---	---	---
LS/R	20	---	---	---	---
1					
LS/S	36	28.0	2.5	39.6	2.9
LS/R	24	24.2	3.1	36.5	3.5
		+3.8*[6]		+3.1*[7]	
2					
LS/S	38	39.8	3.1	52.2	3.5
LS/R	33	37.8	4.6	51.1	3.7
		+2.0*[8]		+1.1	
3					
LS/S	32	32.8	3.1	50.6	4.9
LS/R	24	31.5	3.3	48.4	5.2
		+1.3		+2.2*[9]	

Note. Signs test: 14 of 14 positive differences, $p \leq .0001$. SAT=Sanford Achievement Test. BSF=Basic Skills First test. BSF not administered in kindergarten. LS/S=large school/small class type; LS/R=large school/regular class type.

[a]n=number of class means with enrollment ≤ 17 for small class type and ≥ 22 for regular class type.

*[1]$p \leq .001$ based on t-test; t=3.61, df=58. *[2]$p \leq .01$ based on t-test; t=2.87, df=58. *[3]$p \leq .05$ based on t-test; t=2.10, df=69. *[4]$p \leq .05$ based on t-test; t=2.12, df=54. *[5]$p \leq .10$ based on t-test; t=1.66, df=54. *[6]$p \leq .001$ based on t-test; t=5.15, df=58. *[7]$p \leq .001$ based on t-test; t=3.78, df=58. *[8]$p \leq .05$ based on t-test; t=2.18, df=69. *[9]$p \leq .10$ based on t-test; t=1.65, df=54.

Table C-32: Difference in Test-score Class Means for Small and Regular with Aide Class Types for the 18 Largest Schools

Grade	n[a]	Reading M	Reading SD	Mathematics M	Mathematics SD
		SAT			
K					
LS/S	38	442.4	20.5	490.1	29.4
LS/RA	25	434.2	21.3	474.0	30.2
		+8.2		+16.1*[1]	
1					
LS/S	36	529.1	32.7	534.0	26.2
LS/RA	21	510.5	30.6	523.2	26.2
		+18.6*[2]		+10.8	
2					
LS/S	38	585.1	28.2	579.9	26.0
LS/RA	32	575.9	23.9	571.2	22.2
		+9.2		+7.7	
3					
LS/S	33	620.1	22.3	620.2	22.0
LS/RA	28	612.8	15.8	614.6	17.8
		+7.3		+5.6	
		BSF			
K					
LS/S	38	---	---	---	---
LS/RA	25	---	---	---	---
1					
LS/S	36	28.0	2.5	39.6	2.9
LS/RA	21	26.0	2.6	38.0	3.1
		+2.0*[3]		+1.6*[4]	
2					
LS/S	38	39.8	3.1	52.2	3.5
LS/RA	32	38.2	4.2	51.4	4.3
		+1.6*[5]		+.8	
3					
LS/S	33	32.8	3.1	50.6	4.9
LS/RA	28	32.2	2.6	49.8	4.0
		+.6		+.8	

Note. Signs test: 14 of 14 positive differences, $p \leq .0001$. SAT=Sanford Achievement Test. BSF=Basic Skills First test. BSF not administered in kindergarten. LS/S=large school/small class type; LS/RA=large school/regular with aide class type.

[a]n=number of class means with enrollment ≤ 17 for small class type and ≥ 22 for regular with aide class type.

*[1]$p \leq .05$ based on t-test; t=2.10, df=61. *[2]$p \leq .05$ based on t-test; t=2.16, df=55. *[3]$p \leq .005$ based on t-test; t=2.93, df=55. *[4]$p \leq .05$ based on t-test; t=1.99, df=55. *[5]$p \leq .10$ based on t-test; t=1.87, df=68.

