KANSAS METROPOLITAN LOCATION AND HIGH SCHOOL SIZE AS VARIABLES IN LOW INCOME LOW ACHIEVEMENT CORRELATIONS

by

JOHNNY YI YEE

B.A., University of California-Berkeley, 1979
M.A., California State University, Los Angeles, 1988
M.A., California State University, Los Angeles, 1989

AN ABSTRACT OF A DISSERTATION

submitted in partial fulfillment of the requirements for the degree

DOCTOR OF PHILOSOPHY

Curriculum and Instruction
College of Education

KANSAS STATE UNIVERSITY
Manhattan, Kansas

2007

Abstract

Educators have realized that low-income students have a higher probability of lower achievement than students from a higher SES background and that these low-income students may very well continue into the cycle of poverty. The purpose of this study was to refine our understanding of the relationships between low-income student status and low income academic achievement in Kansas high schools. This study explored high school low income, low reading, low mathematics, low science achievement correlations among three metropolitan locations and four sizes of high schools. The dependent variables were the school building rates of low income and the school building rates of low achievement. The independent variables were school location and school size. The data was retrieved from the Kansas State Board of Education website. The three metropolitan areas studied were the Wichita, the Topeka-Lawrence and the Greater Kansas City Metropolitan Areas. The four sizes of high schools studied were the 6A-, 5A-, 4A-, and 3A-sized high schools. There were seven research questions in this study. All the research questions were non-directional except for research question #2. Correlation coefficients, standard deviation scores, range scores, frequency scores, intercorrelations, coefficient of determinations, partial correlations and ANCOVA scores were used to analyze the data.

The major conclusions for each research questions were: (1) the unsatisfactory + basic scores of all three low achievement areas (reading, mathematics and science) were the most consistent representation of low achievement. (2) in the three metropolitan areas, where income differences were greater, low income and low achievement correlations were greater. Where income differences were smaller, low income and low achievement correlations were smaller. (3)

smaller schools did not have the better school results. (4) the low reading, mathematics and science correlations had different magnitudes depending on the group. Either low mathematics or low science achievement produced the largest correlations with low income in all seven groups. (5) the smaller standard deviation and range scores may have contributed to the smaller correlations in metropolitan area 2 and the 4A-sized high schools. Findings in the frequency distributions have reinforced the standard deviation and range results. (6) low mathematics and low science achievement were as important as low reading achievement. (7) the low-achievement rates (adjusted for low-income rates) did not differ much across the subject areas when the seven subgroups were considered. The idea of building smaller schools was not supported by the findings.

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Acknowledgements

I would like to thank everyone who helped me in this effort. I would like to thank friends, library personnel, Graduate School personnel and fellow graduate students. I would most like to thank my major professor. I would like to thank Dr. Heerman for his expertise and most of all, his patience in working with me. I would also like to thank my family for their constant support and understanding. I would like to especially thank my brother, Dennis. I would have had a much harder time without all his constant support.

Dedication

I would like to dedicate this effort to my parents. It was my parents who taught me to do my very best at all times.

CHAPTER 1 - Introduction

Coleman (1966) was the key researcher in the study of student's low socioeconomic status (SES) and its corrosive effects on achievement. He found that students from higher SES status tended toward performing better academically while students of lower SES status tended toward lower academic performance. This dissertation study explored the rates of low income and low academic achievement among Kansas high schools. In taking this approach, the researcher sought to get a picture of the building rates for low income and low achievement as they relate to high school metropolitan location and high-school size. In terms of using the building level measures, White (1982) reported that when schools or other aggregated units were used as the basis of analysis, traditional measures of SES were correlated strongly enough with academic achievement to be useful as covariates. Thus, the researcher used the building rates for low income and low achievement to study the variance among high schools by metropolitan location and, separately, by school size. The literature on low achievement and low income (see Chapter 2) revealed a significant number of studies devoted to low reading, low mathematics, and low science achievement. This is noteworthy, since this study was originally proposed and accepted as a low reading achievement and low income correlation study. Since the literature review revealed equal emphasis on low reading, low mathematics, and low science achievement, the researcher expanded the study to embrace all three areas of low achievement (reading, mathematics, science) in relation to low income.

Statement of the Problem

Low family income is of concern since students from low-income families have a higher probability of lower educational attainment. Because of this lower educational attainment, these students may very well continue into the cycle of poverty. Thus, educators must address how we can better educate low-income students so they have the potential for breaking the cycle of poverty. The crux of the problem addressed by this study was to refine our understanding of the effects of metropolitan location and high school size on low family income and low achievement (reading, mathematics, and science).

Bernstein (1994) provided the rationale for the metropolitan location variable for high schools. Bernstein studied metropolitan areas in the U.S. and found that, in many of these areas, more affluent families had moved outside the core-city area. As a result, he found that income gaps had formed between the core-city and suburban or exurban (county) families. He found that when these gaps were larger, the economic productivity of both areas suffered. For example, Newark, Detroit, Cleveland, Buffalo, and St. Louis had larger income gaps between core-city and outlying populations. Together, these metropolitan areas had job growth of 6% during the period of 1980-1990. In contrast, Las Vegas, West Palm Beach, Charlotte, Norfolk, and San Diego had smaller income gaps between core-city and outlying populations. Together, the latter group of metropolitan areas had a job growth of 32% during the period of 1980-1990.

Bernstein also looked at the education rates of people in the top 25% of income in comparison to education rates in the bottom 25% of income. Bernstein found significant differences and argued that America’s ability to compete in world markets was compromised by the marginal education rates from students in lower-educated, lower-earning families. Specifically, Bernstein traced low mathematics and science scores, flat test scores overall, and high dropout rates to low-income students. Bernstein stressed that these low-income students suffer from lack of economic opportunity to achieve better educations and from the inferior quality of education provided to them. Bernstein recommended that we do a better job of educating low-income students.

The second variable of high-school size has been acknowledged by various key writers. Raywid (1998) noted the benefits of smaller schools and indicated that solid research now links smaller schools to fewer discipline problems, lower dropout rates, higher levels of student participation, and more learning. Raywid also stated that smaller schools were especially beneficial for disadvantaged or at-risk students who appear to depend more on school size and school organization for succeeding than more fortunate students. Howley, Strange, and Bickel (2000) stated that many authors have endorsed small schools as educationally effective and beneficial for impoverished students. They reviewed recent thinking about small schools and their effects on school achievement. They found that a wide consensus believes that schools larger than 1,000 are unwise for any community. They also emphasized that schools in impoverished communities should be much smaller. Nathan (2002) cited the benefits of smaller schools and highlighted benefits of improved student achievement, higher graduation rates and better faculty morale in smaller schools. Nathan cited one example of such a school that had 290 students in grades 6-12, noting that although the school enrolled a high percentage of students from low income families, all of its 10th graders passed the statewide English test, compared with about 75% in the state and about 67% in Boston. Thus, the literature on school size suggested that smaller high schools may be more productive than larger high schools. As a result, the researcher chose to make high-school size a variable in this study.

Heerman (2002) conducted a pilot study that further helped to shape this study's research problem and research design. Heerman used the 2001 Kansas reading assessment results for low reading achievement and low income for 23 high schools in Sedgwick County, Kansas. Low reading achievement for each building was calculated by adding the unsatisfactory reading scores with the basic reading scores so that each building had a percentage or rate for low reading achievement. The low-income rate was the percentage of low-income students reported for each building. Building rates for low income were correlated to building rates for low reading achievement. The correlation (r = .76) was in the moderate to high range. The range in building low income rates was 0-65 % and the range in building low reading achievement was 21-75 %. Heerman also found that for 11 core high schools located in the Wichita city limits, the mean rate for low-income students was 43.3% while the mean low-income rate for 12 high schools outside the city limits was 9.3%. In sum, Heerman's pilot study showed a healthy variance in low income and low reading achievement rates for the schools. The correlation of low reading achievement rates to low income rates was moderate to high. Finally, the mean low-income rates for high schools in Wichita and outlying areas in the county were markedly different, thus, supporting Bernstein's contention that families with higher income levels have moved from the core city to outlying cities.

In sum, the researcher found a need to better understand relationships between building rates for low-income student status and building rates for low academic achievement in Kansas high schools. The researcher found that Kansas has three metropolitan areas, represented by the cities of Wichita, Topeka, and Kansas City. Nine counties (Sedgwick, Shawnee, Wyandotte, Johnson, Douglas, Jackson, Jefferson, Leavenworth and Osage) make up the areas for these three metropolitan locations. The nine counties had a combined population of 1,457,478 or 53.9% of the total Kansas population of 2,688,418. Along with the variable of metropolitan high school location, the researcher identified high-school size as a researchable variable. Like most states, Kansas has a system for classifying high schools by size using categories for student participation in high school activities. In this study, the researcher used the top four school size categories of the six available categories. High-school sizes in the bottom two categories were extraordinarily small, and high schools in these two categories were not used (See Chapter 3 on research methods).

Research Overview and Questions

The researcher studied correlations between building rates for low income and building rates for low academic achievement. The study was originally proposed using only low reading achievement building rates. The researcher expanded low achievement rates to embrace not only reading, but also mathematics and science. The literature review demonstrated that low achievement in all three areas is of equal concern; thus, the researcher was able to elaborate a more robust study by considering all three subjects. The researcher was able to factor in metropolitan high school location (three metropolitan sites) and high-school size (four high school sizes) as independent variables. There were seven research questions for this study and they are enumerated and explained in the following:

Research question 1: Of the three building rates for low achievement (unsatisfactory, basic and unsatisfactory + basic), which represented the most consistent measure in correlation with the building rates for low income?

As shown in the definitions section of this chapter, state assessment scores for academic achievement are reported in categories of unsatisfactory, basic, proficient, advanced, and exemplary. Adequate student achievement was represented by student scores in the categories of proficient, advanced, and exemplary. Low student achievement was represented by student scores in the categories of unsatisfactory and basic. The researcher studied three categories of low achievement by first studying unsatisfactory scores and basic scores as two separate measures. A third low-achievement score was derived by combining unsatisfactory low-achievement rates with basic low-achievement rates. Data analysis for this research question required that building low-income rates to be correlated with three separate low-achievement building rates: unsatisfactory student achievement, basic student achievement, and unsatisfactory student achievement rates combined with basic student achievement rates. The three categories of low achievement performance were derived for reading achievement, mathematics achievement, and science achievement. This first question and analysis was necessary to first determine which of the three building rates of low achievement most consistently represented low achievement, per se. The researcher then used the same metric for low achievement throughout the remainder of the study. It is reemphasized that building rates of low achievement included the subject areas of reading, mathematics, and science.

Research question 2. What were the observable differences in the correlations (building rates of low income to low achievement) among the three metropolitan locations of high schools?

Here the researcher reported and analyzed the correlations for the three metropolitan high school locations to identify trends for which additional analyses would be needed. It is noted here that building rates of low achievement included the subject areas of reading, mathematics, and science.

Research question 3. What were the observable differences in the correlations (building rates for low income with building rates for low achievement) among the four different sizes of high schools?

Here the researcher reported and analyzed the correlations for the four high-school sizes to identify trends for which additional analyses would be needed. It is again noted that building rates of low achievement included the subject areas of reading, mathematics, and science.

Research question 4. What were the observable differences in the correlations (building rates for low income with building rates for low achievement) when the subjects of reading, mathematics and science were considered?

In the previous two research questions, the researcher considered the correlations, first, for the high school metropolitan location variable and, second, for the school size variable. Here the researcher continued by considering the correlations (building rates of low income with building rates for low academic achievement) regarding the subject areas of reading, mathematics, and science for all of the high schools without regard to metropolitan location or school size.

Research question 5. What did the analysis of standard deviation scores, range scores, and frequency distributions reveal about differences in correlations (building rates for low income with building rates for low achievement) for high school metropolitan location and high school size.

Here the researcher sought to explain differences found in correlations reported for research questions 2 and 3 above. For this, the researcher reported and analyzed the three descriptive statistics named in this research question.

Research Question 6. What was the magnitude of the correlations (building rates for low income with building rates for low achievement) for the subject areas of reading, mathematics and science when the original correlations were correlated for secondary inter-correlations among the building rates for low reading, low mathematics and low science achievement?

The researcher recognized that the original correlations (building rates for low income with building rates for low achievement) were impacted by the inter-correlations among the low achievement rates for the subject areas of reading, mathematics, and science. To correct for this, the researcher completed a partial correlation analysis to correct for the amount of correlation contributed by the common variance in correlations among the three low-achievement scores for reading, mathematics, and science.

Research question 7: Were there significant differences in the building rates for low achievement when comparisons were made among high schools in the three metropolitan locations and among high schools in the four categories of schools size when the buildings' low achievement rates were adjusted by the buildings' low income- rates?

Here the researcher made direct comparisons among the three groups of high schools according to the metropolitan location on the measure of buildings' low-achievement rates. This was done separately for reading, mathematics, and science. In making this comparison, the buildings' low-achievement rates were adjusted by the building's low income rates. A separate comparison was made among the high schools in the four categories of school size. Again, this included comparisons for building rates of low achievement in the subject areas of reading, mathematics, and science. Also, the buildings' rates for low achievement were adjusted by the buildings' rates for low income. Here the researcher was seeking to determine which groups of high schools (three metropolitan locations and four categories of high school size) produced lower rates of low achievement.

Definitions of Terms

1. Low income. Low income refers to the rate (percentage) of low income students in a high school building during the 2002-2003 time period. Low income is set by the Kansas State Department of Education as the number of students who qualify for free or reduced lunch. In the Kansas State Department of Education's reporting, students are also referred to as "economically disadvantaged." In the remaining chapters of this study, the researcher used the term "low

income”, and this was in specific reference to the buildings’ rates or percentages of students receiving free or reduced lunches. In data analysis, low income was also used to refer to the distribution of low income among the Kansas high schools included in this study.

2. Low achievement. Low achievement refers to the rate (percentage) of students in a high school building who score unsatisfactory or basic on state reading, mathematics, and science assessments during the 2002-2003 academic year. In the remaining chapters of this study the researcher used the term “low achievement”, and this was in specific reference to the buildings’ rates or percentages of students scoring combined unsatisfactory and basic on Kansas assessments of reading, mathematics, or science in the 2002-2003 academic year. In data analysis, low achievement was also used to refer to the distribution of low achievement among the Kansas high schools included in this study.

3. Categories of student performance in the Kansas reading, mathematics, and science assessments results. Kansas assessments scores for academic achievement are reported in categories of unsatisfactory, basic, proficient, advanced, and exemplary. Adequate student achievement was represented by student scores in the categories of proficient, advanced, and exemplary. Low student achievement was represented by student scores in the categories of unsatisfactory and basic. The assessment scores used in this study were taken from the 2002-2003 Kansas assessment year. Descriptors for each of the five categories of student performance are as follows:

a. Exemplary. Students who perform at the exemplary level on the Kansas State Assessments reflect consistently high performance. At this level students have a well-developed ability to apply knowledge and skills in all situations. Their work is superior.

b. Advanced. Students who perform at the advance levels on the Kansas State Assessments reflect frequently high performance. At this level students effectively apply knowledge and skills in most situations. They have a command of difficult, rigorous, and challenging material.

c. Proficient. Students who perform at the proficient level on the Kansas State Assessments and demonstrate a mastery of core skills. Students exhibit competence in applying knowledge and skills in most problem situations.

d. Basic. Students who perform at the basic level on the Kansas State Assessment and show partial mastery of fundamental skills. These students have a basic knowledge of content, but struggle in applying knowledge and skills in problem situations.

e. Unsatisfactory. Students who perform at the unsatisfactory level on the Kansas State Assessments lack core knowledge, skills and concepts.

4. Metropolitan location. Three metropolitan locations were identified in this study: Wichita, Topeka and Kansas City. For Wichita the home county was included and for Topeka and Kansas City, the home county and adjacent counties were included. The three metropolitan city locations are depicted with the included counties below:

Wichita	Topeka	Kansas City
Sedgwick	Shawnee	Wyandotte
	Douglas	Johnson
	Jackson	Leavenworth
	Jefferson	
	Osage	

In this study, the researcher referred to metropolitan location as a means of identifying high schools in the three locations outlined above. Low income in metropolitan locations referred to the distribution of low income in the high schools in the three locations. Low achievement in metropolitan high school location referred to the distribution of low reading, mathematics, and science achievement on state assessments in high schools in those three locations.

5. High-school size. Kansas has enrollment categories for grouping high schools by size of enrollment. The categories and enrollment ranges during the 2002-2003 year were as follows:

Category	Range of Enrollment
6A	911-1543
5A	509-908
4A	219-507
3A	132-216

High schools in categories 1A and 2A were excluded from this study as their enrollments were very small. High-school sizes were represented by the four school sizes of 6A, 5A, 4A, and 3A. High schools in the four categories were included from across the state and were not limited to the three metropolitan areas. As a result metropolitan high-school location and high-school size were treated as independent from one another in data gathering and data analysis. The researcher referred to high-school size as a means of identifying high schools in the enrollment size of 6A, 5A, 4A, and 3A. Low income reported by high school size referred to the distribution of low income in the high schools in the four enrollment-size categories. Low achievement reported by high-school size referred to the distribution of low reading, mathematics, and science achievement on state assessments in high schools in the four enrollment-size categories.

6. Median household income. Median household income is the amount which divides the income distribution into two equal groups, half having income above that amount, and half having income below that amount. Mean income (average) is the amount obtained by dividing the total aggregate income of a group by the number of units in that group. The means and medians for households and families are based on all households and families. Means and medians for people are based on people 15 years old and over with income.

Significance of the Study

As shown in Chapter 2, low income and low achievement relationships have been the focus of researchers for forty years. The 1960s War on Poverty recognized that the effects of low family income carried over to the setting of the schools and that we should provide compensatory instruction to students from low income or poverty status in order to improve the quality of their educations. Chapter 2 also revealed that low income/low achievement studies have been fully extended to the content areas of reading, mathematics, and science. Furthermore, numerous interventions with students, families, and the community have been deployed. This study employed variables of high-school metropolitan location, high-school size, building rates of low-income enrollment, building rates of low reading achievement, building rates of low mathematics achievement, and building rates of low science achievement. This served to add to the research literature in terms of the number of subject areas. It further added to the research literature on low achievement in metropolitan locations. Finally, it added to the research literature on low academic performance rates in high schools of various sizes. More importantly, this was a statewide study.

