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# The Relationship Between Class Size and Student Achievement

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THE RELATIONSHIP BETWEEN  
CLASS SIZE AND STUDENT ACHIEVEMENT

Field Project

Presented to the  
Department of Educational Administration  
and the  
Faculty of the Graduate College  
University of Nebraska

In Partial Fulfillment  
of the Requirements for the Degree  
Specialist in Education  
University of Nebraska at Omaha

by

Kathleen Farrell Wallerstedt

July, 1985

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FIELD PROJECT ACCEPTANCE

Accepted for the Graduate Faculty, University of Nebraska, in partial fulfillment of the requirements for the degree Specialist in Education, University of Nebraska at Omaha.

Supervisory Committee

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Chairman

Date 7/10/85

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## CHAPTER I

## INTRODUCTION

Few issues in education have continued to receive as much attention as the topic of class size and its effect on student achievement. Frequent studies on this issue have produced an immense body of related literature. Research during the last eighty years has attempted to determine if smaller classes result in increased achievement, in improved quality of instruction, in increased student and teacher productivity, and in more positive educational outcomes. The research has failed to answer the questions. Porwoll (1978, p. 68) reports that "most reviews of the research have found the overall effects of class size on pupil achievement to be inconclusive--some studies reported that smaller classes were better, some that larger classes were more effective, while others could find no difference between the two."

The issue has the potential of becoming an emotional one, with school boards and teachers on opposite sides. Upper level administrators and school board members feel the pressure of fiscal restraints. They often must deal directly with concerned taxpayers in times when educational costs have continued to escalate in spite of declining enrollments. Teachers, on the other hand, feel intuitively that smaller classes are more desirable. They must deal with the daily frustration of teaching larger numbers in times of gradually declining

achievement scores. Chang and Ogletree (1979, p. 3) report, "the teachers have always believed that smaller class sizes will give higher achievement scores, but research has not supported this feeling. School administrators tend to agree with the research studies probably because of financial reasons. One teacher teaching fifty children costs less than two teachers, each with a class of twenty-five students."

In discussing public opinion regarding educational costs, Porwoll, (1978, p. 60) reports that in the 1976 Gallup Poll on the Public's Attitude Toward Education 70 percent of the respondents were reluctant to increase class size as a way to reduce expenses. In the same poll, however, 55 percent of these same respondents most frequently suggested reducing the number of teachers as a means of cutting school costs. Porwoll (1978, p. 57) suggests that "teachers see smaller classes as a major vehicle for influencing their students' academic and personal development as well as their own morale and job satisfaction." The 1976 Gallup Poll implies that the public views smaller classes as a key causative factor in high educational costs.

Much of the extensive research on the subject has been inconclusive, and a great deal of it, contradictory. "For many years a continuing frustration for teachers has been that research on class size has been reported in ways that resulted in contradictory conclusions." (McGuire, 1980, p. 16)

Research on class size dates back to a study by Rice in 1902. It was followed in 1914 by a study conducted by Elliott. Through the years the research has become statistically more sophisticated. Teachers College at Columbia University has a long tradition of research on class size. (See Blake, 1954; Richman, 1955; and Olson, 1970) These studies generally favored smaller classes for a variety of reasons.

The Educational Research Service (Porwoll, 1978) published a summary of over 100 studies on class size conducted between 1940 and 1978. Porwoll concludes that "there is general consensus that the research findings on the effects of class size on pupil achievement across all grade levels are contradictory and inconclusive." (p. 68)

Undoubtedly the most significant research on class size and its impact on achievement was conducted by Eugene Glass and Mary Lee Smith. (1978) Their meta-analysis of existing research yielded over 700 comparisons of achievement in smaller and larger classes. The authors reported a significant correlation between the two variables. "A clear and strong relationship between class size and achievement has emerged....There is little doubt that other things being equal, more is learned in smaller classes." (p. 46) The study is noteworthy because of its magnitude and because of its claim to conclusive results. Glass (1979, p. 22) reports remarkable findings when class size drops to twenty and fifteen.

A typical pupil in a typical class of 40 students scores at the 50th percentile of an achievement test. If this pupil

had been taught in a group of 30 pupils, his achievement would have tested out at about the same level. But taught in a group of 20, the pupil would score at the 55th percentile. His achievement would rise to the 60th percentile if he were taught in a group of 15, and the 75th percentile in a group of five. This is no mere expression of wishful thinking; it is an aggregation of findings from nearly 80 years of research.

Other authors have come to similar conclusions. In their review of literature, Schieber and her associates (1979) reported that four out of five studies that were statistically sound favored smaller classes. Cahen and his associates (1980, p. 495) supported the findings of the meta-analysis. "We feel that the new findings by Glass and Smith present a convincing case that average achievement increases as class size decreases."

Not all the research produced findings which concurred with the Glass and Smith meta-analysis. Haddad (1978) reviewed twelve significant studies conducted during the 1960's and 1970's. Four of these favored smaller classes, five favored larger classes, and three reported that there was no significant effect of class size on achievement. Haddad also reviewed the research conducted by the International Association for the Evaluation of Educational Achievement. He reported that their extensive studies "failed to show any uniformity in the relationship between class size and student achievement." (Haddad, 1978, p. 7) A major study by Shapson and his associates, (1980) found no significant correlation between class size and achievement in most subjects. They reported, that "standardized measures of students' academic achievement showed a significant class

size effect only for mathematics concepts. There was no significant difference on measures of reading, vocabulary, or mathematics problem-solving." (Shapson, 1980, p. 150)

The strongest criticism of the Glass and Smith meta-analysis came from the Educational Research Service. (1980) These researchers accused Glass and Smith of confusing the entire class size issue by overgeneralizing conclusions, by using inconsistent and untested methodology, and by issuing contradictory interpretations of data. The authors conclude their report by stating that "while the meta-analysis purportedly provides bold new research evidence on class size, many of the conclusions are either misleading or unjustified. Despite claims to the contrary...it would be a mistake for educational decision makers to rely on the Glass and Smith conclusions when formulating class size policy." (Educational Research Service, 1980, p. 241)

The criticism most frequently directed toward research studies on class size and achievement is the failure to control variables. Nello Vignocchi (1980, p. 2) contends that research on this topic is plagued by a "general lack of control of the variables which may affect the achievement of pupils with respect to the size of the class in which they are taught." Bozzomo (1978, p. 78) states that "no research design yet devised has adequately controlled all the possible...confounding variables that the child brings to the research....Neither has any research design completely controlled all of the variables that are associated with the teacher." Fritz Hess (1979, p. 6) criticizes Glass

and Smith on this very point. "The limited number of variables examined by Glass and Smith combine with the weaknesses of their methodology to limit seriously the generalizability of their study."

In spite of claims by researchers, the debate of the effect of class size on student achievement has continued. The questions remain. The need for future research is evident. This view was expressed by Harry C. Mayhew. (1983, p. 23) "The literature indicates there is a need for additional study on class size related to the myriad variables which affect the best class size."