Table C-33: Difference in Test-score Class Means for Small and Regular Class Types for the 17 Smallest Schools

Grade	n[a]	Reading M	Reading SD	Mathematics M	Mathematics SD
		SAT			
K					
SS/S	22	436.3	18.8	485.2	31.2
SS/R	9	433.0	19.3	489.3	32.7
		+3.3		-4.1	
1					
SS/S	17	513.1	30.0	530.6	27.0
SS/R	13	501.0	29.5	522.1	26.4
		+12.1		+8.5	
2					
SS/S	24	590.9	22.8	588.6	24.1
SS/R	13	573.0	22.7	574.2	20.4
		+17.9*[1]		+14.4*[2]	
3					
SS/S	26	622.5	20.2	625.1	21.9
SS/R	6	603.6	18.3	605.2	19.2
		+18.9*[3]		+19.9*[4]	
		BSF			
K					
SS/S	22	---	---	---	---
SS/R	9	---	---	---	---
1					
SS/S	17	27.0	2.9	39.8	2.8
SS/R	13	25.1	3.8	38.2	2.8
		+1.9		+1.6	
2					
SS/S	24	40.6	3.4	54.4	2.7
SS/R	13	37.2	4.6	49.6	3.9
		+3.4*[5]		+4.8*[6]	
3					
SS/S	26	33.1	3.2	52.5	3.6
SS/R	6	31.6	1.9	49.7	2.9
		+1.5		+2.8*[7]	

Note. Signs test: 13 of 14 positive differences, $p \leq .005$. SAT=Sanford Achievement Test. BSF=Basic Skills First test. BSF not administered in kindergarten. SS/S=small school/small class type; SS/R=small school/regular class type.

[a]n=number of class means with enrollment ≤ 17 for small class type and ≥ 22 for regular class type.

*[1]$p \leq .05$ based on t-test; t=2.27, df=35. *[2]$p \leq .10$ based on t-test; t=1.83, df=35. *[3]$p \leq .05$ based on t-test; t=2.09, df=30. *[4]$p \leq .05$ based on t-test; t=2.04, df=30. *[5]$p \leq .05$ based on t-test; t=2.56, df=35. *[6]$p \leq .001$ based on t-test; t=4.38, df=35. *[7]$p \leq .10$ based on t-test; t=1.77, df=30.

Table C-34: Difference in Test-score Class Means for Small and Regular with Aide Class Types for the 17 Smallest Schools

Grade	n^a	Reading M	Reading SD	Mathematics M	Mathematics SD
		SAT			
K					
SS/S	22	436.3	18.8	485.2	31.2
SS/RA	9	438.5	24.9	488.3	43.5
		-2.2		-3.1	
1					
SS/S	17	513.1	30.0	530.6	27.0
SS/RA	15	527.8	28.2	531.0	24.3
		-14.7		-.4	
2					
SS/S	24	590.9	22.8	588.6	24.1
SS/RA	15	581.1	22.6	578.1	25.2
		+9.8		+10.5	
3					
SS/S	26	622.5	20.2	625.1	21.9
SS/RA	15	612.9	18.3	613.9	25.9
		+9.6		+11.2	
		BSF			
K					
SS/S	22	---	---	---	---
SS/RA	9	---	---	---	---
1					
SS/S	17	27.0	2.9	39.8	2.8
SS/RA	15	26.0	2.4	39.0	2.8
		+1.0		+.8	
2					
SS/S	24	40.6	3.4	54.4	2.7
SS/RA	15	38.8	4.0	52.4	2.5
		+1.8		+2.0*	
3					
SS/S	26	33.1	3.2	52.5	3.6
SS/RA	15	32.0	2.7	50.1	3.9
		+1.1		+2.4**	

Note. Signs test: 10 of 14 positive differences, not statistically significant. SAT=Sanford Achievement Test. BSF=Basic Skills First test. BSF not administered in kindergarten. SS/S=small school/small class type; SS/RA=small school/regular with aide class type.

[a]n=number of class means with enrollment ≤ 17 for small class type and ≥ 22 for regular with aide class type.

*$p \leq .05$ based on t-test; t=2.26, df=37. **$p \leq .10$ based on t-test; t=1.98, df=39.