Limitations for This Study

This was a foundational study that did not include instructional variables. In Chapter 5, the researcher was able to make recommendations for further research, but did not make recommendations for educational improvement, improved instructional methods, or new and improved curriculum. Second, this study was limited to Kansas. It will be necessary to replicate this study in other states to gauge the relationship between low achievement and low income. Also, we tend to think of large-enrollment high schools as being synonymous with metropolitan areas. That was not the case in Kansas; there were several large-enrollment high schools outside of the three Kansas metropolitan areas. Finally, building rates for low income and low achievement were used as the metric in this study since the Kansas State Department of Education reports them uniformly for all school buildings.

CHAPTER 2 - Review of Literature

Introduction

Coleman (1966) found that there is a definite relationship between low income and low school achievement. Researchers have supported this position and further enriched the literature on more diverse areas of the low income, low achievement equation. Bernstein (1994) noted that when more affluent families moved out of the core city area, the income gap between those living in the core city and those living in the suburbs widened. Others have studied the effect of school size and school location on achievement with respect to ways that low income affects school achievement. Raywid (1998) noted that smaller schools tend to have fewer discipline problems and higher levels of student participation and learning. Bernstein and Raywid have provided the conceptual framework for this study.

The researcher originally proposed a low income, low reading achievement correlational study that would examine the variables of school location and school size. As the researcher probed more deeply into the research literature, it became clear that mathematics and science achievement should be considered as important as reading achievement. Consequently, the researcher decided to investigate all three areas: reading, mathematics and science achievement.

General Literature

Crane (1996) conducted a statistical analysis of the determinants of test scores among elementary age children, with respect to the following variables: home environment, socioeconomic status and maternal test scores. Crane found that the effects of SES variables were smaller than those of home environments but the total impact of SES was still important.

Crane then added the following details: (1) a standard deviation increase in family income ($10,600) raised mathematics scores 2.9 percentiles, and (2) a standard deviation decrease in household size (1.14 persons) lifted scores 3.2 percentiles.

Levins (2002) also studied the effect of SES on student achievement. This study also examined the income level averages and parental educational attainment level averages in each school. An ANOVA showed no significance differences in academic achievement among samples of students selected according to average income of their parents. Levins reported that the children of parents with two years of college scored higher in mathematics than children of parents who had not completed two years of college.

Okpala, Okpala, and Smith (2001) conducted a study on the relationships between parental involvement, instructional expenditures, family SES attributes and student achievement. They conducted this study on fourth graders in a low-income area in North Carolina. They concluded that the percentage of students in free/reduced lunch programs was statistically significant in explaining differences in mathematics achievement scores in different schools. They also concluded parental volunteer hours per 100 students and instructional expenditures per student were not statistically significant in explaining differences in mathematics achievement. The effectiveness of parental involvement depended on the type of involvement, ethnicity, family income and home environment.

Robinson (2001) noted that other studies have not addressed the disparity of academic achievement demonstrated within the African-American population. Robinson examined whether low SES African-American students who were classified as achievers did better than those with the same SES background who were classified as underachievers. The results showed that the high achievers score higher than the underachievers. Robinson concluded that these findings are linked to school achievement and that further research is needed to understand this phenomenon.

White (1982) conducted a thorough review of the literature that considered the relationship between SES and academic achievement. White's review produced the following findings: (1) with aggregated units of analysis, typically obtained correlations between SES and academic achievement jumped to .73, and (2) family characteristics such as home atmosphere were substantially correlated with academic achievement when individuals were the unit of analysis.

Caldas and Bankston (1997) examined the relationship between the SES status of peers and individual academic achievement. They noted that peer groups have been found to influence behavior and attitudes in a wide variety of ways. They found that an individual's family poverty status, as indicated by participating in the federal/free reduced lunch program, does have a small, independent negative effect on academic achievement. They also found that an individual's family social status has an even greater positive effect on academic achievement. The effect of a schoolmate's family social status was significant, and it was only a little less significant than a student's own family background status.

Cunningham and Sanzo (2002) studied the effect of SES on standardized testing. They noted that SES is a very important factor in determining a student's achievement outcomes. They concluded that students' SES was related to the student's achievement. They were concerned about those who live in the poorer areas. They concluded that those in charge of making legislation should pay attention to the concept of diversity in Virginia and the United States. What they were worried about was that the same test should not be given to those who are poor and those who are not. They believed strongly in the effects of socioeconomic status and were concerned about the unfairness of standardized testing.

Gursky (1998) reviewed studies of the effect of reducing class size on school achievement, noting that the effects of class size had been investigated extensively. Gursky stated that to make the biggest difference in student achievement, educators should focus on the earliest grades and on low-achieving, low-income students. Gursky concluded that evidence has indicated that reduced class size benefits achievement, but that it is only one piece of an overall strategy. Gursky's review indicated that reducing class size was the most popular initiative in the country at that moment. The review also indicated that the students in the program scored significantly higher in reading, language arts, and math than students in comparison schools.

Elliott (1998) studied some important school finance questions. The questions revolved around how the allocation of public funds affects student achievement through access to opportunities to learn (OTL). Two of the conclusions in Elliot's study were as follows: (1) Money does affect student achievements, and (2) In schools where less money is used, classes tend to be larger and teachers are more likely to emphasize the relevance of math and science and memorizing facts in math and to make greater use of calculators. This contrasts with schools where more money is spent. In these schools, the teachers tended to emphasize higher-order thinking in math and were more likely to make greater use of computers in math. Teaching practices and classroom resources matter; however, Elliot reported that the mediating effects among finance, achievement of teaching practices, and classroom resources were demonstrated only in science classes.

Greenwald, Hedges and Laine (1996) reported that it has been proven difficult to determine the relationship between school expenditures and school achievement. They pointed out that much of the earlier work in the previous three decades has used similar methodology. In their 1996 study, they used an even more comprehensive collection of studies than had ever been surveyed before. They concluded that school resources are systematically related to student achievement and that these relationships are large enough to be educationally important. They added that global resource variables such as PPE (per pupil expenditures) showed strong and consistent relationships with student achievement. They then explained that resource variables that attempt to describe the quality of teachers (teacher ability, teacher education, and teacher experience) showed very strong relationships with student achievement. They emphasized that their findings should provide a clear direction for policy makers that money is positively related to student achievement. However, their results are not intended to specify the allocation of existing and new dollars in schools. They concluded that they do not argue that money is everything. They stated that how we spend the money and the incentives that we create for both children and teachers are equally important.

Payne and Biddle (1999) were concerned about unequal distribution of public school funding in the United States. They noted how public school funding varies from wealthy to the poor communities. It appeared obvious to them that huge differences in funding have generated huge differences in student achievement. This meant that those in wealthier schools would perform better than those in poorer schools. They did not mean that well-funded schools will always generate high levels of achievement but that the myth that the level of funding does not matter should be put to rest. They explained that it is hard to compete with other industrialized nations when the issues concerning poverty in poor schools are not addressed. They noted how difficult it is for the poorer schools to make up for the problems created by poverty.

Nyhan and Alkadry (1999) stated that south Florida is one of the fastest growing regions in the United States. They noted that an increase in revenue is necessary and sufficient to help raise student achievement scores by directly influencing class size and indirectly providing more funding for general expenditures on students. They added that most agree that socio-economic conditions of students are a strong predictor of achievement scores. They further stated that socio-economic conditions are outside the control of school districts and need community–wide strategies. They concluded that money can matter and noted that economic status is consistently the best predictor of student achievement. They also concluded that any effective strategies adopted to increase student achievement scores in communities should be grounded in improving the economic status of all citizens.

Sebold and Dato (1981) stated that there is considerable literature on educational public finances but not much on how money is spent. They added that the relative neglect of this issue is especially serious with respect to local services. They noted the link between school funding and student cognitive development is complex. In their study, they reached the conclusion that expenditures and cognitive development are directly related. They added that given the characteristics of a school district and its student population, the equalization of expenditures per average daily attendance would influence the examination scores of students in K-12 students of California.

Bracey (1998) discussed the optimal size for today's high schools. Bracey noted that arguments about the optimal size of high schools are often cast along the lines of specialization versus humanization. Bracey emphasized some findings from the fall 1997 issue of *Educational Evaluation and Policy Analysis.* In mathematics, the gains for low SES schools in the optimal size range (600 to 900 students) were larger than gains for two categories of high SES schools, those with fewer than 300 students or more than 2,100 students. For reading, there was no relationship between size and SES.

Howley, Strange and Bickel (2000) noted that many authors have endorsed small schools arguing they are educationally effective and especially beneficial for impoverished students. They reviewed recent thinking about small schools and their effects on school achievement. They concluded that a wide consensus seems to have emerged that schools larger than 1,000 are unwise for any community. They also emphasized that schools in impoverished communities should be much smaller.

Lewis (1999) reacted to the shooting incident in Columbine High School, noting the advantages of smaller schools. Lewis emphasized that the shooting probably would not have happened if this school had been smaller. Lewis further stated that the signals are growing stronger that a rejection of the depersonalization of schooling is under way, adding that charter schools re-create the smallness that seemed to be so much better for students and that at the high school level, charter schools rarely enroll more than 200 students. Lewis then mentioned that the career academies created in large urban high schools represent a dual effort to build a sense of family among the students enrolled and to connect them to the adult world in purposeful, educationally sound ways through internships and mentoring.

Nathan (2002) noted that throughout the United States, educators and parents are creating small groups through partnerships with the community and sharing facilities. Nathan added that in urban, suburban and rural areas, educators are consulting the latest findings on school size to construct and modify their schools. Nathan also stated the results of these efforts were encouraging, manifested in improved student achievement, higher graduation rates and better faculty morale. Nathan gave one example of such a school in Boston, a small charter school that combined Asian and American traditions of education to teach 290 students in grades 6-12. Nathan stated the results of this school were impressive. Although the school enrolled a high percentage of students from low-income families, all of its 10th graders passed the statewide English test, compared with about 75 % of the students in the state and about 67 % in Boston. Nathan noted that student scores in other areas of statewide testing are also above both state and Boston averages.

Noguera (2002) stated that as educators continue to experiment with numerous strategies for raising student achievement, it is clear that the greatest challenge is how to reform public high schools. Noguera reported that elementary schools have fared better than high schools in raising achievements. Noguera, however, noted some success stories of high schools in the United States with fewer than 200 students. Noguera stated that these schools provide a level of intimacy and support that is rare in most United States high schools. Noguera then made the following points: (1) students learn more in small learning communities; (2) the size of the school does matter, but quality matters more; (3) small schools should be created, not imposed; and (4) small schools need accountability just as big schools do. Noguera concluded that in thinking about ways to improve and reform schools, we should keep in mind what is at stake and why schools need to change.

Raywid (1998) advocated various ideas for downsizing schools. Raywid noted that solid research now links small schools to fewer discipline problems, lower dropout rates, higher levels of student participation, and more learning. Raywid reached the following conclusions about downsizing schools: (1) creating small schools whether anew or in newly subdivided school buildings may be one of the least expensive ways to transform present practices and outcomes, (2) deciding early on how to proceed with the downsizing effort allows for a gradual effort that is slower but has a better chance of getting off to a good start and building some success stories. (3) opportunities for sustained staff discussions should be provided throughout the process, and (4) schools undertaking these efforts should expect tradeoffs.

Literature Related to Reading Achievement

Anderson (2000) explored the relationship between parental involvement and reading achievement. Anderson's study was conducted in 1999, in a St. Louis public school. Ninety-five percent of the students received federally funded free breakfasts and lunches. Anderson noted that these low-income students did increase their scores in vocabulary and comprehension. Eighty-five percent improved in vocabulary and ninety percent improved in reading comprehension. Anderson concluded that parent involvement is a necessary part of the education process before and during the 18 years of school and the years prior to enrollment in school. Anderson also added that until family problems associated with poverty and welfare are solved, reading problems would continue to vex socially economically disadvantaged students.

Desimone (1999) examined the effect of parental involvement with children learning at school and at home. The relationships between 12 types of parent involvement and achievement in mathematics and reading among 8^{th} graders were examined in this study. Desimone indicated that the statistically significant differences existed in the relationship between parental involvement and student achievement according to the student's race-ethnicity and family income, as well as according to how achievement was measured, the type of involvement, and whether the student or parent reported it.

Hardy (1995) investigated the benefits of parental involvement and supportive child rearing styles on the educational performances of children. Hardy's study was particularly interested in generalizing previous positive findings to younger elementary-aged children whose families came from both middle-and low-income groups and lived in rural areas. The outcome variables that were studied included reading achievement, mathematics achievement, and teacher-perceived classroom performance. Hardy noted that the results from the previous positive parent-involvement findings could be generalized to younger elementary-aged children, children whose families live in rural areas, and children from medium-and low-income levels. Hardy concluded that parent support was not found to add additional variance to the outcome variables that were independent of family income, child ability and parental involvement

Hoerner (2001) explored the emergent literacy skills of 50 Spanish-speaking Hispanic preschoolers and examined home environment variables hypothesized to predict emergent literacy outcomes. Hoerner used SES acculturation, the quality of the home environment, reported early literacy home activities, and features of parent-child interactions as the measures of the home environment. Hoerner stated that the results indicated there was variability in the performance of Hispanic preschoolers on the measures of emergent literacy skills. Hoerner concluded that features of parent-child interactions mitigated the relationship of SES and the quality of the home environment on emergent literacy outcomes.

Molfese, Modglin and Molfese (2003) extended previous studies on the influence of environmental measures on intelligence scores by examining how proximal and distal measures of children's environments in the preschool period and in the primary-grade period are related to student performance on reading achievement tests. They concluded that both SES and home scores were found to be related to reading abilities, but preschool environment measures were more strongly and consistently related to and predictive of reading scores. They added that differences in the patterns of correlations and the results of the predictive models were found among the full sample and the poor readers.

Pierre-Pipkin (2001) found that African-American students who were in the same SES as white students scored as well or better on the Texas Assessment of Academic Skills (TAAS) reading and math tests. African-Americans from low-income communities' schools who attended schools in higher income communities perform 15 or more points higher than their white counterparts in both reading and mathematics.

Rashid, Morris, and Sevcik (2005) noted that past research has indicated that a significant relationship exists between young children's early home literacy environment and their reading related skills. They examined the relationship between parent's and children's home literacy activities and a child's academic functioning. Children from above-average and below-average socioeconomic levels were systematically included in the study. The results indicated that children's home literacy activities were not significantly related to any of their academic abilities, whereas parent's home literacy activities were significantly related to children's passage comprehension and spelling scores. They also stated that the relationship between the home literacy environment and reading may be different for children with and without reading disabilities.

Rush (1999) noted that children growing up in low-income environments have lower than average levels of reading achievement and higher than average rates of special education placement. Rush added that research suggested that this discrepancy could be linked to differences in experiences during the early childhood years. Rush also noted that a group of Head Start children's (n = 39) early literacy skills (letter-naming, phoneme blending, and onset recognition), and, expressive and receptive vocabulary skills were assessed and correlated with measures of caregiver-child interactions observed in the home. Rush concluded that children in Head Start demonstrated a range of early literacy and language abilities and variations in these skills were related to some aspects of the children's home environments. In particular, the degree of caregiver involvement, rate of language interactions and participation in early literacy activities were related to early literacy and language skills.

Segel (2000) promoted the success of reading early to young children. Segel reported literature that indicated the skills and habits of literacy are gradually acquired during the first years of life. Segel reasoned that low-income parents, with encouragement, coaching, and appropriate books, could provide a good reading start for their children. Segel started the reading program, "Beginning with Books" with the objective of helping children to read. She stated that one of the goals of the program was to send out new children's books to low-income children. Segel indicated that the program was evaluated for four years by outside evaluators. This outside evaluation showed that kindergarten teachers rated students in the project significantly higher in language and reading ability than a control group. Segel noted that "Beginning with Books" as of 2000 had more than 225 volunteers, who regularly read to kids, one-on-one, at libraries in low-income neighborhoods.

Shaver and Walls (1998) examined the effects of parent-school involvement on the reading and mathematics achievement of Title I students in the 2^{nd} through 8^{th} grades. Shaver and Walls also examined SES and student gender to determine their relationship to the level of parental involvement. They noted that correlations coefficients were also used to assess the relationship of SES and gender factors to reading and math achievement. They concluded that parental involvement is a force influencing student's academic success. They added that the effect held for total reading achievement, reading comprehension, total mathematics achievement and application of mathematics concepts.

Wright (1999) examined the effect of student mobility on achievement test scores. Wright noted that other risk factors such as low family income and ethnic minority status were often found to influence mobility equally. Wright indicated that low achievement scores were associated more highly with internal mobility (students moving within the school district) than with external mobility (students moving in or out of the school district). Wright concluded that mobility was associated with family income and ethnic category memberships and had less effect than either of those two factors.

Chambliss (1980) explored the effectiveness of a Title 1 program on reading achievement. The main goal of the Title 1 program was to improve the educational performances among low-income students. Two of the more important questions asked were: (1) Is there a difference in reading achievement between students in Title 1 pullout classes and students in Title 1 mainstream classes? and (2) Is there a difference in reading achievement between students whose Title 1 teachers are experienced and whose Title 1 teachers are inexperienced? Using ANCOVA for data analysis, Chambliss concluded that there were no consistent relationships existed between reading achievement of students and the two types of instructional settings (pullout and mainstream) and the two levels of teacher experience (experienced and inexperienced).

Cobb (2001) investigated the effects of an early intervention tutorial program on at-risk children's reading achievement. The at-risk children in this study were first, second and third graders. The population of the first school was composed of 75% economically disadvantaged students. The second school was composed of 33% economically disadvantaged students. Cobb concluded that the t-test for independent samples revealed that the experimental group outperformed the control group on the vowels subtest and on total reading score at the first-grade level. Cobb added that no statistically significant differences were found in grades two and three.