The class size/achievement debate remains an issue for decision makers in large metropolitan school districts. Future studies which attempt to control significant variables are needed.

#### Statement of the Problem

The purpose of this study was to determine if there was a significant correlation between class size and student achievement in second and fifth grade classes in a midwestern metropolitan school district. This study tested whether achievement scores are related to class size. It was also the intent of this study to learn if the relationship is more pronounced at one grade level than another and in one socio-economic level than another.

## Hypotheses

1. There is no significant correlation between class size and student achievement in second grade classes in a large midwestern metropolitan school district.
  - 1a. There is no significant correlation between class size and student achievement in second grade classes in schools whose population reflects a high socio-economic status.
  - 1b. There is no significant correlation between class size and student achievement in second grade classes in schools whose population reflects a medium socio-economic status.
  - 1c. There is no significant correlation between class size and student achievement in second grade classes in schools whose population reflects a low socio-economic status.
  
2. There is no significant correlation between class size and student achievement in fifth grade classes in a large midwestern metropolitan school district.
  - 2a. There is no significant correlation between class size and student achievement in fifth grade classes in schools whose population reflects a high socio-economic status.
  - 2b. There is no significant correlation between class size and student achievement in fifth grade classes in schools whose population reflects a medium socio-economic status.
  - 2c. There is no significant correlation between class size and

student achievement in fifth grade classes in schools whose population reflects a low socio-economic status.

3. There is no significant correlation between class size and student achievement in second grade classes which number twenty and below in size.
4. There is no significant correlation between class size and student achievement in fifth grade classes which number twenty and below in size.
5. There is no significant statistical variance among the mean scale scores reported for each socio-economic group and for the total group at the second grade level.
6. There is no significant statistical variance among the mean scale scores reported for each socio-economic group and for the total group at the fifth grade level.

#### Methodology

This study compared class size and student achievement as measured by the class average scale score earned by each class in March of 1984 on the California Achievement Test. The sample consisted of all second and fifth grade classes (except for combination or split-level classes) in a midwestern metropolitan school district. Special education students who are mainstreamed were not included in the study.



To test the first and second hypotheses a coefficient of correlation between class size and student achievement was computed for each grade level by using the Pearson product-moment coefficient of correlation formula.

To test the subhypotheses under the first hypothesis, the second grade classes were stratified into high, medium, and low socio-economic groups based on the percentage of students in the school who were eligible for free or reduced lunch. A separate coefficient of correlation was computed for each of three socio-economic levels.

To test the subhypotheses under the second hypothesis, the fifth grade classes were stratified into high, medium, and low socio-economic groups based on the percentage of students in the school who were eligible for free or reduced lunch. A separate coefficient of correlation was computed for each of three socio-economic levels.

To test the third hypothesis a correlation coefficient was computed for those classes at the second grade level which had a class size of twenty or below.

To test the fourth hypothesis a correlation coefficient was computed for those classes at the fifth grade level which had a class size of twenty or below.

To test the fifth hypothesis a one-way analysis of variance was performed to determine whether there was a significant statistical variance among the mean scale scores reported for each socio-economic group at the second grade level.

To test the sixth hypothesis a one-way analysis of variance was performed to determine whether there was a significant statistical variance among the mean scale scores reported for each socio-economic group at the second grade level.

#### Limitations

1. In this study no attempt was made to ensure that classes in the sample were equivalent in regard to students and teachers. Classes were not constructed for the study, but already existing classes were used in the sample.
2. The study was limited to the 1983-84 school year. Scores were taken from the California Achievement Test taken in the spring of 1984.
3. The results of the study should be considered applicable only to the large midwestern metropolitan school district whose students comprised the sample.

### Assumptions

1. It is assumed that the California Achievement Test is a valid measure of student achievement.
2. It is assumed that the test was administered according to directions under standardized conditions.

### Definitions

Scale Score: a figure produced from a single, equal-interval scale of scores across all grades. It is expressed in three-digit numbers ranging from 000-999 and allows for easy comparability of individual classes, schools and districts. The class scale score is an average of scale scores earned by individual class members. (CTB/McGraw-Hill, 1978, p. 54)

Class size: for purposes of this study, the number of students taking the test in each class, as indicated by the case number on the California Achievement Test class record sheet.

High socio-economic status: for purposes of this study, the term "high socio-economic status" will be applied to those schools in which 0-33 percent of the membership is eligible for free or reduced lunch.

Medium socio-economic status: for purposes of this study, the term "medium socio-economic status" will be applied to those schools in which 34-55 percent of the membership is eligible for free or reduced lunch.

Low socio-economic status: for purposes of this study, the term "low socio-economic status" will be applied to those schools in which more than 55 percent of the membership is eligible for free or reduced lunch.

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## CHAPTER II

## REVIEW OF RELATED LITERATURE

The issue of class size and its relationship to student academic achievement is a frequent topic of discussion in educational journals. In spite of extensive literature on the topic, the question has not yet been laid to rest. The editors of Childhood Education (September, 1966, p. 4) state, "the problem of class size is a hardy perennial." The fact that the issue is still in the forefront of educational research is perhaps a reflection of the inconclusive findings reported by many of the studies. Seemingly competent and conscientious researchers, employing valid methodologies have published conflicting results. "There is a general consensus that the research findings on the effects of class size on pupil achievement across all grade levels are contradictory and inconclusive." (Porwoll, 1978, p. 68)

It is possible to find support for either side of the issue. Advocates of larger classes (frequently school boards and high level administrators) view class size as a means to reduce the number of school employees, thereby decreasing educational costs. On the other hand, advocates of lower class size (such as teachers and their associations) see reducing the number of students assigned to each teacher as a step toward improving the quality of instruction. Often

fiscal restraints and reduced funding lead school boards to use the conflicting data to support their contention that there is no proof that smaller classes are more productive. The inconsistency of research results is a continued frustration for teachers who feel they can do a better instructional job in smaller classes, but lack the conclusive evidence to support their views.

The opposing opinions are obviously a reflection of different points of view. It would seem that school boards are closely accountable to taxpayers for expenditures. Teachers, on the other hand, face the daily frustration of educating large groups of children who have varying levels of ability and wide ranges of intellectual and emotional needs. Lawrence McCluskey (1978, p. 4) advises his readers to "keep in mind that there are no naturally identifiable 'good guys' or 'bad guys' in this controversy. There are simply differing groups trying to impose their view on other groups. Each group is armed with ample research to support its contentions." Nello Vignocchi (1981, p. 3) agrees that there is sufficient literature to validate the views of either side of the issue. "It appears that for every study which shows a significant relationship between the academic achievement of students and class size there is another study which refutes or contradicts the results." There has been abundant research conducted which supports small classes. There is probably an equal amount published which denies the detrimental effects of larger classes. There are a considerable number of studies whose results are so conflicting that they can support nothing except the need for more refined research.