Table C-35: Difference in Test-score Class Means for Small and Regular Class Types for the 12 Large Schools of Matched Pairs

Grade	n[a]	Reading M	Reading SD	Mathematics M	Mathematics SD
		SAT			
K					
LS/S	24	443.9	22.0	490.5	31.8
LS/R	14	437.7	24.2	482.3	34.2
		+6.2		+8.2	
1					
LS/S	25	525.8	34.2	530.7	25.1
LS/R	17	503.4	32.4	515.9	27.1
		+22.4*[1]		+14.8*[2]	
2					
LS/S	26	582.1	23.3	577.1	23.9
LS/R	21	573.6	29.5	573.2	28.8
		+8.5		+3.9	
3					
LS/S	22	619.7	23.9	618.0	24.5
LS/R	15	611.7	23.1	613.4	24.9
		+8.0		+5.6	
		BSF			
K					
LS/S	24	---	---	---	---
LS/R	14	---	---	---	---
1					
LS/S	25	27.3	2.6	39.2	2.9
LS/R	17	23.8	3.5	36.4	3.7
		+4.5*[3]		+3.8*[4]	
2					
LS/S	26	39.4	2.7	52.1	3.4
LS/R	21	37.9	5.3	51.7	3.8
		+2.5		+.4	
3					
LS/S	22	32.4	3.3	49.9	5.5
LS/R	15	31.9	3.7	48.8	6.1
		+.5		+1.1	

Note. Signs test: 14 of 14 positive differences, $p \leq .0001$. SAT=Sanford Achievement Test. BSF=Basic Skills First test. BSF not administered in kindergarten. LS/S=large school/small class type; LS/R=large school/regular class type.

[a]n=number of class means with enrollment ≤ 17 for small class type and ≥ 22 for regular class type.

*[1]$p \leq .05$ based on t-test; $t=2.13$, $df=40$. *[2]$p \leq .10$ based on t-test; $t=1.82$, $df=40$. *[3]$p \leq .001$ based on t-test; $t=3.73$, $df=40$. *[4]$p \leq .01$ based on t-test; $t=2.78$, $df=40$.

Table C-36: Difference in Test-score Class Means for Small and Regular with Aide Class Types for the 12 Large Schools of Matched Pairs

Grade	n^a	Reading M	Reading SD	Mathematics M	Mathematics SD
		SAT			
K					
LS/S	24	443.9	22.0	490.5	31.8
LS/RA	18	437.1	22.4	476.6	30.4
		+6.8		+12.9	
1					
LS/S	25	525.8	34.2	530.7	25.1
LS/RA	14	517.3	29.9	528.3	27.4
		+12.5		+2.4	
2					
LS/S	26	582.1	23.3	577.1	23.9
LS/RA	21	579.5	25.9	574.6	24.3
		+2.6		+2.5	
3					
LS/S	22	619.7	23.9	618.0	24.5
LS/RA	18	610.3	17.5	612.2	19.5
		+9.4		+5.8	
		BSF			
K					
LS/S	24	---	---	---	---
LS/RA	18	---	---	---	---
1					
LS/S	25	27.3	2.6	39.2	2.9
LS/RA	14	26.2	2.6	38.3	3.5
		+1.1		+.9	
2					
LS/S	26	39.4	2.7	52.1	3.4
LS/RA	21	38.5	4.3	52.0	4.5
		+.9		+.1	
3					
LS/S	22	32.4	3.3	49.9	5.5
LS/RA	18	31.4	2.7	49.2	4.7
		+1.0		+.7	

Note. Signs test: 14 of 14 positive differences, $p \leq .0001$. SAT=Sanford Achievement Test. BSF=Basic Skills First test. BSF not administered in kindergarten. LS/S=large school/small class type; LS/RA=large school/regular with aide class type.

[a]*n*=number of class means with enrollment ≤17 for small class type and ≥22 for regular with aide class type.