Davenport, Arnold, Lassman and Lassman (2004) determined the effect of cross-age tutoring on reading attitude and reading achievement. The students in this study were all learning disabled. The fifth graders were assigned to tutor their kindergarten peers. Eighty-two percent of the district's population was Hispanic. Seventy percent of the student population was from low-income families. Davenport et al. concluded that the special education students were successful in tutoring their younger peers. They added that both groups revealed an overall positive attitude towards reading before the implementation of the tutoring program. They found that the academic gains made by the special education students in reading implied that the opportunities provided by the tutoring program had a functional relationship to academic performance. They stated that increased time in actively engaged reading opportunities and other literacy-related activities promoted reading growth for many students.

Jett (2001) extended the findings of the 1997 and 1998 Student Achievement Guarantee in Education (SAGE) program. Jett stated that this program promoted the academic achievement of students in kindergarten through the third grade in schools serving low-income children by reducing the student-teacher ratio in classrooms to 15:1. Results of the regression analysis showed that two variables--promotion of active and dynamic learning behavior and the content of professional development sessions with a range of activities moving from theory to practice--were statistical predictors of reading achievement, accounting for 21% of the variance.

Jones, Staats, Bowling, Bickel, Cunningham and Cadle (2004/2005) conducted a quasi-experimental research study to evaluate the effects of its reading software on middle-school students. The 2000 U.S. Census Report showed approximately 37% of children less than 18 years of age in Calhoun County lived below the poverty line and 285 persons over five years old had a disability. Jones et al. concluded that seven of their nine SAT-9 dependent variables had a statistically significant and positive coefficient. The dependent variables were reading vocabulary, reading comprehension, math problem solving, math procedure, language expression, science and social science.

Jeynes and Littell (2000) conducted that a meta-analysis of fourteen studies that examined whether whole language instruction increased the reading skills of low-SES students in grades K-3. They examined the effects of three modes of instruction (whole language, basal, and eclectic) on the reading achievement of students. They concluded that the evidence suggested that low-SES primary school children do not benefit from whole language instruction, compared to basal instruction.

Hiebert and Pearson (2000) examined on the research agenda of the federally funded Center for the Improvement of Early Reading Achievement (CIERA). Their research found the following: (1) there is no single best approach to early reading instruction, (2) differentiated instruction that utilizes community and families resources was particularly effective with children who have difficulties learning to read, and (3) commercial reading programs and state standards do not necessarily provide the features that support literacy acquisition among low-income children.

Watson (2003) examined on the success of a reading and math-tutoring program that focused in on kindergarten through the 12th grade. Watson stated that this program was serving a school district, in which more than 70 % of the students qualify for free or reduced price meals and about 40 % of the kindergarteners never attended a pre-school or day-care center. Watson noted that the tutors were monitored throughout the year and an outside evaluator was retained to gauge the effectiveness of the program. Watson reported that classroom teachers had already said that they were seeing signs of success in that students read better and were more willing to read aloud.

Yan and Lin (2005) explored the effects of two kindergarten-program organization factors--length of school day and class size--on kindergartners' reading, mathematics and general knowledge achievement at the end of the kindergarten year. Yan and Lin stated that a slight positive relationship was found between small class size and children's achievement in reading and math, particularly for children from minority and lower SES backgrounds. They concluded that no relationship existed between class size and general knowledge achievement. They also added that the relationship between full-day program and the three early academic skills was positive and statistically significant. Almost all children made slightly higher gains in full-day programs compared with their counterparts in part-day programs.

Esposito (1999) investigated the relationship between school climate and social development in the early elementary school years, controlling for maternal education and family resources. Esposito sought to determine whether factors underlying school climate influence those outcomes. Esposito stated that the children and families studied were low-income minority students living in chronically poor urban neighborhoods. Reading and mathematics results were measured with standardized tests. Esposito concluded that results indicated that overall climate and teacher-student relationships significantly predicted social skills in the first and second grades and mathematics and reading achievement scores in the first grade.

Hallinger, Bickman and Davis (1996) explored the nature and extent of the school principal's effects on reading achievement in a sample of 87 U.S. elementary schools. Their study responded to prior critiques of the literature in school administration by formulating and testing a multidimensional model of the school principal's effects on student learning. They concluded that results indicated that principals had no direct effect on student achievement; however, the results supported the belief that a principal can have an indirect effect on school effectiveness through actions that shape the school's learning climate. Hallinger et al. added that they found that a principal's leadership itself is influenced by both personal and contextual variables (SES, parental involvement, and gender).

Mosenthal, Lipson and Torncello (2004) examined the contexts and practices of six Vermont schools whose students met or exceeded standards set for performances on statewide reading tests administered in the second and fourth grades. In their study, the demographic data on all elementary schools in Vermont were used in a cluster analysis to identify those elementary schools serving low-, middle-, and high-socioeconomic status communities. Two high-performing schools and one low-performing school were selected from each cluster. Mosenthal et al. concluded that all SES clusters had high performing schools and that among these schools, instructional approaches varied. They identified factors common to successful schools and absent in less successful schools. Two of these factors are that: (1) within these schools, the commitment to literacy improvement had remained strong over an 8-to 10-year period, with stable administrative and curricular leadership in literacy instruction and (2) the school community was focused, working toward a shared vision of student achievement, with open communication among the faculty.

Nye, Hedges and Konstantopoulous (2000) noted that the effects of class size on academic achievement have been studied for years. They noted that some scholars have contended that the effects of small classes are larger for minorities and the disadvantaged. They stated that these claims have led to policy decisions to implement small classes to reduce inequality in educational outcomes. They concluded that smaller-class-size effects on reading and mathematics achievement were somewhat larger for minorities and low socioeconomic (SES) students. They also noted that the differential effects for minority students (interactions) were statistically significant only for reading achievement in one of the models examined, but not for the others. They concluded that while there were unambiguous positive effects of small classes on both reading and mathematics achievement, there was no evidence of differential effects for low SES students and only weak evidence of differential effects for minority students in reading achievement.

Dharma (1994) examined the relationship between student characteristics, preschool resources, school process variables and fifth-grade student academic achievement in Pennsylvania Elementary Public schools. Dharma stated that the results indicated that the background unique to Pennsylvania families had a strong influence on student achievement both in reading and mathematics. Dharma added that student achievement seems to be lower in the low SES group of schools as compared to student achievement in the high SES group of schools. Dharma concluded that parental involvement had the greatest effect on the school mean reading achievement in the low SES group of schools.

Literature Related to Math and Science Achievement

Dunnan (2001) determined the effect of block scheduling on student achievement in public high schools in Illinois. Dunnan noted that this study also examined the factors of teacher-in-service, curriculum changes, and financial allocations for schools that adopted a block schedule design. The degree to which all three factors related to student achievement was the primary focus of this study. Dunnan found that the block effect did not have any significant negative impact on science achievement at grade 11. Dunnan also found that after controlling for the percentage of low-income students, average class size, percentage of student mobility, and expenditures per pupil, student science achievement in Illinois block-schedule high schools was slightly lower than student achievement in Illinois non-block high schools.

Green (1993) questioned whether magnet classrooms differed from non-magnet classrooms in terms of gender, race, income level and achievement in reading and mathematics. Green noted that while most research on magnet schools has been conducted in large urban districts, this study was conducted in a small district of 5,600 students. Green concluded that magnet classrooms have significantly more girls, significantly fewer minority and low-income students, and significantly higher reading and mathematics achievement test scores than did non-magnet classrooms.

Gordon, Rodgers, Comfort, Gavula and McGee (2001) tested the effectiveness of the teaching method known as Problem-Based Learning (PBI) on the science achievement of low-income students. The student population was 100 % minority, 90 % African-American, and 10 % Hispanic. Gordon et al. found that the science grades for the cohort starting PBI in the sixth grade indicated a trend for an increase in the sixth grade (9 %) and a significant difference in the seventh grade (26 %). In the cohort starting in the seventh grade, a significant difference was found in both the seventh grade (80 %) and eighth grade (31 %) final grade reports. They concluded that use of this method could improve science achievement for urban minority students.

Haycock (2001) stated that a relationship exists between income and achievement. Haycock pointed out that there has been much improvement among poor and minority students. Haycock noted the improvements in the 1970’s and the 1980’s, but also noted the decline in the 1990’s. Haycock then asked the reasons for these results. Haycock stated that poverty, parental involvement, violence and single parents are important reasons and then she noted the importance of better schools. Haycock added that in survey after survey, young people said that they were not challenged in school, a situation that is worsened in the high-poverty schools.

Henderson and Royster (2000) explained that the purpose of the Appalachian Rural Systemic Initiative (ARSI) was to help low-income students in mathematics and science achievement and technology. Henderson and Royster described ARSI as a “bottom-up” team approach to school reform. They noted that the student achievement data for the ARSI catalyst schools validate the impact of the ARSI model. The catalyst schools that started the program during its first year (having had ARSI interventions for two full years) showed a dramatic increase in student achievement in both mathematics and science. They indicated that in science, students scored above the combined state’s average and were significantly higher than comparison districts in the Appalachian region. They concluded that the individual school data revealed even more dramatic results. They noted in individual schools that had ARSI interventions in science, the student achievement in science exceeded the state average in all assessment sub-domain areas, whereas student achievement in all other content areas was below the state average.

Jacobson (2004) noted that nationally certificated teachers were more effective at raising their students’ reading and mathematics scores than were teachers who had applied for the credential but did not receive it. Jacobson also indicated that researchers have found even more significant results for younger pupils and for children from low-income families. This study’s main emphasis was on the importance of having nationally certificated teachers. Jacobson stated that critics have questioned the significant amount of money that has been spent on training teachers certificated by the organization known as the National Board for Professional Teaching

Standards. Jacobson further noted that the researchers did not conclude that the certification process itself created teachers who are more effective. They indicated the importance of the teachers' career path. Jacobson added that if teachers don't want to stay in the profession, then there would be no direct benefits to the students.

Lee (1990) attempted to find clearer insights on the effectiveness of computer-based mathematics. Lee performed a meta-analysis of 72 studies. Lee indicated that the seventy-two studies were collected from published studies, ERIC documents and dissertations. Lee stated that effectiveness was measured in terms of mathematics achievement, problem-solving skills, and attitudes toward mathematics instruction and computers. One relevant result was that students from average-and high-income families have higher average effect-sizes than students from low-income families.

Fantuzzo, Davis, and Ginsburg (1995) examined the unique effects of parental intervention (PI) and the combined effects of parental intervention and reciprocal peer tutoring (PI +RPT) on self-concept and mathematics achievement for low-achieving, low-income, urban elementary school students. Their post hoc comparisons of these means indicated that students in the PI +RPT conditions had significantly higher average rates of accurate computations than did students in the PI and the practice control conditions. There was no significant difference between the means of the PI and practice control conditions. They also conducted a one-way ANCOVA across the comparison groups for the computations of the Standard Diagnostic Mathematics Test (SDMT). Post hoc comparisons of these means indicated that students in the PI+RPT conditions had significantly higher standardized computations scores than students in the practice control conditions.

Lin (2003) noted that parental involvement in children's learning at school and at home was considered a key component of school reform, but more information was needed about how patterns of involvement vary for kindergartners from disparate racial-ethnic and economic backgrounds. Lin's results indicated that parental involvement explained more of the variations in general knowledge achievement than reading and mathematics achievement, especially for Asian children. Lin added that among the five parental involvement composites, school involvement and home resources were the strongest predictors of academic achievement for all children, and taking part in extracurricular activities was associated with all kindergartner's achievement except for Black minority and low-income children. Lin concluded that White and nonpoor children, who could benefit from their more advantaged SES background were not influenced by parental involvement as much as the minority and poor children.

Magnuson (2002) indicated that a positive association between parental education and children's well being, particularly academic achievement, was one of the most consistent findings from developmental studies. Magnuson demonstrated that children's reading, but not mathematics achievement improved when their mothers returned to school on their own volition. Magnuson concluded that although mandating education may not be an effective form of intervention, welfare policies that discourage economically disadvantaged mothers from attending school might be detrimental to young children's well being.

Pungello, Kupersmidt, Burdinal and Patterson (1996) examined the long-term effects of low income and stressful life events on mathematics achievement test percentile scores for over 1,200 children. They concluded that those students with a lower cumulative risk model index scored significantly higher than those with a higher index. They also noted that European American children not living in a low-income home who had not experienced any stressful life events during this study obtained the highest mathematics achievement scores and that these scores increased over time. They also found that African-American children living in a low-income home who were exposed to stressful life events obtained the lowest achievement mathematics scores, and these percentile scores decreased over time. Pungello et al. concluded that low family income and minority status are significant predictors of children's academic achievement over time.

Romero (1988) explored the relationship between children's perception of parental behaviors and the variables of self-concept, educational aspiration, and academic achievement. The specific goal of this study was to gather a more accurate understanding of how low-income Mexican-American children perceived parental behaviors. Romero stated that 135 Mexican-American children from low-income neighborhoods in Santa Barbara, California, were recruited for this study. The results of this study indicated that significant relationships were found between children's perceptions of parental behavior and mathematics achievement scores. Romero also added that children who perceived their parents as being accepting, encouraging autonomy and firm in their discipline tended to have higher mathematics achievement scores.

Temple and Reynolds (1999) investigated the effects of school mobility on reading and mathematics achievement on low-income African-American children in the Chicago area. Temple and Reynolds tracked the scholastic and social development of these students who lived in a high-poverty neighborhood in the Chicago public school area. The students lived in low-income neighborhoods in which families were eligible for Title 1 services. The results of the mathematics achievement performances were as follows. The average standardized test score of 140 in mathematics for Title 1 grade 7 students was significantly below the national average of 156 and the average mathematics score for students in the Chicago area was 145. The relationship between achievement and mobility was estimated using the total number of moves as measures of mobility. They noted that an additional move lowers mathematics achievement scores by 1.19 points. Their results indicated that the number of school moves between kindergarten and grade 7 is negatively associated with mathematics achievement at the end of grade 7.

Von Secker (2004) noted that one of the most commonly investigated risk factors for students is low SES. Low achievement is attributed to the paucity of resources available to persons with low income, which results from low levels of parental education, low-status parental occupation, large family size, and the absence of one parent. Empirical findings, according to Von Secker, show that risk factors have a reciprocal relationship with one's social status. Von Secker found that low achievement among students who lived in poverty is attributed, in part, to lack of academic and social support that results from low levels of parental education and from access to fewer learning resources at home. On average, science achievement of all students in grade 4, 8, and 12 were significantly higher when one or more parents had graduated from college and when home environments were more advantaged, regardless of which school those children attended. Von Secker concluded that while science achievement among children from families of average SES or above remained higher, the gap in achievement for poor children with or without these resources widened between 4 and 12 grades.

Wilson and Martin (2000) built a model for explaining variations in test scores among elementary schools in Toledo, Ohio. They stated from the perspective of the unequal access to educational resources view, children from low-income families tended to live in poor areas, go to poor schools, and receive inadequate education. They also stated that children from well-to-do families tended to live in more affluent areas, go to well-endowed schools, and receive a good education. The two examples that they used were New Tier High and Du Sable High. They noted that New Tier has superior science lab equipment and up-to-date technology while Du Sable has makeshift science equipment.

White (2001) studied the extent to which SES factors, demographic factors, parent and student attitudes, and parental involvement were associated with mathematics achievement. White's results implied that each of the six scales used from the Fennema-Sherman Mathematics Attitudes Scales were significantly associated with the mathematics scores, computation scores, and composite scores of the Terra Nova Standardized Achievement Test. Family annual income, parent's educational level, and parental involvement were also significantly associated with mathematics achievement, SES and attitudinal factors were the most powerful predictors of mathematics achievement while student gender and parental involvement were not strong predictors.

Biddle (1997) focused on poor funding and poverty among children as two causes of achievement problems. Biddle was interested in both mathematics and science achievement. Biddle was especially interested in the 1996 science achievement that was reported in the National Assessment of Education Progress (NAEP) data. These data provided information about the average eighth grade achievement scores for public schools from 40 of the 50 states. Biddle concluded that school funding and poverty are major predictors of state differences in achievement and with science achievement the impact of child poverty is very strong at the state level.

Boggs (2003) explored the degree to which school and community factors influence mathematics and science achievement in public schools in Georgia. Boggs found statistically significant correlations that documented lower academic performances in science related to low income (eligibility for free lunch) as well as high unemployment, high infant mortality, high enrollment in remedial classes, high drop-out rates, low number of adults with high school diplomas, and low enrollment in gifted classes. Boggs concluded that this study confirms the powerful influence of poverty along with infant mortality, unemployment, and school attrition in Georgia on academic achievement.

Holliday and Holliday (2003) reacted critically to the data from the Third International Mathematics and Science Study (TIMSS). They cited problems such as language, sampling of students, and differences among curriculum across various nations. They then stated what they believed to be the sources of real problems linked to school achievement. They believed that TIMSS seldom mentions other sources of statistical variance factors such as income levels of parents, home environments, state and local government funding allocated to public schools, educational and income levels of parents, and other characteristics of student learning unrelated to schools. They added that funding and income together account for 53 % of the variation in average United States science achievement. They concluded that some teachers were fortunate enough to work in "well-off" communities and have students that generally succeed academically while some other teachers, working in struggling communities, experience different results.

Morey (1996) determined the relationships among science achievement, science efficacy and school climate in public elementary schools. The relevant results in Morey's study were: (1) student science achievement was higher in schools where the teachers had a higher sense of personal science teaching efficacy, (2) as the teachers' sense of affiliation with the school and colleagues increased, their belief that science teaching can affect science achievement decreased and (3) the teacher's sense of affiliation with the school and colleges decreased as the proportion of either white or low-income students enrolled increased.

