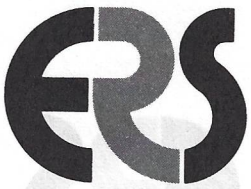
Educational Research Service, Inc.

RESEARCH BRIEF

CLASS SIZE: A SUMMARY OF RESEARCH



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Glen E. Robinson
President
Director of Research

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CONTENTS

LIST OF TABLES

FOREWORD

From the past decades of expanding enrollments through the present period of enrollment declines, class size has presented school officials, teachers, and others with perplexing problems and issues. Is there an optimum class size? Do small classes make a difference in pupil achievement? Do large classes have a negative impact on teacher morale? Does class size affect the kinds of instructional procedures used in the classroom? What is the financial impact of class size policy?

This Research Brief provides a summary of recent research on the effects of class size on pupil achievement and the classroom environment, and on teacher and public opinion concerning the importance of class size to quality education. Provided also are examples of the budgetary impact and policy implications associated with changing class size. Although the research findings leave many questions with uncertain answers, a section is included at the end of the Research Brief that draws tentative conclusions from the available data for consideration when school officials are formulating educational policy regarding class size. It is hoped that school administrators, school board members, educators, and others who must deal with class size policy will find this information useful.

Educational Research Service would like to thank especially the New England School Development Council at Newton, Massachusetts, and the Horace Mann-Lincoln Institute of Teachers College, Columbia University, for granting permission to use extensive portions from their publications. Appreciation is also expressed to the many other publishers who have granted permission for the use of data and information from their publications. Without the generous permission to use such data and information, this Research Brief would not have been possible.

Glen Robinson
Director of Research
Educational Research Service

Introduction

Small Class Size: A Panacea for Educational Ills?
---Bruce M. Mitchell, *Peabody Journal of Education*, July 1969, p. 32.

Smaller Classes Finally Win Research Support
---*Education U.S.A.*, May 10, 1971, p. 199.

We Don't Know Much for Sure About Optimum Class Size
---*Education Summary*, September 15, 1975, p. 5.

Let's Talk Sense About Class Size and Staffing
---Oregon School Study Council *Bulletin*, Winter 1975, p. 23.

Teachers Emphatically Reject Assertions That Class Size Doesn't Count, says NEA
---NEA news release, March 15, 1976.

Smaller Classes, Far from Being a Blessing, May Be "More Costly Way of Doing the Same Old Teaching"
---*Education Summary*, April 15, 1976, p. 8.

Overcrowding Is "Educational Epidemic" of the 70's, Says NEA Publication
---NEA news release, April 29, 1976.

The Question of Class Size May Not Be Meaningful in Light of Schools' Current and Future Concerns
---*Education Summary*, September 1, 1976, p. 2.

Class Size: There Is No Last Word
---*CBE* [Council for Basic Education] *Bulletin*, April 1977, p. 11.

As these titles and headlines suggest, the debate over class size continues unresolved. Many educators and much of the public feel that smaller classes are vital in maintaining quality education. Yet research results have been diverse--some studies indicate that smaller classes lead to increased student achievement and better attitudes, others discover larger classes are more effective, and still others can find no appreciable difference in students' academic or personal development whether they are in either small or large classes.

Declining enrollment has affected class size in school systems in different ways. Class size may decrease, as indicated by 42 percent of 468 school officials surveyed by the National School Boards Association in 1975 whose districts had experienced enrollment declines. [35:3-4]* However, if enrollment declines lead to substantial reductions-in-force among professional staff or to school closings or consolidations, class size may increase.

Some persons in school systems undergoing increases in class size have argued for reducing the number of pupils per class. But even small reductions in class size may cost a large school system millions of dollars. Taking this

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References cited in the text are noted by numbers within brackets. The number before the colon indicates the entry number within the bibliography beginning on page 76; the number following the colon indicates the page within the entry. Where no colon appears, the citation refers to the entire entry.

step, weighing both research and opinion, is difficult. To help with this decision, this Research Brief provides: (1) an introductory examination of class size definitions, statistics, and research design; (2) a summary of the research on class size--including the effects of class size on pupil learning and on the classroom environment; (3) teacher and public opinion on class size; (4) examples of the budgetary impact of altering class size; and (5) some policy implications.