Table C-37: Difference in Test-score Class Means for Small and Regular Class Types for the 12 Small Schools of Matched Pairs

Grade	n[a]	Reading M	Reading SD	Mathematics M	Mathematics SD
		SAT			
K					
SS/S	14	440.0	20.3	496.1	32.7
SS/R	5	428.1	17.1	487.9	35.8
		+11.9		+8.2	
1					
SS/S	12	513.7	34.7	534.2	29.1
SS/R	10	498.7	31.3	523.0	27.5
		+15.0		+11.2	
2					
SS/S	17	588.1	23.4	584.4	23.7
SS/R	10	575.2	25.4	577.0	22.7
		+12.9		+7.4	
3					
SS/S	19	621.5	20.5	627.3	21.5
SS/R	4	600.9	22.9	603.9	24.6
		+20.6*[1]		+23.4*[2]	
		BSF			
K					
SS/S	14	---	---	---	---
SS/R	5	---	---	---	---
1					
SS/S	12	27.5	2.9	40.0	2.9
SS/R	10	25.4	4.2	38.5	3.1
		+2.1		+1.5	
2					
SS/S	17	40.5	3.5	54.0	2.8
SS/R	10	37.2	5.2	49.8	3.2
		+3.2*[3]		+4.2*[4]	
3					
SS/S	19	32.8	3.4	52.8	3.5
SS/R	4	31.0	2.1	49.4	2.9
		+1.8		+3.4*[5]	

Note. Signs test: 14 of 14 positive differences, $p \leq .0001$. SAT=Sanford Achievement Test. BSF=Basic Skills First test. BSF not administered in kindergarten. SS/S=small school/small class type; SS/R=small school/regular class type.

[a]n=number of class means with enrollment ≤17 for small class type and ≥22 for regular class type.

*[1]$p \leq .10$ based on t-test; t=1.79, df=21. *[2]$p \leq .10$ based on t-test; t=1.93, df=21. *[3]$p \leq .10$ based on t-test; t=1.93, df=25. *[4]$p \leq .01$ based on t-test; t=3.09, df=25. *[5]$p \leq .10$ based on t-test; t=1.83, df=21.

Table C-38: Difference in Test-score Class Means for Small and Regular with Aide Class Types for the 12 Small Schools of Matched Pairs

Grade	n[a]	Reading M	Reading SD	Mathematics M	Mathematics SD
		SAT			
K					
SS/S	14	440.0	20.3	496.1	32.7
SS/RA	6	442.7	29.3	495.0	53.1
		-2.7		+1.1	
1					
SS/S	12	513.7	34.7	534.2	29.1
SS/RA	8	528.7	28.5	531.1	20.6
		-15.0		+3.1	
2					
SS/S	17	588.1	23.4	584.4	23.7
SS/RA	10	575.8	24.2	576.9	27.4
		+12.3		+7.5	
3					
SS/S	19	621.5	20.5	627.3	21.5
SS/RA	9	607.0	20.6	615.4	33.5
		+14.5*[1]		+11.9	
		BSF			
K					
SS/S	14	---	---	---	---
SS/RA	6	---	---	---	---
1					
SS/S	12	27.5	2.9	40.0	2.8
SS/RA	8	25.9	2.9	38.4	2.6
		+1.6		+1.6	
2					
SS/S	17	40.4	3.5	54.0	2.7
SS/RA	1	38.1	4.7	52.1	2.6
		+2.3		+1.9*[2]	
3					
SS/S	19	32.8	3.4	52.8	3.5
SS/RA	9	31.4	2.6	49.4	4.6
		+1.4		+3.4*[3]	

Note. Signs test: 12 of 14 positive differences, $p \leq .05$. SAT=Sanford Achievement Test. BSF=Basic Skills First test. BSF not administered in kindergarten. SS/S=small school/small class type; SS/R=small school/regular with aide class type.

[a]n=number of class means with enrollment ≤ 17 for small class type and ≥ 22 for regular with aide class type.

*[1]$p \leq .10$ based on t-test; t=1.74, df=26. *[2]$p \leq .10$ based on t-test; t=1.75, df=25. *[3]$p \leq .05$ based on t-test; t=2.19, df=26.