Adenika-Morrow (1995) noted the high dropout rate for African-American and Hispanic students in today's public schools. This author was interested in how the Teaching Excellence for Minority Student Achievement in the Sciences (TEMSAS) program helped these students. A group of 483 pre-adolescent youths from low-income urban families participated in the summer component of the TEMSAS program. The teachers in this program reported the results of the study during daily debriefings and exit assessments. Adenika-Morrow cited the increased pleasure, the participation, and the demonstration of skill and competence the students experienced from the mathematics and the science investigations and experiments observed by the teachers.

Atwood and Doherty (1984) evaluated the effects of the Mathematics, Engineering and Science Achievement (MESA) program in helping underrepresented minorities in high school mathematics and science. The MESA program was supported in California by a partnership between business and industry and the University of California and the California State University system. Scholars in the field have noted many low-income and minority students don't usually get to the Algebra 1 level. Further, they don't receive nearly as much mathematics and science as they do reading. The MESA program was thought to benefit those low-income and minority students and gave them those opportunities that they had been seeking. The results of the first study suggested that MESA was successful in encouraging minority students to prepare themselves to pursue mathematics and science classes when they get to college. The majority of MESA students were taking classes in mathematics and science in college at the time of this study.

LeTendre, Wurtzel and Bouchris (1999) described how Title 1 of the Elementary and Secondary Education (ESEA) was helping low-income students in math and science achievement in the Memphis City Schools (MCS). The Memphis City schools drafted two standards for its mathematics and science curricula: increased student achievement and increased numbers of students enrolling in courses beyond Algebra 1 and physical science. It has also established two summer programs--an Algebra Summer Camp and the Science, Technology, and Algebra Institute--that promote hands-on learning of mathematics and science.

Rodriguez, Jones, Pang and Park (2001) studied the effectiveness of a university outreach program in San Diego, California. The program, conducted at San Diego State University, was a federally funded outreach program. This program’s goal was to increase the student’s competency in mathematics and science. The second goal was to promote the student’s academic and cultural identity. The program was composed of tenth graders from low-income backgrounds. About 60% reported that their first language was not English. In 1998, the overall mean score of students enrolled in this program increased from 20.21 to 24.00. In 1999, the overall mean score increased from 20.16 to 25.30. Success was further indicated by the students’ subjective responses. Students reported that they felt safer at the summer setting than their regular school site. Some noted that they felt like they belonged. Rodriguez et al. concluded that the program was generally successful but that they didn’t know the long-term academic impact of the program.

Hanich and Jordan (2004) studied the achievement-related beliefs of third-grade children with mathematics and reading difficulties. They were interested in the reading and mathematics skills of reading difficulties students (RD), mathematics difficulties students (MD), students with the combination of both of these problems (MRD) and normal achievement students (NA). Many of these students were low income students. The writers found that there was a positive relationship between the children's competence judgments in mathematics and their mathematics achievement scores. They stated that teachers should help students develop positive but accurate perceptions about their abilities. They added that there are motivational and achievement consequences to children's self-perceptions and perceptions are important predictors of future achievement behavior.

Lee (2003) focused on students who were in the process of acquiring the language, culture, and discourse of the American mainstream. Lee noted that these were non-White students whose home language was not English, and they often resided in low-income families. Lee emphasized that it is important to use linguistic and cultural resources that the students bring to the science classroom, even though these student resources may not be easily recognized by the mainstream. Lee also added that caution should be exercised in interpreting general patterns among diverse student groups. Lee stated that overemphasizing differences between groups tend to mask variations within a group or among individuals. Lee further stated that understanding involved integrating new knowledge with prior knowledge and experience. Lee added that traditional textbooks often do not use examples from diverse backgrounds. Lee expressed the concern that some teachers might find it difficult to communicate with these types of students, concluding that some teachers might even assume these students have no prior knowledge.

Lynch (2001) noted that the science reform movement has failed to respond adequately to the diversity of today's student population. Lynch added that recent international comparison studies showed that students in the United States are far from the goal to be first in the world in science and mathematics. Lynch noted that the important corollary goal of science education reform has been to close achievement gaps among the underserved including linguistically and culturally diverse students. Lynch suggested the following as being needed to improve science education: (1) a better understanding of the nature of science and its interplay with teaching and learning and (2) a willingness to confront the institutionalized inequities in opportunities to learn, mostly still untouched by reform.

Ma (2001) examined the stability of socioeconomic gaps in mathematics and science achievement among Canadian schools. Ma's research questions were the following: Which student and school characteristics affect mathematics and science achievement, and which student and school characteristics affect the within schools socio-economic gap in mathematics and science achievement? Ma concluded that family structure, SES, parent immigrant status, and age had important effects, whereas gender and family size had marginal effects. School characteristics were also related to the school average achievement in mathematics and science. Ma added that within schools socio-economic gaps in achievement were highly correlated between mathematics and science and this correlation was not much affected by student and school characteristics.

Ma and Klinger (2000) examined the influence of student and school factors on sixth grade student performance in mathematics, science, reading, and writing in New Brunswick, Canada. About one-third of New Brunswick's population speaks English. Research literature in general claims that racial-ethnic differences in academic achievement disappear once SES is considered. Their study indicated when SES was taken into account, the relative effect of Canadian native Indian ethnicity on science, reading and writing achievement remained as strong as its absolute effect. They added that native ethnicity was the single most important variable in their study, with more than twice the effect of SES in three out of the four subject areas. They concluded by asserting that such a result has rarely been observed, and that the underachievement of native Indian students is not attributable merely to their SES, but, perhaps, to their unsuccessful incorporation into the mainstream culture.

Archer (1984) reported that American students have been performing poorly in mathematics when compared to other major industrial nations such as England, France and Japan. Archer also noted that one reason for the low mathematics scores is that of a general lack of contact with the mathematics curriculum. Archer stated that research has shown that performances for all students, and African-American students in particular, relates to the amount of mathematics studies completed. Archer concluded that a number of methods of teaching are available to disadvantaged students at all ages. Archer emphasized methods such as individualized instruction, remedial pullout and small group instruction. Archer noted that no single best method is best at helping these types of students. Archer stressed the importance of taking enough mathematics classes and that schools should be organized so that low achievers can take classes that are appropriate for them. Schools should be flexible and have options open as long as possible.

Ballon (1999) noted that curriculum tracking could be viewed as a system of social stratification within high schools. Ballon indicated that research has shown that low-income and minority students were overrepresented in non-college tracks and underrepresented in college tracks. The results of Ballon's study showed that pre-high school factors played an important role in high school mathematics track assignments. Prior mathematics achievement was a primary factor predicting the mathematics track. Other important factors included student background, school composition, and student coursework. For Mexican-American students, underrepresentation in the college and honors mathematics tracks was primarily due to lower eighth-grade mathematics achievement. Ballon concluded that enrollment in college and honors mathematics tracks significantly increased twelfth-grade mathematics achievement and the likelihood of graduating from high school.

Burris, Hebuert and Levin (2004) were interested in the effects of advanced mathematics classes on students at South Side Middle School in New York City where tracked math classes were eliminated. Research had indicated that low-achieving students could fall further behind if they continued in low-level classes. These authors cited the current standards movement and its belief that virtually all students can reach high levels of achievement if they receive high-quality curriculum and instruction. There was a statistically significant increase in the percentage of all students who took math classes beyond Algebra 2 in high school. This benefit applied to every subgroup tested. Some of the subgroups were low-income students, African-American students, Latino students, and average learners. Burris et al. also noted that the rates at which each group took pre-calculus also increased. They concluded that as long as the curriculum is rigorous, heterogeneous mathematics classes can benefit all students.

Gamoran, Porter, Smithson and White (1997) noted that low-achieving, low-income students are often tracked into dead-end mathematics classes in high school. Consequently, transition classes were designed to bridge the gap between elementary and college-preparatory mathematics and to provide access to more challenging and meaningful mathematics for students who enter high school with poor skills. The results of their extensive study found these transition classes to be a partial success in upgrading the quality of mathematics for low-achieving, low-income high school students. These classes were less successful than the college-preparatory mathematics classes but more successful than the general-track mathematics classes. Their study showed that low-achieving, low-income high school are capable of learning much more than is typically demanded of them.

Nuttall and Van Hell (2001) looked at the Massachusetts Comprehensive Assessment System (MCAS) data for the 10th grade from the year 1998 to determine if there were differences between low-income student achievements when types of courses taken previously were considered. They found that science achievement scores and the independent variables had a significant overall ($r^2 = .42$) effect for achievement scores. Regression results indicated that courses taken previously in science accounted for .34 of the variance and that race accounted for .14 of the variance and SES and gender combined accounted for .06 of the variance. They concluded that in mathematics and science, the types of courses taken previously account for more of the variability than low income.

Muller, Stage, and Kinzie (2001) were concerned with the lack of women, people of color, and the poor in the science, mathematics, and engineering fields. Muller et al. examined various factors related to precollege science achievement: SES, positive attitudes toward science and mathematics with increased science achievement, number of science courses taken, and the amount of time spent on learning various skills such as how to complete homework and how to be attentive in class. They found that SES was significantly related to growth rates for African-American females. For all other subgroups, the science achievement gap between low SES and other SES students remained large but constant throughout high school with all other things being equal. The gap between high and low SES African-American females that existed in the eighth grade widened as they progressed through the high school years.

Teitelbaum (2003) studied the influence of high school graduation requirement policies in mathematics and science on student course-taking patterns and achievement. “A Nation at Risk” (1983) made it clear to many that something had to be done to improve student’s academic achievement. One way was to make students take more classes, especially in the areas of mathematics and science. Findings indicated the high school graduation requirements did influence students to take more credits in science and mathematics. However, it was unclear how well these requirements encouraged students to take higher-level courses in those subjects. The results indicated that the new graduation policies did not lead to improvement in student proficiency in mathematics and science.

Wang and Goldschmidt (2003) studied the importance of middle-school mathematics in high school student's mathematics achievement. They noted that inequity in student course taking has become a national concern. They asserted that low-income students have been denied access to quality mathematics classes and that this pattern has been going on for some time. They found that the distribution of mathematics courses taken among various subgroups not only differed in grade 8, but the gap was wider by grade 11. They found that White and Chinese students were overrepresented in advanced courses and that Hispanic and African-American students were underrepresented. On the other hand, Hispanic and African-American students were overrepresented in remedial course enrollments. This situation did not improve between the 8^{th} and 11^{th} grades.

Summary of Trends in Low SES, Low Achievement Literature

Both basic and emergent trends are revealed in the literature on low student-family income and low academic achievement. The following will summarize these trends and reiterates the central elements in this study.

1. The low student-family income, low-achievement relationships continue to be acknowledged by educators, writers, and researchers as central factors in student achievement; however, research has sought to further refine our understanding of these relationships.

2. The research on low student-family income and its impact on student achievement tends toward using multiple measures for academic achievement. The income-reading relationship has been supplanted with combinations of achievement such as reading-mathematics, reading-science, mathematics-science, and reading-mathematics-science achievement measures.

3. School funding is another emerging issue. Here researchers have looked to the amount of funding schools receive, noting that support for instructional interventions may be lacking and that increased funding, in general, may produce increased achievement results. Separately, there is the issue of equity in funding. Results show that within districts, differential spending on schools is producing different results with less well-supported schools producing poorer results. The same is true for schools within states and schools between states. Related is the issue of American's relatively low standing in international testing. Some are pointing to our failure to adequately educate our low SES student population as the main factor for our lower standings in international test results. Finally, it is possible that science achievement is most negatively affected by lower levels of financial support to the schools.

4. High school size may be an important factor in the low student-family income and achievement relationship. However, the emphasis should remain on high-quality programming even as smaller-sized high schools and learning communities are considered. Certainly, high quality charter schools may be considered a factor in right-sizing schools.

5. The parent involvement factor is an important variable for the low SES learner. Parent educational level and income are first factors. The quality of student-family transactions is another. In other words the family must be positively involved in the student's education. Furthermore, the family involvement must be specific in nature to the extent that the family is

supportive of specific educational activities and learning tasks. The question of low-income families being under stress is crucial. Not only does this include financial stress but also emotional stress stemming from significant family problems, other than lack of income.

6. Spending of additional money for instructional resources appears to be positively related to school achievement; however, the money must be spent wisely and on specific factors related to low-income student performance.

7. Interventions to compensate for low student-family income are numerous. Main factors for interventions include, first, the involvement and education of parents so that they can better understand how to support the education of their children. A teacher's willingness to work with and educate low-income students is important; however, the teacher's skill in teaching low SES students may be more important. Smaller class sizes receive considerable emphasis in the literature on educating low-income students; however, simply reducing class sizes produces only marginal results. Mathematics and science represent unique subject fields in the low income-low achievement relationship. Low-income students must first be given full access to higher level mathematics and science courses and curriculum before remedial and compensatory interventions are deployed. Moreover, remedial, compensatory, and supportive interventions may be most effective if they are deployed while low income students are confronting higher level mathematics and science classes.

This study presents the results of a statewide study of low income and low student achievement in Kansas high schools. The researcher used achievement data from reading, mathematics and science achievement. School size was also a variable that was examined as was school location. Low income student's performance in metropolitan schools has been intensely studied over the years. Since Kansas has three metropolitan areas in the south, east central and eastern locations, the researcher elected to compare low income/low achievement correlations among the three metropolitan locations.

CHAPTER 3 - Research Methods

Chapter 3 is reported in four sections entitled conceptual framework, research methods, setting and population, and expected outcomes.

Conceptual Framework

There were several factors that the researcher brought together into a conceptual framework for this study. These factors were described in Chapters 1 and 2 and are summarized here. An overarching factor was represented by students from low income families and their low academic achievement. Researchers have long understood that low-income students have a tendency to experience low academic achievement. Another factor was Bernstein's position (1994) that large income differences between core cities and their outlying suburbs would moderate economic development. The researcher reasoned that educational productivity in these settings would likewise be compromised in the schools encompassed by the metropolitan area because of wide income differences. Moreover, the low income and low achievement correlations would reflect income disparities by being higher where income differences were higher. A second important factor in this study was school size. Writers such as Howley, Strange, Bickel (2000) and Nathan (2002) have promoted the idea that smaller schools in impoverished areas can be more productive on factors such as educational effectiveness, student achievement, graduation rates, and faculty morale. However, for this exploratory study, the researcher studied high-school metropolitan location and high-school size as two separate variables. School size is sometimes specifically tied to low-income student status, but not always. Thus, the researcher included high-school size as a variable along with metropolitan school location.

The researcher acknowledged a key factor in low student income and low achievement relationships. Disparities in school funding are shown by lower financial support for schools in low income areas, while schools in higher income areas receive better financial support. Funding was not a variable in this study, but disparities in funding between schools can explain some of the differences in performances between inner city and suburban schools.

Finally, this study was proposed and accepted with reading as the achievement area. However, in conducting a review of the literature on low income and low achievement, the researcher found that low achievement was of equal concern in the areas of reading, mathematics and science. Since the Kansas Report Card had data on all three achievement areas, it was logical that the researcher expanded the study to include data from the achievement areas of reading, mathematics and science.

Research Methods

The data for this study came from the "Kansas Report Card" for the 2002-2003 school year. The Kansas Department of Education (KSDE) collects data on all schools in Kansas and this includes the building rates for low income enrollment as well as the reading, mathematics and science performances scores derived from the Kansas assessment battery. The data for this study were found at the KSDE website: http://online.ksde.org/card/. This website houses the Kansas Report Card. The data is stored and can be retrieved by county, districts in the county, and school buildings in the districts. This is a public database to which all citizens have access. The researcher made a standard application to the Kansas State University IRB (Institutional Review Board) for approval concerning the rights of human subjects. The application was reviewed by the board and the decision was made that this study was exempt from rights of human subject notifications since the data was being taken from a public database. Data retrieved from the Kansas Report Card database were for the high schools in the three metropolitan areas and from the four specified high school sizes. Data for the specific names of individual high schools were not reported, although the percentages of economically disadvantaged (low family income) and percentages of low achievement were reported for the schools in the three metropolitan locations (grouped data) and for the groups of high schools in the four school size categories.

The dependent measures in this study were the building rate (percentage) of students in a high school building receiving free or reduced lunches during the 2002-2003 academic year. This building rate represented the rate of low-income students, or economically disadvantaged. The second measure was represented by the building rates (percentage) of students in a high school building who scored in the unsatisfactory and basic ranges on the state reading, mathematics and science assessments during the 2002-2003 academic year. The researcher combined the unsatisfactory and basic achievement scores to create a third low achievement score. In sum, low achievement scores were represented by the building rates for scores in the categories of unsatisfactory, basic and a combination of unsatisfactory + basic rates of achievement. These three low achievement measures applied to reading, mathematics and science. These scores were derived from student performances on the Kansas assessment battery, thus students in all buildings took the same tests.

As shown in the next section on setting and population, the researcher used four categories of school size. These were derived from the Kansas High School Activities Association. This association puts Kansas high schools into size categories in order that high schools of approximately the same size compete against one another. The ranges of enrollment for the four categories of school size are provided in the next section. The high schools in the core cities of Wichita, Topeka and Kansas City fell into the larger enrollment high-school sizes. However, high schools in the larger enrollment categories are also found across Kansas. There was no observable relationship between income and school size. Large high schools may have low percentages of low-income students while other large high schools may have high percentages of low-income students.

The three metropolitan areas were represented by the cities of Wichita, Topeka and Kansas City. Johnson County was included with Kansas City as it has a significantly higher population than Wyandotte County (Kansas City, Kansas) as shown in the next section on setting and population.

In sum, the researcher used two dependent variables those being high school building rates of low income and high school building rates for low achievement. The independent variables were high-school size and high school metropolitan location. Research questions, data analysis, and expected outcomes are described in the last section of this chapter.