### Historical Review

The frequency of studies relating to class size appears to be a reflection of the economic conditions of the time. Research was more prevalent around the turn of the century, following World War I, and again during and preceding the Great Depression. We are again witnessing renewed attention on the class size issue. It is not surprising when one considers that the last fifteen years have been marked by high unemployment, higher educational costs in spite of decreasing educational funding and lower enrollments in the schools. (Table I. Glass and Associates, 1982, p. 42)

TABLE I Class Size Comparisons by Year of Study

<i>Year</i>	<i>No. of Comparisons of Smaller &amp; Larger Classes</i>	<i>%</i>
1900-1909	22	3.0%
1910-1919	184	25.4%
1920-1929	138	19.0%
1930-1939	47	6.5%
1940-1949	1	0.0%
1950-1959	62	8.6%
1960-1969	150	20.8%
1970-1979	121	16.7%
	<hr/> 725	<hr/> 100.0%

The teacher-pupil ratio in the United States has gradually declined since 1900, according to Gene Glass and his associates. (Figure 1, 1982, p. 19) Between 1900 and 1975 the average class size had dropped from over 35 pupils to 21, a decrease of 40 percent.

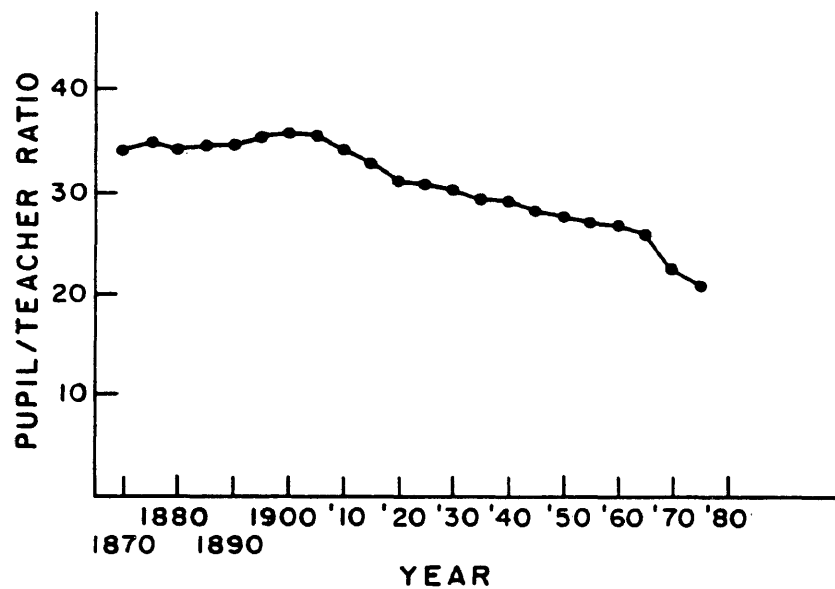


Figure 1. Pupil-to-teacher ratios in the United States from 1870 to 1975

Has this decrease in class size resulted in increased academic achievement? Many researchers have studied this question. A complete history of research pertaining to class size and its relationship to achievement is not the purpose of this paper. A review, however, of the more significant studies is in order. A very early study conducted by Rice (1902) included a discussion of class size and achievement, but revealed no strong correlation between the two factors. Since Rice reported no numbers, the significance of his findings is limited.

In 1914 Charles Elliott studied student achievement in the areas of spelling, handwriting, arithmetic and English composition. He reported a "general lack of a correlation between the size of class in which the children have been taught and such factors as are commonly accepted as adequate measures of school work and progress." (1914, p. 80)

A study in 1909 by Cornman examined promotion records in the Philadelphia School District as an indicator of academic progress and related it to class size. According to Glass and his associates (1982, p. 36) Cornman's "discussion of results showed little sensitivity to questions of experimental control. Such concerns were doubtless not widespread at the time." Glass comments further that "these studies are typified by their rugged non-experimental logic."

Many studies were conducted between 1910 and 1929. Glass feels that the studies of class size in the 1920's were approached with better methods. (1982, p. 36) Table I indicates that fewer studies were conducted during the Depression years and only one was conducted during the 1940's. The reader might assume that during that decade the country's attention was focused on World War II and its aftermath.

Probably the most extensive study on class size in the 1950's was done by Howard Blake. (1954) He located 267 earlier studies dealing with class size. Of these, he used 85 which were based on original

research as the ground work for his study. Only 22 of these proved to be statistically sound. Blake published these results:

1. Sixteen studies (72%) favored small class size.
2. Three studies (14%) favored large class size.
3. Three studies (14%) were inconclusive.

Harold Richman (1955) conducted a rather sophisticated study of the effects of class size. He found that in classes of fewer than 25 students there were:

1. Increased opportunities for children to select learning materials.
2. Increased face-to-face relationships between teacher and students.
3. Increased knowledge by teachers of their pupils' abilities.
4. Increased knowledge by teachers of their pupils' potential.
5. Increased teacher attention to informal pupil guidance.
6. Increased teacher attention to observing non-overt pupil behavior, denoting emotional instability.
7. Increased work with the gifted and the slow learner.
8. Increased attention to grouping and greater flexibility of grouping.

*used* While these items are not specifically measures of achievement, Richman contends that their existence in a class alters the learning environment to allow for greater achievement. Porwoll (1978, p. 39) published *it*

information regarding Richman's study that was overlooked in other sources. In the Richman study classes were deliberately increased or decreased in size. Some teachers were made aware of the intent of the study, while others were not. Porwoll quotes Richman: "Where the teachers were aware of the reduced class-size policy and had been asked to give definite attention to taking advantage of the better situation, results came more quickly and were more pronounced than in those situations where the teachers were not let in on the policy decision." This knowledge on the part of some teachers involved in the study constitutes another variable which could have influenced the results of the study as much as the lower class size.

In its report, "Class size: A Summary of Research" (Porwoll, 1978, pp. 25-30) the Educational Research Service presents a concise summary of significant studies on class size and its effects on student achievement from 1954 through 1977. (Table II) Of approximately 21 studies reviewed in the table, three reported more favorable achievement in larger classes. An almost equal number of studies favored small classes (9) or revealed no significant difference (8) in achievement in larger or smaller classes. Because these research studies have achieved varied and even conflicting results they have done little to clarify the relationship between class size and academic achievement.