Table C-39: Difference in Test-score Class Means for Small and Regular Class Types for the Five Large Inner-city Schools of Matched Pairs

Grade	n[a]	Reading M	Reading SD	Mathematics M	Mathematics SD
		SAT			
K					
LS/S	10	435.7	21.7	482.6	37.6
LS/R	8	432.1	23.5	477.0	35.7
		+3.6		+5.6	
1					
LS/S	11	501.8	15.8	516.0	23.2
LS/R	8	478.7	12.8	493.6	12.4
		+23.1*[1]		+22.4*[2]	
2					
LS/S	12	564.5	14.0	562.1	17.3
LS/R	10	548.2	15.1	555.0	25.5
		+16.3*[3]		+7.1	
3					
LS/S	8	599.7	22.2	600.5	22.0
LS/R	5	588.1	21.7	590.5	17.3
		+11.6		+10.0	
		BSF			
K					
LS/S	10	---	---	---	---
LS/R	8	---	---	---	---
1					
LS/S	11	27.1	2.6	38.9	3.2
LS/R	8	21.6	2.9	34.0	3.3
		+5.5*[4]		+4.9*[5]	
2					
LS/S	12	38.2	3.1	51.5	4.2
LS/R	10	34.3	5.4	49.9	4.2
		+3.9*[6]		+1.6	
3					
LS/S	8	29.2	3.6	44.6	3.8
LS/R	5	28.7	5.2	42.6	5.8
		+.5		+2.0	

Note. Signs test: 14 of 14 positive differences, $p \leq .0001$. SAT=Sanford Achievement Test. BSF=Basic Skills First test. BSF not administered in kindergarten. LS/S=large school/small class type; LS/R=large school/regular class type.

[a]n=number of class means with enrollment ≤ 17 for small class type and ≥ 22 for regular class type.

*[1]$p \leq .005$ based on t-test; t=3.40, df=17. *[2]$p \leq .05$ based on t-test; t=2.47, df=17. *[3]$p \leq .05$ based on t-test; t=2.62, df=20. *[4]$p \leq .001$ based on t-test; t=4.31, df=17. *[5]$p \leq .005$ based on t-test; t=3.25, df=17. *[6]$p \leq .10$ based on t-test; t=2.08, df=20.

Table C-40: Difference in Test-score Class Means for Small and Regular with Aide Class Types for the Five Large Inner-city Schools of Matched Pairs

Grade	n^a	Reading		Mathematics	
		M	SD	M	SD
		SAT			
K					
LS/S	10	435.7	21.7	482.6	37.6
LS/RA	9	432.2	22.0	471.6	26.6
		+3.5		+11.0	
1					
LS/S	11	501.8	15.8	516.0	23.2
LS/RA	5	498.6	19.1	515.8	32.5
		+3.2		+.2	
2					
LS/S	12	564.5	14.0	562.1	17.3
LS/RA	9	559.0	17.6	557.8	23.0
		+5.5		+4.3	
3					
LS/S	8	597.7	22.2	600.5	22.0
LS/RA	6	587.8	4.8	593.8	10.0
		+11.9		+6.7	
		BSF			
K					
LS/S	10	---	---	---	---
LS/RA	9	---	---	---	---
1					
LS/S	11	27.1	2.6	38.9	3.2
LS/RA	5	25.9	3.4	37.4	4.1
		+1.2		+.5	
2					
LS/S	12	38.2	3.1	51.5	4.2
LS/RA	9	36.4	5.2	50.3	6.1
		+1.8		+1.2	
3					
LS/S	8	29.2	3.6	44.6	3.8
LS/RA	6	28.5	1.9	43.7	2.4
		+.7		+.9	

Note. Signs test: 14 of 14 positive differences, $p \leq .0001$. SAT=Sanford Achievement Test. BSF=Basic Skills First test. BSF not administered in kindergarten. LS/S=large school/small class type; LS/RA=large school/regular with aide class type.

[a]n=number of class means with enrollment ≤ 17 for small class type and ≥ 22 for regular with aide class type.