Setting and Population

Table 3.1 summarizes the median household incomes and populations of nine counties in three metropolitan locations. Metropolitan area 1 is represented by Sedgwick County Kansas and this area is referred to as Metropolitan area 1 throughout this study. The county had a median household income of $42,485 and a population of 452,869. Metropolitan area 1 is represented by only one county, thus, table 3.2 reports the median household income of ten cities in Sedgwick County that have high schools and this includes the core-city of Wichita. Wichita had the lowest median household income ($33,939) while the other nine cities, located outside of Wichita in

Table 3.1 Median Household Incomes and Populations in Select Kansas Counties with the Total Population of Three Metropolitan Location Areas*

Metro/county areas	Median household income	Population (counties)	Population (metro areas)
Metropolitan area 1			
Sedgwick County	42,485	452,869	452,869
Metropolitan area 2			
Jefferson County	45,535	23,348	
Shawnee County	40,988	169,871	
(Topeka)	35,928		
Jackson County	40,451	12,657	
Osage County	37,928	21,112	
Douglas County	37,547	99,962	326,950
(Lawrence)	34,669		
Metropolitan area 3			
Johnson County	61,455	451,086	
Wyandotte County	33,784	157,882	
Leavenworth County	48,114	68,691	677,659
Totals (metropolitan areas)			1,457,478

*This was 53.9% of the total Kansas population of 2,688,418

Table 3.2 Median Household Incomes of Ten Cities in Sedgwick County that have High Schools

Cities	Median household income
Derby	58,508
Maize	51,845
Clearwater	50,694
Valley Center	50,683
Goddard	50,532
Andale	47,333
Mulvane	46,923
Haysville	46,667
Cheney	45,221
Wichita	33,939

Sedgwick County had higher incomes. The highest median household income was reported for Derby ($58,508). The range in median household incomes for Metropolitan area 1 was $24,569.

While Sedgwick County was a good representation of the Bernstein model of core city and suburban areas, Metropolitan area 2 represented a slightly different representation of the model. The researcher used two cities to form the core areas and these were Topeka and Lawrence, Kansas. Topeka, the seat for Shawnee County, had a population of 122,377 while Lawrence, the seat for Douglas County had a population of 80,089. Topeka and Lawrence are two cities which are close to one another and the researcher estimated that these two cities with a total population of 202, 466 would be a reasonable representation of the core city for Metropolitan area 2. Table 3.1 shows that a total of five counties were used to form Metropolitan area 2 and the total population for this metropolitan area was 326,950. As shown in Table 3.1, Metropolitan area 2 had a low median household income of $34,669 (Lawrence), a high median household income of $45,535 (Jefferson County), and a range of $10,866.

The researcher used three counties to form Metropolitan area 3: Johnson, Wyandotte and Leavenworth counties. With a total population of 677,659, Metropolitan area 3 was the largest metropolitan population area. Kansas City (Wyandotte County) represented the core-city area with the low median household income of $33,784. Leavenworth and Johnson counties were depicted as the suburban area. Johnson County had the highest median household income ($61,455), thus, the range in median household income for Metropolitan area 3 was $27,671.

In this section, the researcher reported the demographics for the three metropolitan areas. Metropolitan area 1 was represented by Sedgwick County with the city of Wichita forming the core-city. The researcher designated two cities as the core-city for Metropolitan area 2: Topeka and Lawrence with a total of five counties in Metropolitan area 2. Metropolitan area 3 was composed of three counties with Kansas City, Kansas (Wyandotte County) representing the core city area. The median household income ranges for the three metropolitan areas are summarized as follows:

Area	minimum	maximum	range
Metropolitan area 1	33,939	58,508	24,569
Metropolitan area 2	34,669	45,535	10,866
Metropolitan area 3	33,784	61,455	27,671

As explained in the previous section, Kansas high schools are grouped into size categories and these are designated as 6A, 5A, 4A, 3A, 2A. The researcher excluded 1A and 2A category schools since their enrollments are very small and small numbers can distort the building rates for low income and low achievement. Table 3.3 shows the ranges in enrollment for each of the four categories and these ranges of enrollment are summarized below:

6A sized high schools	911-1543 students
5A sized high schools	509-908 students
4A sized high schools	219-507 students
3A sized high schools	132-216 students

Table 3.3 reports the number and distribution of high schools in this study by the three metropolitan areas and by the non-metropolitan areas. There were 69 total high schools in the three metropolitan areas and 114 high schools in non-metropolitan areas for a total of 183 high schools.

Table 3.3 Number and Distribution of High Schools in the Study by Metropolitan and Non-Metropolitan Areas Grouped in Categories for High School Size (total = 183)*

Group	911-1543 6A	509-908 5A	219-507 4A	132-216 3A	Totals
Metro area 1	10	05	03	04	22
Metro area 2	04	04	06	05	19
Metro area 3	12	09	06	01	28
Non-metropolitan	06	12	47	49	114
Totals	32	30	62	59	183

*Metropolitan = 69

*Non = metropolitan = 114

Expected Outcomes

In this section on expected outcomes, the researcher has restated the seven research questions. Following each research question, the researcher describes the expected outcomes and the statistical procedures used to analyze the data for each question.

Research question 1: Of the three building rates for low achievement (unsatisfactory, basic and combined unsatisfactory and basic), which represented the most consistent measure in correlation with the building rates for low income?

As shown in the definitions section of this chapter, state assessment scores for academic achievement were reported in categories of unsatisfactory, basic, proficient, advanced, and exemplary. Adequate student achievement was represented by student scores in the categories of proficient, advanced, and exemplary. Low student achievement was represented by student scores in the categories of unsatisfactory and basic. The researcher studied three categories of low achievement by first studying unsatisfactory scores and basic scores as two separate measures. A third low-achievement score was derived by combining unsatisfactory low achievement rates with basic low-achievement rates. Data analysis for this research question required building low-income rates to be correlated with three separate low-achievement building rates: unsatisfactory student achievement, basic student achievement, and unsatisfactory student achievement rates combined with basic student achievement rates. The three categories of low achievement performance were derived for reading achievement, mathematics achievement, and science achievement. This first question and analysis was necessary to first determine which of the three building rates of low achievement most consistently represented low achievement, per se. The researcher then used the same metric for low achievement throughout the remainder of the study. It is reemphasized that building rates of low achievement included the subject areas of reading, mathematics, and science. The researcher expected to find the most consistent measure of low achievement in one of the three building rates of low achievement (unsatisfactory student achievement, basic student achievement, and unsatisfactory and basic achievement).

The researcher used the Pearson r correlation statistic for this research question. This statistic was used to determine the strength of the relationship between low income and low school achievement (reading, mathematics and science) in the three metropolitan areas and four sizes of high schools.

Research question 2. What were the observable differences in the correlations (building rates of low income to low achievement) among the three metropolitan locations of high schools?

Here the researcher reported and analyzed the correlations for the three metropolitan high school locations to identify trends for which additional analyses would be needed. It is noted here that building rates of low achievement included the subject areas of reading, mathematics, and science. The researcher expected the metropolitan locations to have different correlations. This was based on the fact that they had different ranges in median household incomes within each of the three locations. In other words, when the metropolitan median household income range was higher, the researcher expected the correlation between building rates of low income and building rates of low achievement to be higher.

The researcher used the Pearson r correlation statistic for this research question. This statistic was used to determine the strength of the relationship between low income and low school achievement (reading, mathematics and science) in three metropolitan locations.

Research question 3. What were the observable differences in the correlations (building rates for low income with building rates for low achievement) among the four different sizes of high schools?

Here the researcher reported and analyzed the correlations for the four high-school sizes to identify trends for which additional analyses would be needed. It is again noted that building rates of low achievement included the subject areas of reading, mathematics, and science.
The researcher inquired to see if there were trends pertaining to the observable differences in the correlations (building rates for low income with building rates for achievement) among the four different sizes of high schools for which additional analysis would be needed.

The researcher used the Pearson r correlation statistic for this research question. This statistic was used to determine the strength of the relationship between low income and low school achievement (reading, mathematics and science) in four sizes of high schools.

Research question 4. What were the observable differences in the correlations (building rates for low income with building rates for low achievement) when the subjects of reading, mathematics and science were considered?

In the previous two research questions. The researcher considered the correlations, first, for the high school metropolitan location variable and, second, for the school size variable. Here the researcher continued by considering the correlations (building rates of low income with building rates for low academic achievement) regarding the subject areas of reading, mathematics, and science for all of the high schools without regard to metropolitan location or school size. The researcher inquired to see if there are observable differences in the correlations (building rates for low income with building rates for low achievement) considering the subjects of reading, mathematics and science for all of the high schools without regard to metropolitan location or school size.

The researcher used the Pearson r correlation statistic for this research question. This statistic was used to determine the strength of the relationship between low income and low school achievement (reading, mathematics and science) in three metropolitan areas and four sizes of high schools.

Research question 5. What did the analysis of standard deviation scores, range scores, and frequency distributions reveal about differences in correlations (building rates for low income with building rates for low achievement) for high school metropolitan location and high school size.

Here the researcher sought to explain differences found in correlations reported for research questions 2 and 3 above. For this, the researcher reported and analyzed the three statistics named in this research question. The researcher expected to use standard deviation scores, range scores, and frequency distributions for a follow up analysis.

The researcher used standard deviation scores, range scores and frequency distributions for this research question. The standard deviation scores were used as a measure of the spread or dispersion of scores in a distribution. The range scores were used as a measure of the lowest and highest scores in a distribution. The frequency distribution scores were used as a measure of the frequency of occurrence of scores in a distribution.

Research Question 6. What were the magnitudes of the correlations (building rates for low income with building rates for low achievement) for the subject areas of reading, mathematics and science when the original correlations were correlated for secondary inter-correlations among the building rates for low reading, low mathematics and low science achievement?

The researcher recognized that the original correlations (building rates for low income with building rates for low achievement) were impacted by the inter-correlations among the low achievement rates for the subject areas of reading, mathematics, and science. To correct for this, the researcher completed a partial correlation analysis to correct for the amount of correlation contributed by the common variance in correlations among the three low-achievement scores for reading, mathematics, and science. The researcher expected to find the magnitude of the correlations (building rates for low income with building rates for low achievement) for the subject areas of reading, mathematics and science when the original correlations were correlated for secondary inter-correlations among the building rates for low reading, low mathematics and low science achievement.

The researcher used the partial correlation statistic for this research question. This statistic was used to correct for a possible higher common variance (higher intercorrelations) among the low-achievement scores. In other words, this statistic adjusted for the common variance among the low-achievement scores then recalculated the correlations between low income and the low achievement measures.

Research question 7: Were there significant differences in the building rates for low achievement when comparisons were made among high schools in the three metropolitan locations and among high schools in the four categories of schools size when the buildings' low achievement rates were adjusted by the buildings' low income-rates?

Here the researcher made direct comparisons among the three groups of high schools according to the metropolitan location on the measure of buildings' low-achievement rates. This was done separately for reading, mathematics, and science. In making this comparison, the buildings' low-achievement rates were adjusted by the building's low-income rates. A separate comparison was made among the high schools in the four categories of school size. Again, this included comparisons for building rates of low achievement in the subject areas of reading, mathematics, and science. Also, the buildings' rates for low achievement were adjusted by the buildings' rates for low income. Here the researcher was seeking to determine which groups of high schools (three metropolitan locations and four categories of high school size) produced lower rates of low achievement. The researcher expected to determine if significant differences existed in the building rates for low achievement when comparisons were made among high schools in the three metropolitan locations and four categories of high school size when the buildings' low-achievement rates were adjusted by the buildings' low-income rates.

The researcher used the Analysis of Covariance (ANCOVA) statistic from the Statistical Analysis System (SAS Version 9.1, 2002/2003) program for this research question. The ANCOVA statistic made direct comparisons among the low achievement (reading, mathematics and science) variances for the three metropolitan areas and separately for the four school sizes. The ANCOVA statistic also accommodated a correlate to the main comparison. In this case, low income was the correlate to low achievement, and the main comparison was made on low achievement. The low achievement scores were adjusted by the correlate of low income for each group compared. The adjusted mean for low achievement was an estimated mean of what would happen if the average low income had been the same in all three metropolitan areas and four sizes of high schools.

CHAPTER 4 - Data Reporting and Analysis

The data from this study is reported and analyzed in this chapter. The researcher used the main focus of each research questions as topic headings in this chapter in order to maintain a logical sequence and organization; however, the research questions will be fully answered in Chapter 5 on Summary, Conclusions, and Recommendations. For the first research question, the researcher recognized that the state of Kansas has two levels of low performance for the reading, mathematics, and science assessments and these are ”unsatisfactory” and “basic”. The researcher also recognized that the unsatisfactory and basic scores could be added together to produce a third low achievement score: combined. Through correlational explorations the researcher sought to determine a stable score for low student performance.

Best Representation of Low Achievement

Research question 1: Of the three building rates for low achievement (unsatisfactory, basic and unsatisfactory + basic), which represented the most consistent measure in correlation with the building rates for low income?

Data were collected and analyzed for each of the three low achievement areas of reading, mathematics, and, science; thus, this research question applied to each of the three low achievement areas. Table 4.1 reports the correlations between low income and low reading achievement for the seven subgroups of Kansas’s high schools. A first trend that was observed was that low income/unsatisfactory reading correlations closely paralleled those of the low income/combined score reading correlations. The mean correlation (r = 0.65) for unsatisfactory

Table 4.1 Low Income/Low reading Achievement Correlations Reported by High School Location and Size with Unsatisfactory, Basic, and Combined Reading Scores

Low Income	Schools n	Unsatisfactory scores	Basic scores	Uns + bas scores (comb.)
High school metropolitan location				
Metro 1	22	0.80	0.70	0.79
Metro 2	19	0.58	0.44	0.61
Metro 3	28	0.83	0.61	0.83
High school size				
6A sized	32	0.72	0.63	0.73
5A sized	30	0.79	0.56	0.78
4A sized	62	0.24	0.09	0.21
3A sized	59	0.56	0.40	0.59
Mean correl.	252	0.65	0.49	0.65

Table 4.2 Low Income/Low Mathematics Correlations Reported by High School Location and Size with Unsatisfactory, Basic, and Combined Mathematics Scores

Low Income	Schools n	Unsatisfactory scores	Basic scores	Uns + bas scores (comb.)
High school metropolitan location				
Metro 1	22	0.77	0.31	0.79
Metro 2	19	0.75	0.28	0.71
Metro 3	28	0.93	-0.12	0.89
High school size				
6A sized	32	0.91	0.74	0.91
5A sized	30	0.88	-0.11	0.89
4A sized	62	0.19	0.27	0.27
3A sized	59	0.61	0.27	0.59
Mean correl.	252	0.72	0.30	0.72

Table 4.3 Low Income/Low Science Achievement Correlations Reported by High School Location and Size with Unsatisfactory, Basic, and Combined Science Scores

Low Income	Schools n	Unsatisfactory scores	Basic scores	Uns + bas scores (comb.)
High school metropolitan location				
Metro 1	22	0.84	0.62	0.84
Metro 2	19	0.85	0.47	0.82
Metro 3	28	0.92	-0.06	0.90
High school size				
6A sized	32	0.86	0.56	0.62
5A sized	30	0.89	0.04	0.91
4A sized	62	0.19	0.14	0.21
3A sized	59	0.57	0.61	0.69
Mean correl.	252	0.73	0.36	0.71

reading/low income was the same as the mean correlation (r = 0.65) for combined, unsatisfactory and basic reading/low income. The mean correlation (r = 0.49) for basic reading/low income was substantially lower than the other two. Thus, the researcher concluded that the most consistent low reading achievement/low income correlation was derived with the combined score of unsatisfactory + basic reading achievement.

Table 4.2 reports the correlations between low income and low mathematics achievement for the seven subgroups of Kansas high schools. A first trend that was observed was that the low income/unsatisfactory mathematics correlations paralleled those of low income/combined mathematics correlations. The mean correlation (r = 0.72) for unsatisfactory mathematics/low income was the same as the mean correlation (r = 0.72) for combined, unsatisfactory and basic mathematics/low income. The mean correlation (r = 0.30) for basic mathematics/low income was substantially lower than the other two. Thus, the researcher concluded that the most consistent low mathematics achievement/low income correlation was derived with the combined score of unsatisfactory + basic mathematics achievement.

Table 4.3 reports the correlations between low income and low science achievement for the seven subgroups of Kansas high schools. A first trend that was observed was that low income/unsatisfactory science correlations closely paralleled those of the low income/combined science correlations. The mean correlation (r = 0.73) for unsatisfactory science/low income was very close to the mean correlation (r = 0.71) for combined, unsatisfactory and basic science/low income. The mean correlation (r = 0.36) for basic science/low income was substantially lower than the other two. Thus, the researcher concluded that the most stable low science achievement/low income correlation was derived with the combined score of unsatisfactory + basic science achievement. The trend in all three subject areas (reading, mathematics, and science) was that the combined score (unsatisfactory + basic) proved to be the most consistent score in correlation to low income. As a result, when the researcher refers to low achievement in the remainder of this chapter, this is in reference to the combined scores (unsatisfactory + basic) in reading, mathematics, and science.

Observable Metropolitan Location Correlation Differences

Research question 2. What were the observable differences in the correlations (building rates of low income to low achievement) among the three metropolitan locations of high schools?

This research questions applied to each of the three low achievement areas of reading, mathematics, and science. Here the researcher identified the similarities and differences found in the data for the high schools in the three metropolitan locations and judged the magnitude of the correlations. Returning to Table 4.1, the main observable trend was that the low income/low reading correlation ($r = 0.61$) for metropolitan area 2 (Shawnee and adjacent counties) was observably lower than the correlation ($r = 0.79$) for metropolitan area 1 (Sedgwick County), and observably lower than the correlation ($r = 0.83$) for metropolitan area 3 (Wyandotte/Johnson and adjacent counties). For metropolitan area 1, the correlation was in the “high” category, and for metropolitan area 3, the correlation was in the “very high” range category while in metropolitan area 2 the correlation was in the “moderate” category.

Returning to table 4.2, the main observable trend was that the low income/low mathematics achievement correlation ($r = 0.71$) for metropolitan area 2 (Shawnee and adjacent counties) was slightly lower than the correlation ($r = 0.79$) for metropolitan area 1 (Sedgwick County), and was observably lower than the correlation ($r = 0.89$) for metropolitan area 3 (Wyandotte/Johnson and adjacent counties). For metropolitan areas 1 and 2 the correlations were in the “high” category while metropolitan area 3 yielded a “very high” correlation.