Table II.--The Effects of Class Size on the Achievement of Elementary School Pupils (K-8)

Author and Year of Study	Subject Areas	Grade Level	Sample	Definition of "small" and "large" classes	Findings	Criticisms Contained in the Literature
Johnson and Others (1977)	reading and mathematics	1	498 students in 25 "small" (experimental) classes; 668 students in 25 "large" (control) classes	"Small" classes averaged 19.9 students; "large" classes averaged 26.7 students.	Smaller classes significantly affected reading and overall achievement, but not mathematics achievement. Teacher in-service training and class size together affected achievement in reading, but not mathematics or overall achievement.	
Madison Metropolitan District (1976)	reading	3-year longitudinal analysis of same group studies from grades 1-3	517	"Small": equal to or less than the median class size for a particular year (23-24); "large": greater than the median class size for a particular year (more than 23-24)	1) Reading scores declined as the number of years pupils spent in small classes increased. 2) There was a small but significant difference between the reading abilities of pupils in small classes for three consecutive years and those in large classes for all three years. 3) Students consistently enrolled in small classes had lower reading abilities than those enrolled in large classes. 4) However, due to confounding with attendance area and special education programs, it was not possible to determine if placing students in small classes, grades 1-3, would affect reading achievement.	

(Continued)

(Continued)

Author and Year of Study	Subject Areas	Grade Level	Sample	Definition of "small" and "large" classes	Findings	Criticisms Contained in the Literature
Summers and Wolfe (1975)	scores from Iowa Tests of Basic Skills	3-6	627 students in 103 elementary schools		<p>1) Class size greater than 34:1 negatively affected achievement.</p> <p>2) Class size from 28 to 33 had no effect on achievement of students who scored at grade level in the third grade. However, class size in this range positively affected high achievers and negatively affected low achievers.</p>	The data used were too limited in scope to be valid. [32; 90]
Murnane (1975)	reading and mathematics	2-3	875 inner-city black children		Achievement of students with family incomes of \$10,000 or less was negatively affected in classes of 32 or more.	
Coldiron and Skiffington (1975)	cognitive and noncognitive output measures	5			Class size had no effect on pupil achievement. However, insufficient variation in the class sizes examined may be the reason for this finding.	
Helm and Perl (1974)	reading and arithmetic	K-5	63 New York State school districts		Staff-to-pupil ratio was found to be a nonsignificant indicator of student performance.	
					Lower pupil-teacher ratio resulted in significant achievement gains in both reading and arithmetic in grades K-2. Lower pupil-teacher ratio also influenced reading achievement in grades 3-5, but less than in the early primary grades.	

(Continued)

Author and Year of Study	Subject Areas	Grade Level	Sample	Definition of "small" and "large" classes	Findings	Criticisms Contained in the Literature
Johnson and Scriven (1967)	English and mathematics	7-8	7,500 pupils in 130 English and 135 mathematics classes	Initial study: "small": below 29 (grade 7), below 28 (grade 8) "large": 29 and above in both grades	No significant achievement gains were found in either study between small and large classes based on the results from the <i>Iowa Tests of Basic Skills</i> .	
				study of smallest and largest classes: "small": less than 24 "large": over 34		
Fox (1967)	reading and arithmetic	1-8	More Effective Schools Program, New York City	1966 average class size in MES: 20.1; in control schools: 28.5; in special service schools: 27.2; in citywide elementary schools: 27.7	No relationship was found between class size and pupil achievement	
Balow (1967)	reading	3-year longitudinal analysis of same group studied from grades 1-4	656 in experimental group; 602 in control group	"small": 15 "large": 30	1) When students were in small classes for two or more consecutive years, class size positively affected achievement. 2) First grade was critical to reading achievement, but by the third grade class size alone was not the only factor in determining achievement.	



Moody and Others (1972)	mathematics	4	83	20 groups of 1, 10 groups of 2, 4 groups of 5, 1 group of 23	The smaller groups showed greater achievement gains than did the class of 23. 1:1 instruction was found better than 1:5 instruction.	The superiority of one-to-one instruction is probably restricted to learning outcomes not demanding much pupil-to-pupil interaction. [18]
Flinker (1972)	language arts and mathematics	7	123	"small": 34 "large": 55	The large class showed more achievement gains than the small classes.	Inadequate research design may have contaminated the results of this study. [104]
Taylor and Fleming (1972)	reading and mathematics	K-6	766 pupils in 2 elementary school buildings	Class size averaged no more than 25 pupils.	Pupil achievement increased during the first two years of the program, but by the third year began to decline in relation to the control group.	
Katzman (1971)	reading and mathematics	2, 5, 6	56 elementary school attendance districts in Boston		Student-staff ratio was found to correlate significantly with average daily attendance and output measures of school persistence. "Noncrowding" influenced reading scores and percentage of sixth graders passing Latin High's entrance exam. "Crowding" did not correlate with attendance.	
Counellis (1970)	reading	1			Reading achievement of the disadvantaged, primarily black sample, was not significantly related to class size.	
Woodson (1968)	reading and arithmetic	4, 6	95 school systems	"small": less than 22 "large": more than 27	A small inverse relationship was found between class size and achievement, but with five qualifications.	1) School districts were not randomly selected. 2) There was no control for the teacher variable. 3) Differences in school districts may affect these outcomes. [18]

(Continued)

Furno and Collins (1967)	reading and arithmetic	5-year longitudinal analysis of same group studied from grade 3 to grades 5-10	16,449	4 different groups studied: 25 or less, 26-31, 32-37, 38 or more	1) Smaller classes showed significant gains in both reading and arithmetic achievement for students in both the regular and special education curricula. 2) Class size of 1-25 was considerably better for non-white students than larger classes. 3) Implications of data on significant differences were dismissed too hastily. [18]
Menniti (1964)	reading and mathematics	Elementary classes in Harrisburg, Pa. and Evansville, Ind. dioceses.		"small": less than 36 "large": 40 and over	1) Large classes favored achievement gains for average pupils in mathematics in both dioceses and in reading in Harrisburg. 2) Low IQ groups were affected similarly, though not as much as average students. 3) High IQ groups showed no achievement differences when in large groups.
Frymier (1964)	reading	1 219 pupils in 9 small classes; 201 pupils in 6 large classes		"small": less than 30 "large": more than 36	1) There were loose controls on the teacher variable. 2) There was no control on the pupil intelligence variable. 3) Classes defined as "small" in this study are actually considered large for the first grade. [18]
Clark (1963)	mechanical reading ability and intelligence	8-year-olds	4,000		No significant differences were found between small and large classes.
	reading	7-11-year-olds	7,000		Large classes, large schools, superior buildings, and urban areas positively affected performance.

(Continued)

(Continued)

Author and Year of Study	Subject Areas	Grade Level	Sample	Definition of "small" and "large" classes	Findings	Criticisms Contained in the Literature
Clark (continued)	English comprehension	10-year-olds	76,000		There was little relationship between class size and achievement in English comprehension.	
	reading and arithmetic	5,7			Classes of less than 30 pupils best led to achievement gains.	
Marklund (1963)	reading, writing, mathematics, English, history, geography, mature knowledge	6	150 classes of 3,691 students in the national sample; 39 classes of 1,223 students in the south Stockholm sample	pupils in four categories were compared: 16-20, 21-25, 26-30, 31-35	Reductions in class size alone would not lead to improved achievement.	
Spitzer (1954)	reading, arithmetic, language, and study skills as measured by the Iowa Every-Pupil Tests of Basic Skills	3  6	50 small classes; 26 large classes  55 small classes; 17 large classes	"small": 26 or less "large": 30 or more	No significant differences in achievement were found in test scores for students in small or large classes.	