Table C-41: Difference in Test-score Class Means for Small and Regular Class Types for the Five Small Inner-city Schools of Matched Pairs

Grade	n[a]	Reading M	Reading SD	Mathematics M	Mathematics SD
		SAT			
K					
SS/S	6	432.6	20.0	485.3	38.0
SS/R	2	416.5	19.1	480.9	70.0
		+16.1		+4.4	
1					
SS/S	5	488.0	28.4	514.9	28.4
SS/R	5	479.4	27.8	513.9	33.2
		+8.6		+1.0	
2					
SS/S	6	568.0	20.5	567.6	13.3
SS/R	4	552.2	18.5	560.8	21.4
		+15.8		+6.8	
3					
SS/S	6	607.5	14.4	613.4	12.7
SS/R	3	596.8	26.1	601.8	29.7
		+10.7		+13.6	
		BSF			
K					
SS/S	6	---	---	---	---
SS/R	2	---	---	---	---
1					
SS/S	5	26.8	3.6	38.5	3.5
SS/R	5	24.5	5.3	37.0	3.2
		+2.3		+1.5	
2					
SS/S	6	38.3	3.4	52.9	3.2
SS/R	4	32.3	4.5	46.0	3.8
		+6.0*		+6.9**	
3					
SS/S	6	31.4	3.5	51.1	3.8
SS/R	3	30.7	2.5	48.2	2.0
		+.7		+2.9	

Note. Signs test: 14 of 14 positive differences, $p \leq .0001$. SAT=Sanford Achievement Test. BSF=Basic Skills First test. BSF not administered in kindergarten. SS/S=small school/small class type; SS/R=small school/regular class type.

[a]n=number of class means with enrollment ≤ 17 for small class type and ≥ 22 for regular class type.

*$p \leq .05$ based on t-test; t=2.43, df=8. **$p \leq .05$ based on t-test; t=3.07, df=8.

Table C-42: Difference in Test-score Class Means for Small and Regular with Aide Class Types for the Five Small Inner-city Schools of Matched Pairs

Grade	n^a	Reading		Mathematics	
		M	SD	M	SD
		SAT			
K					
SS/S	6	432.6	20.0	485.3	38.0
SS/RA	2	448.6	63.5	498.2	116.4
		-16.0		-12.9	
1					
SS/S	5	488.0	28.4	514.9	28.4
SS/RA	2	502.6	40.7	517.0	33.5
		-14.6		-2.1	
2					
SS/S	6	568.0	20.5	567.6	13.3
SS/RA	4	554.1	20.4	560.7	30.8
		+13.9		+6.9	
3					
SS/S	6	607.5	14.4	613.4	12.7
SS/RA	5	593.3	9.5	597.6	19.9
		+14.2*		+15.8	
		BSF			
K					
SS/S	6	---	---	---	---
SS/RA	2	---	---	---	---
1					
SS/S	5	26.8	3.6	38.5	3.6
SS/RA	2	21.9	2.5	34.8	2.1
		+5.9		+3.7	
2					
SS/S	6	38.3	3.4	52.9	3.2
SS/RA	4	34.4	5.4	51.0	3.4
		+3.9		+1.9	
3					
SS/S	6	31.4	3.5	51.1	3.8
SS/RA	5	29.7	1.8	47.1	3.9
		+1.7		+4.0	

Note. Signs test: 10 of 14 positive differences, not significant. SAT=Sanford Achievement Test. BSF=Basic Skills First test. BSF not administered in kindergarten. SS/S=small school/small class type; SS/R=small school/regular with aide class type.

[a]n=number of class means with enrollment $\leq$17 for small class type and $\geq$22 for regular with aide class type.

*$p \leq .10$ based on t-test; t=1.88, df=9.