Returning to table 4.3, the main observable trend was that the low income/low science achievement correlation (r = 0.82) for metropolitan area 2 (Shawnee and adjacent counties) was close to the correlation (0.84) for metropolitan area 1 (Sedgwick County), and was lower than the correlation (r = 0.90) for metropolitan area 3 (Wyandotte/Johnson and adjacent counties). For metropolitan areas 1, 2, and 3, all three correlations were in the "very high" category.

Observable High School Size Correlation Differences

Research question 3. What were the observable differences in the correlations (building rates for low income with building rates for low achievement) among the four different sizes of high schools?

This research question applied to each of the three low achievement areas of reading, mathematics, and science. Here the researcher identified the similarities and differences found in the data for the high schools in the four size categories and judged the magnitude of the correlations. Returning to Table 4.1, the obvious trend was that 4A-sized high schools produced the lowest correlation (r = 0.21) for low income/low reading in comparison to the other three high school sizes (r = 0.73, 0.78, and 0.59). Further, the 6A-and 5A-sized correlations tended toward the "high" range. The correlation for the 3A-sized high schools was in the "moderate" range, while the 4A sized high school was clearly a "very low" correlation.

Returning to Table 4.2, the main trend was that 4A-sized high schools produced the lowest correlation (r = 0.27) for low income/low mathematics in comparison to the other three high school sizes (r = 0.91, 0.89, and 0.59). Further, the 6A-and 5A-sized correlations tended toward the "very high" range. The correlation for the 3A-sized high schools was in the "moderate range" while the 4A-sized high school score was clearly a "low" correlation.

Returning to Table 4.3, the obvious trend was that the 4A-sized high schools produced the lowest correlation (r = 0.21) for low income/low science in comparison to the other three high schools (r = 0.62, 0.91, 0.69, respectively). Furthermore, the 6A-sized correlations were in the "moderate" range and the 3A-sized correlations tended toward the "moderate to high" range. The correlation for the 5A-sized high schools was in the "very high" range, while the 4A-sized high school score was clearly a "very low" correlation.

Low Income/Low Achievement Correlation Differences

Research question 4. What were the observable differences in the correlations (building rates for low income with building rates for low achievement) when the subjects of reading, mathematics and science were considered?

Table 4.4 summarizes the low income/low achievement correlations by reading, mathematics, and science for metropolitan high school location. These data were taken from Tables 4.1, 4.2, and 4.3 for each of the three metropolitan locations and reported in ranked order of highest, second highest, and third highest correlations. Table 4.5 summarizes the low income/low achievement correlations by reading, mathematics, and science for high school size. These data were taken from Tables 4.1, 4.2, and 4.3 for each of the high school size groups and reported in ranked order by the highest, second highest, and third highest correlations.

The observable differences in the correlations (building rates for low income with building rates for low achievement) when considering the subjects of reading, mathematics, and science for the total high schools without regard to metropolitan location or school size are as follows: The highest correlations were found in low science achievement and low mathematics achievement only. Low science achievement has the highest correlations in all three

Table 4.4 Summary of Correlations: Low Income with Low Reading Achievement, Low Mathematics Achievement, Low Science Achievement Reported by High School Metropolitan Location

Group	r
Metropolitan area 1	
Low science achievement	0.84
Low reading achievement	0.79
Low mathematics achievement	0.79
Metropolitan area 2	
Low science achievement	0.82
Low mathematics achievement	0.71
Low reading achievement	0.61
Metropolitan area 3	
Low science achievement	0.90
Low mathematics achievement	0.89
Low reading achievement	0.83

Table 4.5 Summary of Correlations: Low Income with Low Reading Achievement, Low Mathematics Achievement, and Low Science Achievement Reported by High School Size

Group	r
6A high schools	
Low mathematics achievement	0.91
Low reading achievement	0.73
Low science achievement	0.62
5A high schools	
Low science achievement	0.91
Low mathematics achievement	0.89
Low reading achievement	0.78
4A high schools	
Low mathematics achievement	0.27
Low reading achievement	0.21
Low science achievement	0.21
3A high schools	
Low science achievement	0.69
Low reading achievement	0.59
Low mathematics achievement	0.59

metropolitan locations (r = 0.84, r = 0.82, and r = 0.90) and in the 5A (r = 0.91) and 3A (r = 0.69) high schools. Low mathematics achievement has the highest correlations in the 6A (r = 0.91) and 4A (r = 0.27) high schools. The second highest correlations were found in low reading achievement and low mathematics achievement only. Low reading achievement has the second highest correlations in metropolitan location 1(r = 0.79), the 6A (r = 0.73), 4A (r = 0.21), and 3A (r = 0.59) high schools. Low mathematics achievement has the second highest correlations in metropolitan location 2 (r = 0.71), metropolitan 3 (r = 0.89) and in the 5A (r = 0.89) high schools. The third highest correlations were found in low reading achievement, low mathematics and low science achievement. Low mathematics achievement has the third highest correlations in metropolitan location 1(r = 0.79) and the 3A (r = 0.59) high schools. Low reading achievement has the third highest correlations in metropolitan location 2 (r = 0.61), metropolitan location 3 (r = 0.83), and the 5A (r = 0.78) high schools. Low science achievement has the third highest correlations in the 6A (r = 0.62) and 4A (r = 0.21) high schools.

Description Statistic Inferences

Research question 5. What did the analysis of standard deviation scores, range scores, and frequency distributions reveal about differences in correlations (building rates for low income with building rates for low achievement) for high school metropolitan location and high school size.

Standard deviation scores. Table 4.6 summarizes the standard deviation scores for low income, low reading achievement, low mathematics achievement, and low science achievement. The reader is reminded that the low achievement scores were those derived by adding the unsatisfactory scores to the basic scores. The data in Table 4.6 is reported by the metropolitan

Table 4.6 Standard Deviation Scores for Percent Low Income and Percent Low Achievement (Reading, Mathematics, and Science) Reported by High School Metropolitan Location and High School Size

Deleted: Low

Group	% Low Income	% Low Reading	% Low Math	% Low Science
High school metropolitan location				
Metro 1	23.59	15.46	18.05	24.31
Metro 2	12.95	12.38	14.37	13.46
Metro 3	23.46	17.33	20.15	21.07
High school size				
6A	18.52	11.10	14.61	15.26
5A	22.27	15.73	17.60	20.87
4A	09.76	09.74	10.81	10.51
3A	13.61	13.49	17.32	17.59

Table 4.7 Range Scores for Percent Low Income, Low Reading Achievement, Low Mathematics Achievement and Low Science Achievement Reported for Metropolitan High School Location

Group	%Low Income	%Low Reading	%Low Math	%Low Science
Metro1				
Min/max	0.0-86.49	18.20-73.90	31.90-95.50	16.40-95.20
Range	86.49	55.70	63.60	78.80
Metro 2				
Min/max	11.68-65.97	27.70-71.00	26.70-87.90	13.30-80.10
Range	54.29	43.30	61.20	66.80
Metro3				
Min/max	0.96-82.24	18.70-80.80	26.40-97.00	22.90-95.70
Range	81.28	62.10	70.60	72.80

Table 4.8 Range Scores for Percent Low Income, Low Reading Achievement, Low Mathematics Achievement and Low Science Achievement Reported for High School Size

Group	%Low Income	%Low Reading	%Low Math	%Low Science
6A sized				
Min/max	0.96-65.60	18.70-56.10	26.40-75.10	22.90-71.40
Range	64.60	37.40	48.70	48.50
5A sized				
Min/max	0.0-82.24	18.20-80.60	35.40-97.00	18.70-95.70
Range	82.24	62.40	61.60	77.00
4A sized				
Min/max	4.15-46.33	14.30-60.80	32.40-71.00	20.30-69.20
Range	42.18	46.50	38.60	48.90
3A sized				
Min/max	0.0-86.49	7.10-73.90	16.0-95.50	13.30-95.20
Range	86.49	66.80	79.50	81.90

locations and by the four high school size groups. In the case of high school metropolitan location, the standard deviation scores (low income, low reading, low mathematics, and low science) for the high schools in metropolitan area 2 were smaller than those for metropolitan areas 1 and 3. These smaller metropolitan area 2 standard deviations reflect narrower distributions of scores, and these narrower distributions could have contributed to smaller low income/low achievement correlations reported previously for metropolitan area 2.

Table 4.6 also shows that the standard deviation scores (low income, low reading, low mathematics, and low science) for 4A-sized high schools were smaller than those of the 6A-,5A-,and 3A-sized high schools. The smaller 4A sized high school standard deviations reflect the narrower distributions of scores, and these narrower distributions could have contributed to smaller low income/low achievement correlations reported previously for 4A-sized high schools.

Range scores. Table 4.7 summarizes the range scores for low income, low reading achievement, low mathematics achievement, and low science achievement. The data in Table 4.7 is reported by the high schools in the three metropolitan locations. The low achievement scores were those derived by adding the unsatisfactory scores to the basic scores. The trend shown in Table 4.7 was that the range scores for high schools in metropolitan area 2 were smaller than those in metropolitan areas 1 and 3. This reinforces the trend shown by the previously reported standard deviation scores that showed that metropolitan area 2 produced narrower distributions.

Table 4.8 summarizes the range scores for low income, low reading achievement, low mathematics achievement, and low science achievement. The data in Table 4.8 is reported by the high schools in the four school size categories. The low achievement scores were those derived by adding the unsatisfactory scores to the basic scores. The trend shown in Table 4.8 was that the range scores for 4A-sized high schools were smaller than those for 6A-, 5A-, and 3A-sized high schools. This reinforces the trend shown by the previously reported standard deviation scores that shows that 4A-sized high schools produced narrower distributions. At the same time, the researcher found two exceptions to the trend of lower range scores for 4A-sized high schools. The 6A-sized high schools produced smaller range scores in comparison to 4A-sized high schools in low reading achievement (6A range = 37.40, 4A range = 46.50). The 6A-sized high schools also produced smaller range scores in comparison to 4A-sized high schools in low science achievement (6A range = 48.50, 4A range = 48.90).

Frequency distributions. Here the researcher continued his examination of descriptive statistics in order to better understand the trends in the low income/low achievement correlations reported at the beginning of this chapter. The researcher established ten-point frequency intervals for percentages of low income, low reading achievement, low mathematics achievement, and low science achievement. The frequency distributions reflect the number and percent of high schools in each interval. The data are reported first, by high school location (Tables 4.9, 4.10, 4.11, 4.12), and second, by high school size (Tables 4.13, 4.14, 4.15, and 4.16). The low achievement scores in the intervals were those derived by adding the basic scores to the unsatisfactory scores.

Table 4.9. Frequencies in the percent of low-income students for high schools by metropolitan location. The three metropolitan locations have sizeable cumulative percentages of high schools in the percentage of low-income students in the intervals of 0-30, and the data below were taken from table 4.9 to illustrate this.

Metro area	Cumulative % low-income students per high schools	
1	54.55	(intervals 0-30)

Table 4.9 Frequencies in the Percent of Low-Income Students for High Schools by Metropolitan Location (n=69 High Schools)

	School Location					
Intervals	**Metro 1**		**Metro 2**		**Metro 3**	
	f	%	f	%	f	%
0 - 10	03	13.64	00	00.00	16	57.14
11 - 20	06	27.27	11	57.89	05	17.86
21 - 30	03	13.64	05	26.32	02	07.14
31 - 40	02	09.09	01	05.26	00	00.00
41 - 50	03	13.64	01	05.26	01	03.57
51 - 60	02	09.09	00	00.00	01	03.57
61 - 70	02	09.09	01	05.26	01	03.57
71 - 80	00	00.00	00	00.00	01	03.57
81 - 90	01	04.55	00	00.00	01	03.57
91 - 100	00	00.00	00	00.00	00	00.00
Totals	22	100.00	19	100.00	28	100.00

2	84.21	(intervals 0-30)
3	82.14	(intervals 0-30)

Beyond the intervals of 0-30, Table 4.9 shows that metropolitan area 1 has a continuous distribution of high schools throughout the higher percentage frequencies of low-income students. This is true for metropolitan area 3. In contrast to metropolitan areas 1 and 3, metropolitan area 2 has only one high school in the interval of 61-70 and none in intervals of 71-100.

Table 4.10. Frequencies in the percent of low reading achievement students for high schools by metropolitan location. Cumulative frequencies in low reading-achievement students (intervals 11-50) in the three metropolitan areas have been taken from Table 4.10 and are illustrated as follows:

Metro area	Cumulative % low reading achievement students per high schools	
1	68.18	(intervals 11-50)
2	84.21	(intervals 11-50)
3	71.43	(intervals 11-50)

Metropolitan area 2 high schools have the greatest cumulative percent (84.21%) of low reading-achievement students in high schools in the interval range of 11-50. Metropolitan area 1 has a bimodal distribution (Table 4.10) and includes high schools in the higher intervals of low reading achievement students. Metropolitan area 3 has a continued distribution beyond the interval range of 11-50.

Table 4.10 Frequencies in the Percent of Low Reading Achievement Students for High Schools by Metropolitan Location (n=69 High Schools)

	School Location					
Intervals	**Metro 1**		**Metro 2**		**Metro 3**	
	f	%	f	%	f	%
0 - 10	00	00.00	00	00.00	00	00.00
11 - 20	02	09.09	01	05.26	01	03.57
21 - 30	04	18.18	03	15.79	09	32.14
31 - 40	08	36.36	07	36.84	07	25.00
41 - 50	01	04.55	05	26.32	03	10.71
51 - 60	05	22.73	02	10.53	04	14.29
61 - 70	01	04.55	01	05.26	01	03.57
71 - 80	01	04.55	00	00.00	03	10.71
81 - 90	00	00.00	00	00.00	00	00.00
91 - 100	00	00.00	00	00.00	00	00.00
Totals	22	100.00	19	100.00	28	100.00

Table 4.11. Frequencies in the percent of low mathematics achievement students for high schools by metropolitan location. Cumulative frequencies in percentages of low mathematics achievement students in the three metropolitan area high schools have been taken from Table 4.11 and are illustrated as follows.

Metro area	Cumulative % low math achievement students per high schools	
1	68.18	(intervals 31-70)
2	89.47	(intervals 31-70)
3	75.00	(intervals 31-70)

Here the pattern is clear in that metropolitan area 2 has its cumulative frequency of percentage of low mathematics achievement students (89.47%) concentrated across four intervals while the other two metropolitan areas have lower cumulative frequencies (68.18%, 75.00%) across the same four intervals.

Table 4.11 Frequencies in the Percent of Low Mathematics Achievement Students for High Schools by Metropolitan Location (n=69 High Schools)

	School Location					
Intervals	**Metro 1**		**Metro 2**		**Metro 3**	
	f	%	f	%	f	%
0 - 10	00	00.00	00	00.00	00	00.00
11 - 20	00	00.00	00	00.00	00	00.00
21 - 30	00	00.00	01	05.26	01	03.57
31 - 40	04	18.18	02	10.53	09	32.14
41 - 50	03	13.64	08	42.11	07	26.15
51 - 60	05	22.73	02	10.53	01	03.57
61 - 70	03	13.64	05	26.71	04	14.29
71 - 80	04	18.18	00	00.00	02	07.14
81 - 90	02	09.09	01	05.26	01	03.57
91 - 100	01	04.55	00	00.00	03	10.71
Totals	22	100.00	19	100.00	28	100.00

Table 4.12. Frequencies in the percent of low science achievement students for high schools by metropolitan location. Cumulative frequencies in the percentage of low science achievement students in the three metropolitan area high schools have been taken from Table 4.12 and are illustrated as follows:

Metro area	Cumulative % low science achievement students per high schools	
1	50.00	(intervals 31-70)
2	89.47	(intervals 31-70)
3	67.86	(intervals 31-70)

Here the pattern is clear in that metropolitan area 1 has 50.00% of low science achievement students in high schools systemically distributed across four intervals. In contrast, metropolitan area 2 has 89.47% of low science achievement students in high schools concentrated in four intervals and metropolitan area 3 has 67.86 % of low science achievement in high schools distributed across the same four intervals.

Table 4.12 Frequencies in the Percent of Low Science Achievement Students for High Schools by Metropolitan Location (n=69 High Schools)

	School Location					
Intervals	**Metro 1**		**Metro 2**		**Metro 3**	
	f	%	f	%	f	%
0 - 10	00	00.00	00	00.00	00	00.00
11 - 20	03	13.64	01	05.26	00	00.00
21 - 30	03	13.64	00	00.00	05	17.86
31 - 40	03	13.64	06	31.58	09	32.14
41 - 50	03	13.64	06	31.58	04	14.29
51 - 60	03	13.64	05	26.32	06	21.43
61 - 70	02	09.09	00	00.00	00	00.00
71 - 80	02	09.09	01	05.26	00	00.00
81 - 90	01	04.55	00	00.00	01	03.57
91 - 100	02	09.09	0.0	00.00	03	10.71
Totals	22	100.00	19	100.00	28	100.00

Table 4.13. Frequencies in the percent of low-income students for high schools by size. The researcher pulled the frequencies (intervals 0-50) of percentage of low-income students in the four high-school sizes from Table 4.13 and these are illustrated as follows as cumulative frequencies.

School Size	Cumulative % low-income students per high schools	
6A	93.75	(intervals 0-50)
5A	80.00	(intervals 0-50)
4A	100.00	(intervals 0-50)
3A	96.61	(intervals 0-50)

The main trend seen in the data above is that 100% of 4A-sized high schools are found in the low-income students interval range of 0-50. No 4A-sized schools fall in the range of 51-100% low income. In contrast 6A-,5A-,and 3A-sized high schools include buildings with low income percentages in the range of 51-100% low-income students. About 20% of the 5A-sized high schools have buildings in the range of 51-100% low-income students as shown in Table 4.13.