Notably absent from the Educational Research Service review, was an extensive study conducted by Martin Olson (1970) which involved 18,528 elementary and secondary classrooms in 112 school systems over a twelve-year period. He reported the following results in smaller classes:

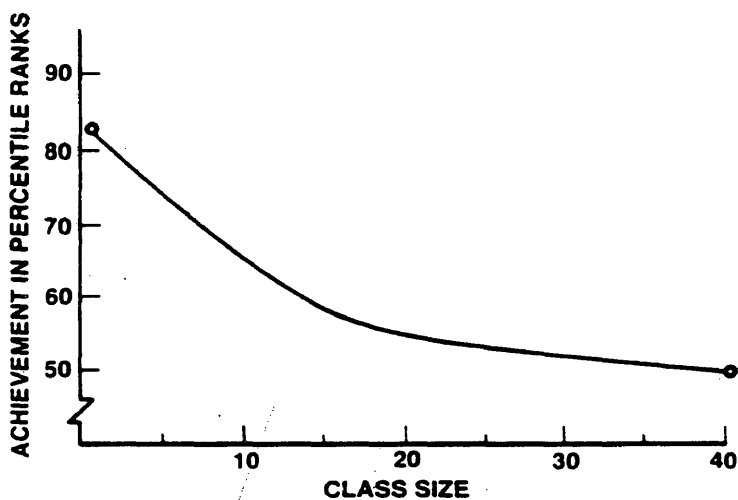
1. There is improved discipline.
2. Teachers use a wide variety of instructional strategies.
3. Students benefit from more individual instruction.
4. Students learn basic skills better.
5. Students engage in more creative thinking processes.
6. Students function more effectively as group members.
7. Teacher attitudes and morale are more positive.
8. Students develop better human relations.

#### The Meta-Analysis by Glass and Smith

The publication of the Meta-Analysis of Research on the Relationship of Class-Size and Achievement (Glass and Smith, 1978) marked a milestone in educational research on this topic. Glass and Smith authored this meta-analysis as part of a project in class size and instruction undertaken by the Far West Laboratory for Educational Research and Development. The authors did not collect original data for their study, but reviewed already existent research. Meta-analysis is a rather complicated statistical method which integrates data obtained from many sources. "Meta-analysis proceeds by calculating the size of one or more measures as data points for further analysis." (Cohen and

Filby, 1979, p. 492) Initially Glass and Smith reviewed 300 studies, from which 77 were selected for further study because of their statistical validity. These 77 studies yielded over 100 comparisons between different class sizes and academic achievement. The findings were that as class size increased, achievement decreased. (Figure 2, Glass and Smith, 1978, p. vi)

**Figure 2. Relationship Between Achievement and Class Size  
(Data integrated Across Approximately 100 Comparisons from  
Studies Exercising Good Experimental Control)**



In defending their research, Glass reported, "We collected about 50% more studies than any previous reviewer....The results of hundreds of comparisons were tallied and analyzed. More than 60% of the comparisons favored small classes." (Glass, 1979, p. 22) Figure 2 reveals that Glass and Smith found the most noteworthy results when class size dropped to twenty students or below.

Whether or not there is agreement with the results, the Smith and Glass study is worthy of recognition. The magnitude of the study is impressive. Glass and Smith criticized earlier research for various reasons. "Previous reviews of the evidence have been overly selective and insufficiently quantitative....Previous research reviews lost their way in the forest of data and failed to find a defensible generalization." (Glass and Smith, 1978, pp. iv-v) In their summary Glass and Smith disagree specifically with these findings published by Porwoll: "Research findings on class size to this point document repeatedly that the relationship between pupil achievement and class size is highly complex. Existing research findings do not support the contention that smaller classes will of themselves result in greater academic achievement gains for pupils." (Porwoll, 1978, pp. 68-69)

Because of the amount of research considered in the study, the meta-analysis of Glass and Smith cannot be ignored. For many subsequent studies it has become a point of reference, even when researchers disagree with its results. This paper will examine the research following the meta-analysis in two groups, those which agree with it and those which do not.

#### Studies in Agreement with Glass and Smith

Lawrence E. Bozzomo (1978) expressed opinions agreeing with those of Glass and Smith but made no reference to the meta-analysis. He

contends that there have been a sufficient number of valid studies on the issue to warrant some action. According to Bozzomo, there are still skeptics who won't be convinced. <sup>Use</sup> "I question the wisdom of a society that bans cyclamates, saccharin and red dye number two on the strength of one conclusive study out of ten, conducted on laboratory animals in a sterile environment, while at the same time ignoring (or calling insignificant) 50 percent of the research suggesting that class size does, indeed affect pupil achievement, self-image, and the quality of interaction between student and teacher." (Bozzomo, 1978, p. 81)

<sup>Use</sup> Bozzomo suggests that we have large classes because education is given a low priority in this country, and cites the lack of educational funding as proof.

<sup>Use</sup> Cahen and Filby (1979, p. 495) support the findings of Glass and Smith. "We feel that the new findings by Glass and Smith present a convincing case that average achievement increases as class size decreases." In their own research involving over 900,000 students, Cahen and Filby found that student achievement increased sharply when class size was reduced to fifteen students or below.

<sup>Use</sup> Not surprisingly, the 1980 president of the National Education Association applauded the Glass and Smith study. (McGuire, 1980, p. 16) "The results were clear and conclusive: regardless of grade level, subject taught, or ability of pupils, students achieve more as class size is reduced....Teachers have long known that the number of students

in a class does make a difference, not only in student achievement, but also in student behavior and attitude toward learning and in student and teacher satisfaction with instruction....Educational researchers have at last conclusively proved what teachers know from experience."