Table C-43: Difference in Test-score Class Means for Small and Regular Class Types for the Five Large Rural Schools of Matched Pairs

Grade	n^a	Reading M	Reading SD	Mathematics M	Mathematics SD
		SAT			
K					
LS/S	9	443.1	22.7	490.5	30.7
LS/R	4	441.8	31.6	484.7	42.3
		+1.3		+5.8	
1					
LS/S	9	542.7	40.5	535.9	22.4
LS/R	6	512.0	24.5	525.3	14.2
		+30.7		+10.6	
2					
LS/S	9	597.3	21.6	594.4	25.0
LS/R	7	596.9	21.4	599.0	20.4
		+.4		-5.6	
3					
LS/S	10	634.4	18.4	628.7	24.3
LS/R	6	625.8	15.5	629.7	24.0
		+8.6		-1.0	
		BSF			
K					
LS/S	9	---	---	---	---
LS/R	4	---	---	---	---
1					
LS/S	9	27.1	3.3	38.9	3.3
LS/R	6	24.3	2.2	37.6	2.9
		+2.8*		+1.3	
2					
LS/S	9	40.6	2.0	53.2	2.8
LS/R	7	40.8	3.0	54.3	2.2
		-.2		-1.1	
3					
LS/S	10	34.2	1.7	52.1	4.9
LS/R	6	33.3	1.7	52.7	3.2
		+.9		-.6	

Note. Signs test: 9 of 14 positive differences, not statistically significant. SAT=Sanford Achievement Test. BSF=Basic Skills First test. BSF not administered in kindergarten. LS/S=large school/small class type; LS/R=large school/regular class type.

[a]n=number of class means with enrollment $\leq$17 for small class type and $\geq$22 for regular class type.

*$p \leq .10$ based on t-test; t=1.84, df=13.

Table C-44: Difference in Test-score Class Means for Small and Regular with Aide Class Types for the Five Large Rural Schools of Matched Pairs

Grade	n^a	Reading M	Reading SD	Mathematics M	Mathematics SD
		SAT			
K					
LS/S	9	443.1	22.7	490.5	30.7
LS/RA	7	441.2	26.5	477.2	38.7
		+1.9		+13.3	
1					
LS/S	9	542.7	40.5	535.9	22.4
LS/RA	5	529.3	31.1	532.8	30.9
		+13.4		+3.1	
2					
LS/S	9	597.3	21.6	594.4	25.0
LS/RA	8	596.0	18.4	588.7	15.1
		+1.3		+5.7	
3					
LS/S	10	634.4	18.4	628.7	24.4
LS/RA	8	622.9	7.4	623.7	18.8
		+11.5		+5.0	
		BSF			
K					
LS/S	9	---	---	---	---
LS/RA	7	---	---	---	---
1					
LS/S	9	27.1	3.3	38.9	3.3
LS/RA	5	26.4	3.0	37.7	3.9
		+.7		+1.2	
2					
LS/S	9	40.6	2.0	53.2	2.8
LS/RA	8	40.3	3.2	53.9	2.7
		+.3		-.7	
3					
LS/S	10	34.2	1.7	52.1	4.9
LS/RA	8	33.1	1.9	52.0	3.2
		+1.1		+.1	

Note. Signs test: 13 of 14 positive differences, $p \leq .005$. SAT=Sanford Achievement Test. BSF=Basic Skills First test. BSF not administered in kindergarten. LS/S=large school/small class type; LS/RA=large school/regular with aide class type.

[a]*n*=number of class means with enrollment ≤ 17 for small class type and ≥ 22 for regular with aide class type.

Table C-45: Difference in Test-score Class Means for Small and Regular Class Types for the Five Small Rural Schools of Matched Pairs

Grade	n^a	Reading M	Reading SD	Mathematics M	Mathematics SD
		SAT			
K					
SS/S	5	441.0	15.7	499.3	24.3
SS/R	2	437.0	18.5	494.6	6.2
		+4.0		+4.7	
1					
SS/S	5	520.1	21.4	538.2	14.4
SS/R	4	510.2	15.6	525.2	14.6
		+9.9		+13.0	
2					
SS/S	7	591.5	17.2	582.9	21.8
SS/R	5	588.0	16.5	589.3	19.0
		+3.5		-6.4	
3					
SS/S	9	619.2	17.3	623.1	14.7
SS/R	1	613.3	---	610.3	---
		+5.9		+12.8	
		BSF			
K					
SS/S	5	---	---	---	---
SS/R	2	---	---	---	---
1					
SS/S	5	27.5	2.6	40.6	2.1
SS/R	4	25.6	3.1	39.7	2.4
		+1.9		+.9	
2					
SS/S	7	40.7	3.8	53.9	2.6
SS/R	5	40.2	2.2	52.0	2.6
		+.5		+1.9	
3					
SS/S	9	32.2	3.1	52.3	2.8
SS/R	1	31.8	---	53.0	---
		+.4		-.7	