Table 4.13 Frequencies in the Percent of Low-Income Students for High Schools by Size (n=183 High Schools)

	School Size							
Intervals	**6A**		**5A**		**4A**		**3A**	
	f	%	f	%	f	%	f	%
0 - 10	12	37.50	03	10.00	07	11.29	02	03.39
11 - 20	05	15.63	08	26.67	20	32.26	15	25.42
21 - 30	03	09.38	06	20.00	19	30.65	20	33.90
31 - 40	06	18.75	05	16.67	15	24.19	16	27.12
41 - 50	04	12.50	02	06.67	01	01.61	04	06.78
51 - 60	01	03.13	01	03.33	00	00.00	01	01.69
61 - 70	01	03.13	03	10.00	00	00.00	00	00.00
71 - 80	00	00.00	01	03.33	00	00.00	00	00.00
81 - 90	00	00.00	01	03.33	00	00.00	01	01.69
91 - 100	00	00.00	00	00.00	00	00.00	00	00.00
Total	32	100.00	30	100.00	62	100.00	59	100.00

Table 4.14. Frequencies in the percent of low reading achievement students for high schools by size. The researcher pulled the frequencies (intervals 0-60) of percentages of low reading achievement students in the four high-school sizes from Table 4.14 and these are illustrated as follows as cumulative frequencies.

School size	Cumulative % low reading achievement students per high schools	
6A	96.88	(intervals 11-60)
5A	83.33	(intervals 11-60)
4A	100.00	(intervals 11-60)
3A	91.53	(intervals 11-60)

For the 4A-sized high schools, 100% of the distributions of low reading achievement high schools are found in the interval range of 11-60%. For 5A-and 3A-sized high schools, the percent distribution is smaller (83.33%, 91.53%) in the 11-60 % intervals with high schools found in the upper range (61-100%). The percent distribution is also smaller (96.88%) in the 6A-sized high schools.

Table 4.14 Frequencies in the Percent of Low Reading Achievement Students for High Schools by Size (n=183 High Schools)

	School Size							
Intervals	**6A**		**5A**		**4A**		**3A**	
	f	%	f	%	f	%	f	%
0 - 10	01	03.13	00	00.00	00	00.00	01	01.70
11 - 20	00	00.00	02	06.67	03	04.84	01	01.70
21 - 30	12	37.50	01	03.32	08	12.90	15	25.41
31 - 40	09	28.13	12	40.00	24	38.71	14	23.73
41 - 50	05	15.62	05	16.67	20	32.26	15	25.42
51 -60	05	15.62	05	16.67	07	11.29	09	15.25
61 - 70	00	00.00	02	06.67	00	00.00	03	05.08
71 - 80	00	00.00	03	10.00	00	00.00	01	01.70
81 - 90	00	00.00	00	00.00	00	00.00	00	00.00
91 - 100	00	00.00	00	00.00	00	00.00	00	00.00
Totals	32	100.00	30	100.00	62	100.00	59	100.00

Table 4.15. Frequencies in the percent of low mathematics achievement students for high schools by size. The researcher pulled the frequencies (intervals 31-70) of percentages of low mathematics achievement students in the four high-school sizes from table 4.15 and these are illustrated as follows as cumulative frequencies

School size	Cumulative % low math achievement students per high schools	
6A	81.25	(intervals 31-70)
5A	70.00	(intervals 31-70)
4A	98.39	(intervals 31-70)
3A	79.66	(intervals 31-70)

Just about all (98.39%) of the low achievement mathematics students in 4A-sized high schools are found in the four intervals of 31-70. For the 3A (79.66%), 5A (70.00%), and, 6A (81.25%) high schools, the distributions in the four intervals of 31-70 are smaller and Table 4.15 shows that the frequency distributions are wider for 3A-, 5A-, and 6A-sized high schools.

Table 4.15 Frequencies in the Percent of Low Mathematics Achievement Students for High Schools by Size (n=183 High Schools)

	School Size							
Intervals	**6A**		**5A**		**4A**		**3A**	
	f	%	f	%	f	%	f	%
0 - 10	00	00.00	00	00.00	00	00.00	00	00.00
11 - 20	00	00.00	00	00.00	00	00.00	01	01.69
21 - 30	01	03.13	90	00.00	00	00.00	04	06.78
31 - 40	09	28.13	04	13.33	12	19.35	12	20.31
41 - 50	08	25.00	05	16.67	12	19.35	15	25.42
51 - 60	03	09.38	06	20.00	21	33.87	10	16.97
61 - 70	06	18.75	06	20.00	16	25.81	10	16.97
71 - 80	05	15.63	04	13.33	01	01.62	02	03.39
81 - 90	00	00.00	02	06.67	00	00.00	04	06.78
91 - 100	00	00.00	03	10.00	00	00.00	01	01.69
Total	32	100.00	30	100.00	62	100.00	59	100.00

Table 4.16. Frequencies in the percent of low science achievement students for high schools by size. The researcher pulled the frequencies (intervals 31-70) of percentages of low science achievement students in the four high-school sizes from table 4.16 and these are illustrated as follows as cumulative frequencies

School size	Cumulative % low science achievement student per high schools	
6A	78.13	(intervals 31-70)
5A	70.00	(intervals 31-70)
4A	91.94	(intervals 31-70)
3A	74.58	(intervals 31-70)

The results for low science achievement parallel those for low mathematics achievement. A large percentage (91.94%) of the low achievement science students in 4A-sized high schools are found in the four intervals of 31-70. For the 3A (74.58%), 5A (70.00), and, 6A (78.13%) high schools, the distributions in the four intervals of 31-70 are smaller and Table 4.16 show that the frequency distributions are wider for 3A-, 5A-, and 6A-sized high schools.

Table 4.16 Frequencies in the Percent of Low Science Achievement Students for High Schools by Size (n=183 High Schools)

	School Size							
Intervals	**6A**		**5A**		**4A**		**3A**	
	f	%	f	%	f	%	f	%
0 - 10	00	00.00	00	00.00	00	00.00	00	00.00
11 - 20	00	00.00	02	06.67	00	00.00	05	08.47
21 - 30	06	18.75	01	03.33	05	08.06	07	11.86
31 - 40	09	28.13	06	20.00	24	38.71	17	28.81
41 - 50	06	18.75	07	28.33	19	30.65	13	22.03
51 - 60	04	12.50	07	23.33	08	12.90	12	20.34
61 - 70	06	18.75	01	03.33	06	09.68	02	03.40
71 - 80	01	03.12	02	06.67	00	00.00	00	00.00
81 - 90	00	00.00	01	03.34	00	00.00	01	01.69
91 - 100	00	00.00	03	10.00	00	00.00	02	03.40
Total	32	100.00	30	100.00	62	100.00	59	100.00

Findings from Descriptive Statistics with Implications for Discrepancies in low Income/Low Achievement Correlations.

Tables 4.1, 4.2, 4.3 revealed smaller low income/low achievement correlations for metropolitan area 2 (school location) high schools and for 4A (school size) high schools. As a result, the researcher examined (Tables 4.6, 4.7 and 4.8) standard-deviation and range-score descriptive statistics. In these descriptive statistics explorations, the researcher found smaller standard deviations and range scores in low income, low reading achievement, low mathematics achievement, and low science achievement for metropolitan area 2 and for 4A-sized high schools. The exceptions were that 6A-sized high schools produced smaller range scores in low reading achievement and low science achievement. As a result of this follow up analysis of standard deviation and range scores, the researcher finds that smaller descriptive statistics scores (standard deviation and range scores) may have accounted for the smaller correlations between low income and low achievement in metropolitan area 2 and 4A-sized high schools.

The researcher also examined (Tables 4.9 through 4.16) the distribution in low income, low reading achievement, low mathematics achievement, and low science achievement in order to gain further insight into why metropolitan area 2 and 4A-sized high schools produced lower correlations between low income and low achievement scores. For high schools in metropolitan area 2, low income buildings were not found in higher intervals (71-100). Also, the greater concentration (84.21%) of low income high schools in metropolitan area 2 was found in the comparable range of 0-30. For low reading achievement, the researcher found a parallel pattern in metropolitan area 2 high schools. There were no high schools found in the higher intervals (71-100) of low reading achievement, and there was a greater concentration (84.21%) of low reading achievement in the comparable range of 11-50. For low mathematics achievement, there was a greater concentration (89.47%) of low mathematics achievement in the comparable range of 31-70. For low science achievement, there were no high schools found in the higher intervals of 81-100, and there was a greater concentration (89.47%) of low science achievement in the comparable range of 31-70.

Similar patterns were found for 4A-sized high schools in the school size group. None of the 4A-sized high schools were found in the low income intervals of 51-100. All of the 4A-sized high schools were found in the intervals of 0-50 in comparison to the other three school size groups. For low reading achievement, none of the 4A-sized high schools was found in the intervals of 61-100 and all schools fell in the intervals of 11-60. For low mathematics achievement, none of the 4A-sized high schools fell in the intervals of 0-30 and 81-100. There was a greater concentration (98.39%) of 4A-sized high schools in the intervals of 31-70. For low science achievement, none of the 4A-sized high schools fell in the intervals of 0-20 and 71-100. There was a greater concentration (91.94%) of 4A-sized high schools in the intervals of 31-70.

Partial Correlation Results

Research Question 6. What was the magnitude of the correlations (building rates for low income with building rates for low achievement) for the subject areas of reading, mathematics and science when the original correlations were correlated for secondary inter-correlations among the building rates for low reading, low mathematics and low science achievement?

Partial correlation analysis was used in this study to correct for a possible higher common variance (higher intercorrelations) among the achievement scores. In other words, it was possible, for example, that the low reading achievement/low income correlation could have been affected by the low income/low science achievement correlation. To correct for the possible higher common variance among the achievement scores, the researcher completed a partial

Table 4.17 Intercorrelations and Coefficient of Determination Scores Among Low Reading, Low Mathematics, and Low Science Achievement

Achievement variables	r	r^2
Low reading to low math		
School location group	0.83	0.69
School size group	0.70	0.49
Low reading to low science		
School location group	0.86	0.74
School size group	0.71	0.50
Low math to low science		
School location group	0.92	0.85
School size group	0.81	0.66

Table 4.18 Partial Correlation Coefficient Scores Between Low Academic Achievement (Mathematics, Science, Reading) and Low Family-Student Income*

Low academic achievement	r	p
Mathematics	0.24	0.01
Science	0.21	0.01
Reading	0.19	0.01

*Partial correlation analysis removes the overlap in correlations among science and reading, mathematics and reading, and science and mathematics and leaves a residual or partial correlation.

correlation analysis. This statistic adjusts for the common variance among the achievement scores while recalculating the correlations between low income and the low achievement measures.

To accomplish the partial correlation analysis the researcher first calculated correlations among low reading, low mathematics, and low science achievement. The purpose was to determine if the three achievement areas (low reading, low mathematics, and low science) shared sizeable common variance, or overlap. Table 4.17 reports the results of low reading, low mathematics, low science intercorrelations (r) and coefficients of determinations (r^2). The achievement score intercorrelations ranged from .70 to .92 which falls into the moderately-high to high categories. The common variance (r^2) ranged from 49 to 85%. This identified the need to adjust for these overlaps in the three achievement areas.

To correct for this substantial common variance among the three achievement areas, the researcher completed a partial correlation analysis. Table 4.18 reports the results of this analysis. Those correlations (low income to low mathematics, $r = 0.24$; low income to low science, $r = 0.21$; low income to low reading; $r = 0.19$) were found to be significant ($p = 0.01$). The data shows when the effects of sizeable secondary correlations among achievement scores are removed, low mathematics has the most powerful residual correlation to low income; low science achievement has the second most powerful residual correlation to low income; and low reading achievement has the third most powerful correlation to low income.

ANCOVA Results

Research question 7: Were there significant differences in the building rates for low achievement when comparisons were made among high schools in the three metropolitan locations and among high schools in the four categories of schools size when the buildings' low achievement

Table 4.19 ANCOVA Results for Comparisons Among Low Reading, Mathematics, and Science Achievement Scores for Three Metropolitan Locations (controlled for low income)

Achievement	df	ms	F	P
Low reading achievement	3,68	3245.35	33.90	0.01
Low mathematics achievement	3,68	5168.42	49.04	0.01
Low science achievement	3,68	7004.87	66.55	0.01

Table 4.20 Fisher LSD Post Hoc Pairwise Comparison Results for Low Reading, Mathematics, and Science Achievement Adjusted Mean Scores for the Three Metropolitan Locations

Pairwise comparisons		Differences between means
Low reading achievement		
Metropolitan areas		
1	2	-3.93*
1	3	-9.13*
2	3	-5.19*
Low mathematics achievement		
Metropolitan areas		
1	2	1.70*
1	3	-3.75*
2	3	-5.45*
Low science achievement		
Metropolitan areas		
1	2	-3.80*
1	3	-9.22*
2	3	-5.42*

* The mean differences were statistically significant at the 0.05 level.

Table 4.21 Mean and Adjusted Mean Scores for Low Reading, Mathematics and Science Achievement for the Three Metropolitan Locations (adjusted for low income)

Achievement/Location	Means	Adjusted means
Reading (adjusted means listed from lowest to highest*)		
Metropolitan 1	41.04	36.19
Metropolitan 2	39.43	40.12
Metropolitan 3	41.98	45.32
Mathematics (adjusted means listed from lowest to highest*)		
Metropolitan 2	51.94	52.79
Metropolitan 1	60.46	54.49
Metropolitan 3	54.13	58.24
Science (adjusted means listed from lowest to highest*)		
Metropolitan 1	50.33	43.22
Metropolitan 2	46.00	47.02
Metropolitan 3	47.54	52.44

*Low percentages of low academic achievement were considered the most favorable result, thus, the lowest adjusted mean score reflected the highest score.

rates were adjusted by the buildings' low-income rates?

This research question required that direct comparisons be made among the low achievement (reading, mathematics, and science) variances for the three metropolitan areas, and separately for the four school sizes. The researcher used the Analysis of Covariance (ANCOVA) statistic from the Statistical Analysis System (SAS Version 9.1, 2002/2003) program. This statistic allows for direct comparisons of variances among groups. It also accommodates a correlate to the main comparison. In this case, low income was the correlate to low achievement, and the main comparison was made on low achievement. The SAS program provided the results of the ANCOVA. Second, it provided the results from the Fisher LSD (least significant difference) results. Where ANCOVA comparisons proved to be statistically significant, the Fisher LSD post hoc statistic was used to make pairwise comparisons to pinpoint significant differences between the compared group's adjusted mean scores. Third, the SAS program provided the adjusted means. In this case, the low achievement scores were adjusted by the correlate of low income for each group compared.

Table 4.19 reports the ANCOVA results for comparisons among low reading, mathematics, and science for the three metropolitan locations. This analysis of three achievement areas (reading, $F = 33.90$, $p = 0.01$; mathematics, $F = 49.04$, $p = 0.01$; science $F = 66.55$, $p = 0.01$) for the three metropolitan areas revealed significant differences among the three locations.

Table 4.20 reports the results of the Fisher LSD post-hoc comparisons for low reading, mathematics, and science achievement for the three metropolitan locations.
The pairwise comparisons showed significant differences ($p < 0.05$) among the three locations for all three low achievement areas. The means compared were the adjusted means. The results

represent a real difference among the three groups of high schools in the three metropolitan areas on the measures of low reading, mathematics and science achievement.

Table 4.21 reports the mean and adjusted mean scores for low reading, mathematics and science achievement for the three metropolitan locations. The adjusted mean for low achievement was an estimated mean of what would happen if the average low income had been the same in all three metropolitan areas. After low income was adjusted, metropolitan area 1 had the lowest adjusted mean (36.19) for low reading achievement, metropolitan area 2 had the second lowest adjusted mean (40.12) for low reading achievement, and metropolitan area 3 had the third lowest adjusted mean (45.32) for low reading achievement. After low income was adjusted, metropolitan area 2 had the lowest adjusted mean (52.79) for low mathematics achievement, metropolitan area 1 had the second lowest adjusted mean (54.49) for low mathematics achievement, and metropolitan area 3 had the third lowest adjusted mean (58.24) for low mathematics achievement. After low income was adjusted, metropolitan area 1 had the lowest adjusted mean (43.22) for low science achievement, metropolitan area 2 had the second lowest adjusted mean (47.02) for low science achievement, and metropolitan area 3 had the third lowest adjusted mean (52.44) for low science achievement.

Table 4.22 reports the ANCOVA results for comparisons among low reading, mathematics, and science for the four high-school size groups. This analysis of three achievement areas (reading, $F = 29.07$, $p = 0.01$; mathematics, $F = 42.00$, $p = 0.01$; science $F = 39.07$, $p = 0.01$) for the four high-school size groups revealed significant differences among the four groups.

Table 4.23 reports the results of the Fisher LSD post-hoc comparisons for low reading, mathematics, and science achievement for the four high school size groups. The pairwise

Table 4.22 ANCOVA Results for Comparisons Among Low Reading, Mathematics, and Science Achievement Scores for the Four High School Size Groups (controlled for low income)

Achievement	df	ms	F	P
Reading	4,182	2864.40	29.07	0.01
Mathematics	4,182	5183.74	42.00	0.01
Science	4,182	5455.20	39.07	0.01

Table 4.23 Fisher LSD Post Hoc Pairwise Comparison Results for Low Reading, Mathematics, and Science Achievement Adjusted Mean Scores for the Four High School Size Groups

Pairwise comparisons		Differences between means
Low reading achievement		
School sizes		
3A	4A	-2.26*
3A	5A	-4.86*
3A	6A	0.82*
4A	5A	-2.60*
4A	6A	3.08*
5A	6A	5.68*
Low mathematics achievement		
School sizes		
3A	4A	-4.63*
3A	5A	-7.83*
3A	6A	-3.00*
4A	5A	-3.20*
4A	6A	1.63*
5A	6A	4.83*
Low science achievement		
School sizes		
3A	4A	-3.08*
3A	5A	-6.36*
3A	6A	-3.05*
4A	5A	-3.27*
4A	6A	0.04*
5A	6A	3.31*

* The mean differences were statistically significant at the 0.05 level.