There are others who favor small classes. Michael Clark (1981, p. 64) states: "It is inevitable that generally, standards will have to fall when class sizes rise." In reviewing research on class size, Schieber (1979, p. 122) and her associates found that "four out of five studies favor small classes and the results of other studies are inconclusive....It appears that researchers have found what competent teachers over a period of years have been saying, that student growth is better in small classes." "Project Primetime," an experimental program sponsored by the Indiana State Department of Public Instruction to improve students' basic skills in reading, writing and arithmetic, employed the use of larger and smaller classes. One result of the program was that students in the project scored higher on standardized tests than did students in larger classes. (Negley, 1983, p. 1)

*Use*

An interesting report published by Hedges and Stock (1983) is critical of the Glass and Smith study. They question the quality and comparability of data, and the seeming lack of systematic statistical theory and formal statistical models for meta-analysis. Hedges and Stock defined a formal statistical model and re-examined the data used by Glass and Smith. It is important to note that while they criticize



their methods, Hedges and Stock concur with the conclusions drawn in the meta-analysis. "The results of the reanalysis confirm most of the conclusions drawn by Glass and Smith....The use of suboptimal statistical methods does not seem to have affected most of the conclusions." (Hedges and Stock, 1983, p. 64)

#### Studies Which Disagree with Glass and Smith

*Use*

There are a number of recent research studies which contradict the results published by Glass and Smith. Haddad (1978) presents an interesting review of significant research studies. He cites four studies conducted between 1967 and 1976 which concluded that smaller classes are more effective than larger ones. Haddad also discusses five studies published from 1968 through 1976 which came to the opposite conclusion. Three studies done between 1962 and 1970 report that class size had no significant effect on pupil achievement. Haddad summarizes in this way: "It cannot be concluded that increase in class size will necessarily lead to a decrease in the level of academic achievement of pupils." (1978, p. 12)

*Use*

In 1978 graduate students in the School of Education at the University of North Carolina undertook a rather complete review of existing research on class size. They reported, "there is little research support for the idea of reducing class size as a method for improving pupil achievement." (1978, p. 44)

*Use*  
Fritz Hess (1979, pp. 4 & 5) disagrees with the approach taken by Glass and Smith. "The energy and innovation used by Glass and Smith to complete their statistical methodology are commendable, if not circumspect. In their obvious desire to compile a means of integrating diverse pieces of data, however, they committed a few glaring errors." Hess concedes that integrating a large number of surveys that were independently conceived and constructed amounts to an immense challenge. Nevertheless, he berates Glass and Smith on several points; poor randomization, uncertain influence of the time variable, statistical error and significance, and the control of only a very limited number of variables. *Use* Hess concludes with the opinion that because of their questionable methodology Glass and Smith have produced a rather shaky set of conclusions and have drastically weakened the value of their results.

*Use*  
Probably the most significant criticism (because of the prestige of the publisher) of the Glass and Smith meta-analysis was published by the Educational Research Service. (1980) The criticism is strong and direct. The report contends that several of the claims made by Glass and Smith "were not supported by their own data. Moreover a number of interpretations of the meta-analysis findings and the recommendations for educational policy based on these conclusions were not only unsupported but also conflicting." (Educational Research Service, 1980, p. 239.) The report criticized Glass and Smith in several areas:

1. Their conclusions were overgeneralized.

2. They relied on only a few studies. (The publishers claim that Glass and Smith ultimately used only 14 statistically sound studies rather than the 77 reported in the meta-analysis.)
3. Their methodology was inconsistent.
4. There were contradictory interpretations.
5. Meaningful clues were lost because the methodology obliterated important distinctions in class size studies and distorted the findings of existing research.

The December, 1980 issue of Phi Delta Kappan printed Glass's response to the above criticism. In very strong language he defends both his methodology and his conclusions. He systematically dismisses each ERS complaint regarding his research. Glass stands by his findings and makes no concessions. (Glass, 1980)

Shapson and his associates (1980, p. 150) conducted a study in the Toronto Public Schools involving class size and achievement. They reported that "standardized measures of students' academic achievement showed a significant class size effect only for mathematics-concepts....There were no significant differences on measures of reading, vocabulary, or mathematics problem-solving."

### The Question of Variables

Many researchers who take issue with either the conclusions or the methodologies of the Glass and Smith meta-analysis discuss the need to control more variables in studies of this kind. Vignocchi (1979) claims that variables are often ignored and cites this as the reason why results are inconsistent. He criticizes a study by Flinker (1972) for this very reason when he says, "This study is indicative of the general lack of control of the variables which may affect the achievement of pupils with respect to the size of the class in which they are taught." (Vignocchi, 1980, p. 4) Fritz Hess (1979, p. 8) applies this criticism to the meta-analysis. "The limited number of variables examined by Glass and Smith combine with the weaknesses of their methodology to limit seriously the generalizability of their study."

There are, indeed, many variables which may affect student achievement. These occur in the actual physical setting, such as size of room, accoustics and amount of light. There are variables in teachers, age, sex, amount of education, teaching styles, competence and personality, to name a few. And there are those innumerable variables in the children themselves. "No research design yet devised has adequately controlled all of the possible (and obvious) confounding variables that the child brings to the research--variables such as

intelligence, health, family stability, family background, emotional stability, motivation, sense of fulfillment, sense of well-being, self-image and attitude." (Bozzomo, 1978, p. 78)

The Ryan-Greenfield report (1975, p. 42) states that "class size research has suffered because it has failed to adequately control the most important variable--the quality of teaching."

Although not all studies confirm their beliefs, the great majority of teachers know the benefits of smaller classes. They feel intuitively that they can do a better job of teaching with fewer students. "Results of national opinion polls conducted among elementary school teachers indicate that about half of the teachers polled believed they could do their most effective teaching with a class containing 20-24 children." (Chang and Ogletree, 1979, p. 12) A "Teacher Opinion Poll" was given to teachers by the National Education Association in 1975. The most frequent response to the question of what one change they would make to improve teacher morale and job satisfaction was to lower class size. (Moore, 1975)

It seems that a review of the literature on achievement and class size between 1900 and the present, reveals few absolutes. Research fails to offer irrefutable evidence regarding the link between the two factors. It is entirely possible to support or oppose smaller classes

and to cite impressive literature to defend either position. Glass and Smith appear to have earned the distinction of having conducted the most exhaustive research to date. When the opposing points of view are read, it is apparent that the issue is by no means, a dead one, for the definitive study has not yet been conducted.

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## CHAPTER III

### METHODOLOGY

This study was a correlation study which tested the strength of the relationship between class size and student achievement in a midwestern metropolitan school district. The sample included all second and fifth grade classes in the district, with the exception of combination or split-level classes. The second and fifth grades were selected as representative samples of the primary and intermediate levels. The combination classes were eliminated from the study because the amount of teacher-pupil contact time is affected by having two grade levels taught by one teacher in the same classroom. This arrangement might have had an unknown influence on student achievement in these classrooms.

The mean scale score as reported for each class on the California Achievement Test taken by students in the spring of 1984 was used as a measure of achievement. Class size was determined by the number reported to have taken the California Achievement Test in each class. The scale scores and class size figures were taken from the California Achievement Test summary sheets maintained by the research office of the school district in which the study was conducted.

For this study the schools in the district were stratified into three socio-economic groups, using percentage of students eligible for free or reduced lunch as the stratifying factor. The high socio-economic classification was applied to those schools in which 0 to 33 percent of the students were eligible for free or reduced lunch. The medium socio-economic group was comprised of those schools in which 34-55 percent of the students were eligible for free or reduced lunch. The low socio-economic group consisted of schools in which more than 55 percent of the students were eligible for free or reduced lunch. These figures regarding free or reduced lunch eligibility were obtained from the research office of the school district in which the study was conducted.