Note. Signs test: 12 of 14 positive differences, $p \leq .05$. SAT=Sanford Achievement Test. BSF=Basic Skills First test. BSF not administered in kindergarten. SS/S=small school/small class type; SS/R=small school/regular class type.

[a]n=number of class means with enrollment ≤ 17 for small class type and ≥ 22 for regular class type.

Table C-46: Difference in Test-score Class Means for Small and Regular with Aide Class Types for the Five Small Rural Schools of Matched Pairs

Grade	n^a	Reading M	Reading SD	Mathematics M	Mathematics SD
		SAT			
K					
SS/S	5	441.0	15.7	499.3	24.3
SS/RA	2	442.8	1.2	501.5	8.8
		-1.8		-2.2	
1					
SS/S	5	520.1	21.4	538.2	14.4
SS/RA	4	526.7	3.8	531.2	10.0
		-6.6		+7.0	
2					
SS/S	7	591.5	17.2	582.9	21.8
SS/RA	5	590.7	14.7	590.4	21.9
		+.8		-7.5	
3					
SS/S	9	619.2	17.3	623.1	4.9
SS/RA	3	623.5	21.6	640.1	25.1
		-4.3		-17.0	
		BSF			
K					
SS/S	5	---	---	---	---
SS/RA	2	---	---	---	---
1					
SS/S	5	27.5	2.6	40.6	2.1
SS/RA	4	26.8	.5	39.4	.7
		+.7		+1.2	
2					
SS/S	7	40.7	3.8	53.9	2.6
SS/RA	5	41.1	2.0	53.3	1.7
		-.4		+.6	
3					
SS/S	9	32.2	3.1	52.3	2.8
SS/RA	3	33.6	2.3	53.0	4.5
		-1.4		-.7	

Note. Signs test: 9 of 14 negative differences, not statistically significant. SAT=Sanford Achievement Test. BSF=Basic Skills First test. BSF not administered in kindergarten. SS/S=small school/small class type; SS/R=small school/regular with aide class type.

[a]*n*=number of class means with enrollment $\leq$17 for small class type and $\geq$22 for regular with aide class type.

VITA

Kenneth Earl Nye was born in Toledo, Ohio, on April 4, 1947. He attended elementary schools in Atchison, Kansas, and graduated from Atchison High School in May, 1965. The following September he entered Kansas State Teachers College, later renamed Emporia State University, and in May, 1970, received the degree of Bachelor of Arts in social sciences and mathematics. He reentered Emporia State University in June, 1972, and in May, 1977, received a Master of Science degree in early childhood education. In June, 1981, he entered the University of Tennessee, Knoxville, and in August, 1995, received a Doctor of Education degree in educational administration and supervision.

Beginning in 1968 he served as assistant program manager for the Head Start supplementary training program in Kansas, in 1971 as director of education and career development for the Northeast Kansas Head Start Program, in 1972 as state career development specialist and program manager for the Head Start supplementary training program in Kansas, in 1975 as director of the leadership development program and director of cooperative and experiential education at Western Kentucky University, and in 1978 as director of grants and contracts development at the University of Tennessee, Nashville and then at Tennessee State University. Since 1985 he has been employed as research associate and executive administrative assistant at the Tennessee Board of Education in Nashville, Tennessee.

He is married to Barbara A. Nye (née Dawson) from Knoxville, Tennessee, and is the father of five children, Michael, Christopher, Kendra, Kelly and Kristianne.