Table 4.24 Mean and Adjusted Mean Scores for Low Reading, Mathematics and Science Achievement for the Four High School Sizes (adjusted for low income)

Achievement/Size	Means	Adjusted means
Reading (adjusted means listed from lowest to highest*)		
6A high schools	36.29	37.78
3A high schools	39.44	38.60
4A high schools	39.45	40.86
5A high schools	46.29	43.46
Mathematics (adjusted means listed from lowest to highest*)		
3A high schools	51.74	50.59
6A high schools	51.57	53.59
4A high schools	53.30	55.22
5A high schools	62.28	58.42
Science (adjusted means listed from lowest to highest*)		
3A high schools	43.25	42.06
6A high schools	43.00	45.11
4A high schools	43.15	45.15
5A high schools	52.44	48.42

*Low percentages of low academic achievement were considered the most favorable result, thus, the lowest adjusted mean score reflected the highest score.

comparisons showed significant differences ($p < 0.05$) among the four high-school size groups for all three low-achievement areas. The means compared are the adjusted means. The results represent a real difference among the schools in low reading, mathematics, and science achievement. Table 4.24 reports the mean and the adjusted mean scores for low reading, mathematics, and science achievement for the four high-school size groups. The adjusted low achievement mean was an estimated mean of what would happen if the average low income had been the same in all four high-school size groups. After low income was adjusted, the 6A-sized high schools had the lowest adjusted mean (37.78) for low reading achievement, the 3A-sized high schools had the second lowest adjusted mean (38.60) for low reading achievement, the 4A-sized high schools had the third lowest adjusted mean (40.86) for low reading achievement and the 5A-sized high schools had the fourth lowest adjusted mean (43.46) for low reading achievement. After low income was adjusted, the 3A-sized high schools had the lowest adjusted mean (50.59) in low mathematics achievement, the 6A-sized high schools had the second lowest adjusted mean (53.59) in low mathematics achievement, the 4A-sized high schools had the third lowest adjusted mean (55.22) for low mathematics achievement and the 5A-sized high schools had the fourth lowest adjusted mean (58.42) for low mathematics achievement. After low income was adjusted, the 3A-sized high schools had the lowest adjusted mean (42.06) for low science achievement, the 6A-sized high schools had the second lowest adjusted mean (45.11) for low science achievement, the 4A-sized high schools had the third lowest adjusted mean (45.15) for low science achievement and the 5A-sized high schools had the fourth lowest adjusted mean (48.42) for low science achievement.

CHAPTER 5 - Summary, Conclusions and Recommendations

Introduction

This study correlated building rates for low income, low reading, low mathematics, and low science achievement in Kansas high schools at three metropolitan locations and four sizes of high schools. The researcher retrieved high school building rates for low income and low achievement from the Kansas State Board of Education website (http://online.ksde.org/rcard). This is a public access database. The data were analyzed through intercorrelations of 1) the rate (percentage) of students in a high school building receiving free or reduced lunches during the 2002-2003 academic year and 2) the rate (percentage) of students in a high school building who scored in the unsatisfactory and basic categories on state reading, mathematics and science assessments during the 2002-2003 academic year.

The high schools for the three metropolitan locations were taken from 1) the Wichita area, 2) the Topeka-Lawrence area, and 3) the greater Kansas City area. There were a total of 69 high schools in these three metropolitan locations. There were 22 high schools in metropolitan location 1, 19 high schools in metropolitan location 2, and 28 high schools in metropolitan location 3. Statewide, there were 32 6A-sized high schools, 30 5A-sized high schools, 62 4A-sized high schools, and 59 3A-sized high schools. The category sizes for the high schools were determined by the state on the basis of membership for athletic competition. The four sizes of high schools made up a total of 183 high schools and included those in the three metropolitan locations.

The study was originally proposed and accepted as a low reading achievement and low income correlational study, however, the researcher expanded the study to include low mathematics and low science achievement. The literature review demonstrated that low-income student status and low achievement in all three academic areas was of equal concern. The researcher sought to extend the literature on low achievement-low income relationships by factoring in high school size and high school metropolitan location.

Conclusions and Recommendations for Research Questions

Seven research questions were posed in this study. The conclusions and recommendations were written for these research questions.

Research question 1: Of the three building rates for low achievement (unsatisfactory, basic and unsatisfactory + basic), which represented the most consistent measure in correlation with the building rates for low income?

At the time this study was initiated and through 2005, the Kansas State Board of Education used five categories of academic performance on state achievement testing: exemplary, advanced, proficient, basic and unsatisfactory. Scores in the categories of proficient, advanced and exemplary met the No Child Left Behind (NCLB) requirement for adequate yearly performance (AYP). Scores in the categories of unsatisfactory and basic represent inadequate yearly performance. Findings reported in Tables 4.1 through 4.3 showed that the unsatisfactory + basic building rates of low achievement provided the most consistent correlations with building rates of low income. Basic scores provided inconsistent correlations with low income while unsatisfactory scores provided similar correlations to the combined scores of unsatisfactory and basic. As a result the researcher concludes that when low income is considered, the most consistent basis for low achievement correlations are found in the combined scores of unsatisfactory and basic. This is in line with the state requirement that unsatisfactory and basic scores reflect inadequate yearly progress.

Research question 2: What were the observable differences in the correlations (building rates of low income to low achievement) among the three metropolitan locations of high schools)?

Tables 4.1 through 4.3 summarized the correlations for this research question. The main finding was in metropolitan area 3 where building rates for low income and low achievement fell in the range of 0.83 to 0.93. This is in line with the median household income differences in the three counties making up the third metropolitan area as reported in chapter 3. The income range of $27,671 was the largest of the three metropolitan areas. Here the researcher tentatively concludes for Metropolitan area 3, that the higher correlations (rates for low income with rates for low achievement) give credence to the Bernstein thesis regarding income differences in metropolitan areas. It appears that the wide range in the three counties median household incomes is mirrored in the wider range correlations between low income and low achievement. Essentially, the correlations are higher.

The second highest set of correlations (.79 through .84) was found in the Metropolitan area 1 represented by Sedgwick County. The range in median household incomes for this metropolitan area was $24,569 as reported in chapter 3. This range for Metropolitan area 1 was slightly lower than that for Metropolitan area 3, however the correlations in low income were also slightly lower in the first Metropolitan area in comparison to Metropolitan area 3.

The lowest set of correlations (.61 through .82) was found in the five county areas that made up Metropolitan Area 2 where the range in median household incomes was $10,866: The low- income and low achievement correlations lined up fairly well with the Bernstein thesis on differences in income in metropolitan areas. In other words, in the three metropolitan areas in this study, where income differences were greater, low income and low achievement correlations were greater. Where income differences were smaller, low income and low achievement correlations were smaller.

Research question 3: What were the observable differences in the correlations (building rates for low income with building rates for low achievement) among the four different sizes of high schools?

Tables 4.1 through 4.3 summarize the correlations for this research question. The highest set of correlations (.78 through .91) was found in the 5A-sized high schools. The second highest set of correlations (.62 through .91) was found in the 6A-sized high schools. The third highest set of correlations (.59 through .69) was found in the 3A-sized high schools and the lowest set of correlations (.21 through .27) was found in the 4A-sized high schools. Obviously, there were considerable differences in the low income/low achievement correlations. In particular, the researcher took note of the small correlations in the 4A-sized group of high schools and elected to do follow up analysis with research question 5.

Research question 4: What were the observable differences in the correlations (building rates for low income with building rates for low achievement) when the subjects of reading, mathematics and science were considered?

Tables 4.4 and 4.5 summarized the correlations for this research question. The researcher noticed that building rates of low income in correlation with building rates of low achievement produced varying results. That is low reading, mathematics and science achievement correlations had different magnitudes depending on the group, although either low mathematics or low science achievement produced the largest correlations with low income in all seven groups.

The researcher concluded that these results merits further analysis and the researcher did so in research question 6 where the researcher conducted a partial correlation analysis in order to get a clearer picture of building rates of low income in relation to building rates of low reading, low mathematics and low science achievement.

Research question 5: What did the analysis of standard deviation scores, range scores, and frequency distributions reveal about differences in correlations (building rates for low income with building rates for low achievement) for high school metropolitan location and high school size.

Here, the researcher completed a follow up analysis to determine if standard deviations, range scores, and frequency distributions contributed to the low correlations found for the 4A-sized high schools. Data from tables 4.6, 4.7 and 4.8 showed that the standard deviation scores and range scores were smaller in metropolitan location 2 and the 4A-sized high schools. The two exceptions were the 6A-sized high schools in low reading and low science. They both had lower range scores than the 4A-sized high schools. Tables 4.9 through 4.16 summarize the frequency distributions for this research question. The frequency distributions revealed that metropolitan location 2 and the 4A-sized high schools have a higher concentration of frequency distributions in comparable intervals than the other two metropolitan locations and three sizes of high schools. The frequency distributions also revealed that metropolitan location 2 and the 4A-sized high schools have only three frequency distributions (low math and low science achievement of metropolitan 2 and low math achievement of the 4A high schools) in the higher intervals.

The researcher concluded that the narrower distribution of standard deviation and range scores (with the exception of the 6A-sized high schools in low reading and low science) may have contributed to the lower correlations in metropolitan location 2 and the 4A-sized high schools. In addition, the frequency distributions have indicated that the higher concentration of distributions in various comparable intervals along with only three frequency distributions (low math and low science achievement of metropolitan location 2 and low math achievement of the 4A high schools) in the higher intervals have reinforced the findings of the standard deviation and range scores.

A main concern of the researcher was the small correlations (r=.21-.27) for the 4A-sized high schools. The researcher sought additional information to further understand the low correlations between building rates of low income and low achievement among the 4A-sized high schools. For this the researcher retrieved median household incomes for the 4A-sized high school cities. The range in median household incomes was about $39,000 with a minimum of $24,000 and a maximum of $63,000. This was a very large income range; however, the distribution of city median household incomes was concentrated in the lower part of the distribution. Important values calculated by the researcher were reported by the categories of $1,000 increments:

Range = $39,000 ($63,000 to $24,000)

Mean = $37,000

Median = $35,000

Mode = $31,000 (n = 9)

In addition, about 68% of the cities fell within the range of $24,000 to $40,000. The distribution of both low income and low achievement scores in the 4A-sized high schools were narrow and concentrated in a lower segment of the distribution. It was possible that the smaller range of building rates of low income concentrated in the lower segment of the distribution mirrored the narrower range in median family income. Possibly, low achievement may simply mirror the structural distribution across the 4A cities. Additional research needs to be done on 4A-sized high schools and their cities, particularly concerning the structural distribution of family incomes across those cities.

Research Question 6: What was the magnitude of the correlations (building rates for low income with building rates for low achievement) for the subject areas of reading, mathematics and science when the original correlations were correlated for secondary inter-correlations among the building rates for low reading, low mathematics, and low science achievement?

After adjusting for intercorrelations among the achievement areas, the residual correlations showed building rates of low mathematics achievement to have the most powerful correlations with building rates of low income. Building rates of low science achievement was the second most powerful correlate with building rates of low achievement, and, building rates of low reading achievement was the third most powerful correlate with building rates of low achievement. Thus, the researcher concludes that low mathematics and science achievement are of equal if not greater importance than low reading achievement. Future researchers should continue to monitor the relationship of low reading, low mathematics and low science achievement to low income to identify any changes that may occur in these correlations over time.

Research question 7: Were there significant differences in the building rates for low achievement when comparisons were made among high schools in the three metropolitan locations and among high schools in the four categories of schools size when the buildings' low achievement rates were adjusted by the buildings' low income-rates?

Tables 4.19 through 4.24 summarize the ANCOVA results, Fisher LSD results, and adjusted means of this research question. Significant group variance differences were found for the building rates for low achievement (reading, mathematics, and science) among the high schools in the three high school locations and four sizes of high schools after the high schools' building rates for low achievement were adjusted with the use of the high schools' building rates for low income.

Table 5.1 combines data from Tables 4.21 and 4.24. This table summarizes and illustrates the building rates for low academic achievement means for the seven groups. These means were adjusted by low-income building rates. The researcher does not attempt to compare school location results to school size results with this table. First, it can be seen that the ranked adjusted mean low-achievement rates in reading, mathematics and science for the seven groups are fairly stable considering that there were seven groups of high schools.

Thus, in the end, it is concluded that low-achievement rates (adjusted for low-income rates) do not differ much across the subject areas when the seven subgroups were considered. A second conclusion is that the idea of building smaller high schools is not supported by these findings. The 6A high schools (enrollment range of 911-1543) and the 3A-sized high schools (enrollment range of 132-216) produced relatively better scores for achievement when these were adjusted for low-income rates. Similarly, the 4A-sized high schools (enrollment range of 219-507) and the 5A-sized high schools (enrollment range of 509-908) produced relatively worse achievement rates when these were adjusted for low-income rates. School size did not produce a distinct pattern in this study. A third aspect of this study, metropolitan school location, produced a partially distinct pattern. Metropolitan area 3 (Wyandotte, Johnson, and Leavenworth counties) did produce the lowest rate of low achievement (adjusted for low-income rates) in all three subject areas. Metropolitan area 1 (Sedgwick County) did produce the better low-achievement rates (adjusted for low-income rates) in reading and science; however,

Table 5.1 Low Academic Achievement Means for the Seven Groups Adjusted by Low-Income Building Rates (summarized from tables 4.21 and 4.24).

Reading		Mathematics		Science	
Group	Mean	Group	Mean	Group	Mean
Metro 1	36.19	3A sized	50.59	3A sized	42.06
6A sized	37.78	Metro 2	52.79	Metro 1	43.22
3A sized	38.60	6A sized	53.59	6A sized	45.11
Metro 2	40.12	Metro 1	54.49	4A sized	45.15
4A sized	40.86	4A sized	55.22	Metro 2	47.02
5A sized	43.46	Metro 3	58.24	5A sized	48.42
Metro 3	45.32	5A sized	58.42	Metro 3	52.44

Metropolitan area 2 produced the better low-achievement rate (adjusted for low-income rates) in mathematics in comparison to Metropolitan area 1. The researcher recommends that additional research needs to be done on school location and school size in Kansas high schools.

Summary of Recommendations

When the researcher collected the data for this study, the low-income rate for all Kansas schools was 32%. With the posting of the 2006 Kansas assessments results, the researcher found that the low-income rate had increased to 38.5%. In examining the 2006 reading scores for several high schools, the researcher discovered that there had been a significant reduction in the low reading achievement rates. Increases in low-income rates and decreases in low reading achievement rates support replication of this study in order to measure possible changes that may have occurred in low income and low achievement correlations.

With the 2006 reporting year for Kansas achievement test results, the state changed the performance categories to: Exemplary, Exceeds standard, Meets standard, Approaches standard, and Academic warning. This study should be replicated to ascertain the most consistent correlations between low income and low achievement given the changes in the categories of the performance levels.

The findings for the school size variable did not bear out the belief that smaller high schools produce better results and that larger schools produce lesser results in the Kansas setting. The metropolitan school location factor did support the Bernstein conceptualization of differences in income within a metropolitan area. However, the Bernstein viewpoint may not provide a complete picture of the Kansas setting. Berube (2006) studied family poverty figures for the U.S. and found that in raw numbers, people living in poverty outside the core-cities exceeded the number of people living in poverty within the core-cities. Some of his explanations for this include,

1. Some people living in poverty in the core-cities have migrated to outlying suburban and exurban areas along with everyone else.
2. Some suburban areas have aged and people have moved on to exurbs and newer suburbs.
3. Major core-city areas have deployed incentives for young skilled workers to remain living in the core-cities.
4. Suburban and exurban areas have low paying jobs in the service industries, particularly in the large malls found in these areas.
5. Immigrants in many cases are avoiding the core-cities and settling directly in the suburbs.

Along with these new demographics, Berube states that we should consider economics as regional rather than local. In sum, the Bernstein conceptualization of income differences was verified in this study, however, the Bernstein model has limitations for the Kansas scene. The Rural Policy Research Institute at the University of Missouri has prepared a, “Demographic and Economic Profile: Kansas,” (July, 2006) (w.w.w.rupri.org) report that divided Kansas counties into three groups: metropolitan, micropolitan and non-core. The report designated 17 counties as metropolitan, 19 counties as micropolitan and 69 counties as non-core. Micropolitan areas were identified with counties that include an urban population of 10,000 to 49,900 with commuting ties to other counties. Non-core areas were considered rural by this report. Notably, this report looks at the Kansas settings in terms of regions rather than locales. Future research on low income and low achievement in Kansas high schools should include these four regional designations as the basis for analysis. The total regional model would include,

a. Core-city metropolitan high schools
b. Metropolitan high schools, excluding the core-city high schools.
c. Micropolitan high schools
d. Non-core high schools

This revision for future research preserves the Bernstein concept of core city versus suburban schools however it embraces Berube's concept of regionalization on economic and demographic factors. School size did not produce expected results in this study; however, school size could be reconfigured experimentally by combing 3A-and 4A-sized high schools to produce one group size and by combining 5A-and 6A-sized high schools for a second group size. The researcher realizes that the 3A-sized high schools have better adjusted mean results and the 4A-sized high schools have weaker adjusted mean results but it is both reasonable and practical to group the 3A- and 4A-sized high schools together. The 3A-sized and 4A-sized high schools contain such a small school population and both groups are located mostly in the non-core areas. The researcher also realizes that the 6A-sized high schools have better adjusted mean results and the 5A-sized high schools have the weaker adjusted mean results but it is also both practical and reasonable to group these two sizes of high schools together. They both have larger school populations and both groups are located mostly in metropolitan, metropolitan related (suburban and exurban) and micropolitan areas. Thus, future researchers could consider the two high school size groups (3A/4A and 5A/6A) across the four regions listed above (metropolitan core high schools, metropolitan high schools [non-core], micropolitan high schools, and high schools in non-core areas). In application of the revised design, the core high schools in the three locations would be combined into one group, metropolitan related (suburban and exurban) would be combined into a second group, micropolitan high schools would represent the third group, and non-core high schools would be represent the fourth group.

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