The class size numbers and the scale scores reported by the summary sheets for the California Achievement Test administered in the spring of 1984 were compared by applying the Pearson product-moment coefficient of correlation formula to each pair of numbers. A coefficient of correlation was computed for each socio-economic group at each grade level and for the total grade level.

In view of the findings of Glass and Smith of significant correlations when class size drops to twenty and below, additional correlation tests were conducted between class size and student achievement at each grade level using only those classes with a size of twenty or below. This test did not consider socio-economic levels, but

considered the classes of twenty or below as one group at each grade level. This was done because the sample of classes in this category was small, eighteen in the second grade, and twenty-two in the fifth grade. A coefficient of correlation was computed between class size and student achievement for these smaller classes at each grade level.

The scale scores for all classes in each socio-economic group were averaged to compute a mean scale score for the classes in that group at each grade level. The class size numbers for all classes in each socio-economic group were averaged to compute a mean class size for each group at each grade level.

To test whether the mean scale scores for the three socio-economic groups at each grade level were significantly different, a one-way analysis of variance was performed. An  $F$  ratio was computed for the mean scale scores at each grade level. When significant statistical variation among mean scale scores for the three socio-economic groups was found, Scheffe's test was applied to the data by computer to determine exactly where the significant variations were.

## Discussion of Statistical Procedures

Correlation studies are concerned with the degree of co-variation between two variables, in this case, class size and student achievement. A number which indicates the extent to which two variables co-vary is called a correlation coefficient. The Pearson product-moment formula was developed by Karl Pearson early in the twentieth century as an instrument for computing correlation. It is the most widely used formula for determining the degree of co-variation between two variables. (Jaeger, p. 69) The correlation coefficient, derived by applying the formula to two sets of variables, provides a numerical summary of the degree of relationship between the two variables. If two variables tend to co-vary, it is possible to predict the value of one variable by knowing the value of the other. It is important to note, however, that correlation does not infer causality. It cannot be said that because one variable tends to co-vary with another that it causes the other.

A tendency to co-vary can be expressed as a positive or a negative correlation. A positive correlation implies that as one variable increases, the other also increases. A negative correlation is a relationship in which one variable increases as the other decreases. Correlation coefficients are expressed in numbers ranging from +1.00 which reflects a perfect positive correlation and -1.00, which indicates that a perfect negative correlation exists. Perfect correlations are

seldom, if ever, found. The closer, however, that a correlation coefficient is to a plus or minus 1.00, the more accurately a researcher can predict the value of one variable from another. Herein lies the value of correlation studies. The points at which correlation becomes significant were established by Pearson when he developed his formula. When the number in the sample is small, a higher degree of correlation is required for significance. Conversely, with a large sample, a lower degree of correlation can be considered significant.

#### Scale Scores

Scale scores are produced from a single scale of equal intervals across all grade levels. The mean scale score reported for each class on the California Achievement Test summary sheets is an average of the scale scores earned by the students in that class. They are expressed in three-digit numbers ranging from 000 to 999 and allow easy comparability of scores from individual classes, from entire schools, from entire districts, and across all the grade levels in the district. The use of scale scores makes it possible to describe the range of student achievement from kindergarten through high school on a single scale.

### One-way Analysis of Variance

A one-way analysis of variance (often abbreviated ANOVA) is an inferential statistical procedure used to test the null hypothesis that the means of three or more populations are equal to each other. The one-way analysis of variance computes an F ratio, a figure which summarizes the variation among sample averages. When computed, the F ratio is compared to tabulated critical values. If the computed F ratio is larger than the critical value, the null hypothesis of equal population averages can be rejected in favor of the alternative hypothesis that the population averages differ. The F value allows the researcher to decide if there are significant differences among the means of the groups being compared.

### Scheffe's Test

When a significant F ratio has been obtained, there are several tests for determining exactly where the significant differences lie. These post hoc comparisons adjust the level of significance to reduce the influence of chance because of having more than just one comparison. A liberal post hoc comparison will find a significant difference when the means are fairly close together. A conservative method will claim significance only when the means are reasonably far apart. The post hoc comparison in this study was made by using Scheffe's test, recognized as the most conservative of the post hoc comparisons. (Huck, 1974)

## CHAPTER IV

## PRESENTATION OF DATA AND DISCUSSION OF FINDINGS

The frequency of class sizes at both grade levels is shown in Table III. It is obvious from the table that the range of class sizes used in this study, 15 to 30, was very limited.

Table III

Frequency of Class Sizes in Second and Fifth  
Grades in a Midwestern Metropolitan  
School District

Class Size	Number of Cases in Gr. 2	Number of Cases in Gr. 5
15	0	1
16	0	0
17	0	4
18	1	5
19	6	6
20	11	6
21	8	8
22	5	12
23	9	11
24	13	5
25	20	14
26	14	10
27	10	6
28	7	10
29	5	3
30	2	3



The results of the first correlation tests involving socio-economic groups and total groups at both grade levels are presented in Tables IV and V.

Table IV

Data Collected on Class Size and Student Achievement in Second Grade Classes in a Midwestern Metropolitan School District

Socio-Economic Group	Number of Classes	Mean Class Size	Mean Scale Score	Coefficient of Correlation	Coefficient Required for Significance
Low	39	23.79	366.87	-.066	.304
Medium	50	24.18	377.86	-.072	.273
High	21	24.86	393.48	-.323	.423
Total	110	24.17	376.94	-.024	.195

Table V

Data Collected on Class Size and Student Achievement in Fifth Grade Classes in a Midwestern Metropolitan School District

Socio-Economic Group	Number of Classes	Mean Class Size	Mean Scale Score	Coefficient of Correlation	Coefficient Required for Significance
Low	37	24.22	476.76	+.109	.325
Medium	28	23.71	486.36	-.227	.361
High	39	22.59	503.23	-.087	.304
Total	104	23.47	489.26	-.186	.195

No significant correlations between class size and student achievement were found for any socio-economic group or for the total group at either grade level. With this information it is not possible to reject the first or second hypotheses or their subhypotheses. There appears to be no significant relationship between the two variables. These results tend to support the previous research which drew the same conclusions.

The results of the second correlation tests involving only those classes which numbered twenty and below are shown in Table VI.

Table VI

Correlation Coefficients Between Class Size and Student Achievement in Second and Fifth Grade When Class Size is Twenty and Below

Grade	Sample Number	Coefficient Required for Significance	Coefficient of Correlation
2	18	.444	-.502*
5	22	.404	+.097

\*Denotes  $P < .05$

No significant correlation was found between class size and student achievement at the fifth grade level. At the second grade level, however, a significant negative correlation was found. These results

concur with those found by Glass and Smith in their meta-analysis which revealed impressive gains in student achievement when class size dropped to twenty students and below. This data makes it possible to reject the third hypothesis because of the significant correlation found between class size and student achievement in second grade classes which numbered twenty and below in size. The results at the fifth grade level do not make it possible to reject the fourth hypothesis.

Table VII depicts the socio-economic composition of the smaller classes in second and fifth grades.

Table VII

Socio-Economic Composition of Classes Which Numbered  
Twenty and Below at Second and Fifth Grade Levels

Socio- Economic Group	Grade 2		Grade 5	
	No. of Classes	Percentage of Total	No. of Classes	Percentage of Total
Low	7	39%	5	23%
Middle	7	39%	4	18%
High	4	22%	13	59%
Total	18	100%	22	100%

It is noteworthy that at the fifth grade level the large majority of the smaller classes was found in high socio-economic schools. This was not the case in second grade where the distribution was more even. Two

interpretations of this data are possible. Lower class size might have a stronger relationship to student achievement at the primary level. It is also possible that the relationship appeared stronger at this level because almost 80 percent of the classes in this sample were found in the low and medium socio-economic schools. This interpretation would be in keeping with the conclusions drawn by James Coleman and Christopher Jencks whose research findings emphasized the effects of social class and cultural influences on educational success. "Schools bring little influence to bear on a child's achievement that is independent of his background and general social context." (Coleman, 1966, p. 325) In 1979 Jencks reaffirmed the importance of family background in predicting academic achievement. The research by Coleman and Jencks reported that children from higher social classes achieved more academic success. (Coleman, 1966; Jencks, 1979) The researcher might validly question why such a high percentage of smaller fifth grade classes in this school district was found in the high socio-economic schools. Because of the small sample size, it was not possible to control the socio-economic variable for the test on small classes.

It is of great interest that the mean scale scores for the three socio-economic groups increased at both grade levels as socio-economic level increased, with the highest mean scores reported for the high socio-economic group. (See Tables IV and V) When the one-way analysis of variance was performed on the mean scale scores of each socio-economic group, statistically significant variances were revealed at

both grade levels. The F ratios computed were 26.2917 at the second grade level and 26.4129 at the fifth grade level, with P less than .01 at both levels.

Table VIII

Results of Scheffe's Test Applied to Mean Scale Scores  
at Second and Fifth Grade Levels

Socio- Economic Group	Grade 2			Grade 5		
	Low	Medium	High	Low	Medium	High
Low						
Medium	X					
High	X	X			X	X

In second grade the score for the high socio-economic group was significantly different from those of the medium group and the low group. The score for the medium group was also significantly different from that reported for the low group. In fifth grade the mean score for the high group was found to be significantly different from those reported for the medium as well as the low group. It is noteworthy that at both grade levels the mean score for the high groups proved to be significantly different from the mean scores of both lower groups. This data makes it possible to reject both the fifth and the sixth hypotheses, because the mean scale scores of the three socio-economic groups proved to be significantly different at both grade levels.

## CHAPTER V

## SUMMARY, CONCLUSIONS AND RECOMMENDATIONS

This study tested the strength of the correlation between class size and student achievement in second and fifth grade classes in a midwestern metropolitan school district. Correlation coefficients were computed for total grades and for three socio-economic groups within each grade. No significant correlations were found between class size and student achievement for any socio-economic group or for the total group at either grade level. A second correlation test between class size and student achievement using only those classes which numbered twenty and below revealed a significant correlation between the two variables at the second grade level. A one-way analysis of variance was performed to determine the degree of variance among the mean scale scores for three socio-economic groups at each grade level. When significant variance was found, Scheffe's test located the significant variances between the high and medium socio-economic groups and between the high and low socio-economic groups at both grade levels. A significant variance was also found between the medium and low groups at the second grade level.

### Conclusions

1. It can be concluded from this study that class size and student achievement do not co-vary when class size ranges between twenty and thirty students.
2. It can be concluded from this study that class size and student achievement do not significantly co-vary at any particular socio-economic level.
3. It can be concluded that class size and student achievement do co-vary significantly at the second grade level when class size drops to twenty students or below. The reasons for this co-variance or the reasons why it did not also appear at the fifth-grade level cannot be determined from this study.
4. The significant F ratio produced by the one-way analysis of variance allows the researcher to conclude that the mean scores among various socio-economic groups are significantly different. Since the mean scale scores increased as socio-economic level increased, at both grade levels, one could expect higher achievement from students having a higher socio-economic background.

### Recommendations

1. Further studies testing the significance of the relationship between class size and student achievement are recommended in classes numbering twenty students or below. If future studies confirm that a significant correlation exists between the two variables in classes of this size, the obvious recommendation is to establish twenty as the maximum class size.

2. The significant variance among mean scale scores for different socio-economic groups is disturbing. The philosophy upon which our public education system is based does not intend that the opportunity for educational success be provided for only those students who are in higher socio-economic strata. Academic success must be equitably achievable for all socio-economic groups. Close scrutiny of the situation is recommended in order to determine the means for minimizing the disparity of achievement scores between higher and lower socio-economic groups.

3. This study failed to prove that class size significantly affects student achievement when class size is above twenty. Since the majority of classes in this study were larger than twenty and student achievement as measured by the California Achievement Test did not appear to suffer, one can conclude that large classes will not adversely affect the types of achievement measured by standardized achievement tests.



Much of the research, however, reports negative effects on children in large classes which would not be detected by a standardized achievement test. These negative effects are in the affective domain and include intangibles such as behavior, attitude, and adjustment. (Cannon, 1966; and Today's Education, 1975) According to the literature, these negative effects decrease as class size is lowered. (Richman, 1955; McKenna, 1955; and Olson, 1970) It is recommended that researchers strive to develop instruments other than achievement tests for assessing academic growth. Relying on the results of standardized achievement tests in effect establishes the acquisition of factual knowledge as a school system's highest priority, because factual knowledge is the entity measured by these tests. It is recommended that instruments be devised to assess the degree to which one is able to use critical thinking skills, such as interpretation, synthesis, analysis, and evaluation. When these instruments have been perfected, the degree of correlation between class size and real intellectual progress can be determined.

4. The literature has revealed repeatedly that teachers feel they are more effective when they are teaching smaller groups. Much of the research in this area has emphasized the adverse effects of large classes on teacher morale. (University of North Carolina, 1978; Chang and Ogletree, 1979); McGuire, 1980); and Mayhew, 1983) Yet we have not seen a significant reduction in class size for the purpose of improving teacher morale. It is recommended that school boards consider teacher

morale as a high enough priority to warrant the expense of lowering class size. It is recommended that school boards not wait for low teacher morale to translate into lower scores on achievement tests before action is taken. It is doubtful that teachers with low morale would be effective in teaching the skills of critical thinking, which, in this writer's opinion, are a more valid measure of academic growth.

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