DEFINING CLASS SIZE

Different measures used to calculate staffing ratios have different meanings. For the research to be interpreted accurately and consistently, it is essential to understand the differences among these basic terms. Indeed, inexact usage of class size, pupil-teacher ratio, student-staff ratio, "large" and "small" classes by both researchers and users of the research has made it difficult to interpret such findings.

In their 1955 literature review, *Class Size: The Multi-Million Dollar Question*, Donald H. Ross and Bernard McKenna defined a class as "any group of students scheduled to meet regularly for all or a definite fraction of a school day with one particular teacher for the purpose of learning or being instructed in some specific part of the school's curriculum." [92:3] A 1965 report published by the Research Division of the National Education Association (NEA) described a class as "the number of pupils for whom a teacher is responsible in a self-contained classroom." [21:7]

Pupil-teacher ratio, on the other hand, is the total number of students within a given school or school district divided by the number of full-time and part-time teachers in that school or district. [89:157] In its publications, the National Center for Education Statistics, a part of the U.S. Department of Health, Education, and Welfare, cautions users of its data on pupil-teacher ratios to be aware of the differences between pupil-teacher ratio and class size:

> The average number of pupils per classroom teacher, often used as a measure of teacher workload, is not a valid measure of average class size. Furthermore, pupil-teacher ratios do not reflect the educational services provided in varying degrees by staff outside the classroom. The ratios shown in [our] table[s] serve only as rough guidelines in studying the State-by-State situation, and more detailed information on other aspects of school staffing would be needed in order to make valid judgments. [132:4]

Another staffing descriptor, student-staff ratio, measures the number of pupils in a school or school system divided by the number of <u>all</u> professional staff members involved in instruction or central-office administration in that school or school system. Instructional staff would include teachers, principals (including teaching principals), assistant principals, counselors, librarians, school nurses, and psychologists. Central-office administrators consist of superintendents at various levels and administrators with supervisory capabilities. [113:2]

Ross and McKenna argued that "numbers of nonclassroom, professional personnel are at least as important [as teachers] in predicting what is going to happen in the classroom as actual class size." [92:12] They also described an indicator that further refines the staffing ratio concept--Numerical Staff Adequacy. Based on the research of the New York Metropolitan School Study Council, Numerical Staff Adequacy denotes the number of instructional professionals per 1,000 pupils. [92:3]

In addition to these differences in terminology, what are considered "small" and "large" classes may vary according to the individual researcher. To help reduce confusion over definitions found in the literature on class size, Ross and McKenna offered these four guidelines:

1. Average class size and numerical staff adequacy of school systems are not as closely related as one would expect. . . .

2. High school and elementary school class-size statistics should never be combined. You have virtually no power to predict high school class size from knowing elementary class size. Whatever a community's reasoning for having small or large classes for one level or another, there is very seldom application of this reasoning across the board. . . .

3. There is more variation within systems in actual class size than among systems of a state or region. An average class size of twenty-five for a high school is no assurance that you will not find physical education and music classes over ninety and French and trigonometry classes of under ten. The only class-size policy statement that really has teeth in it would be something like this: "We don't permit classes over thirty-five."

4. A small class or a large class is what the researcher or respondent thinks it is. There have been studies where "small" classes were anything under forty and "large" classes anything over fifty. There have been other studies where "small" classes were defined as having less than fifteen students and "large" classes more than twenty-five. Obviously, the applicability of any study to your situation would be the coincidence of the researcher's basic definition (as well as criteria) with your own. The Metropolitan School Study Council studies have tended to set twenty to twenty-five as the upper limit of small classes and thirty to thirty-five as the lower limit of large classes. [92:4-5]

STAFFING STATISTICS

The differences among the terms class size, pupil-teacher ratio, and student-staff ratio are sharpened further when figures in each category are compared. Because student-staff ratios include all staff involved in teaching and administration, they typically are lower than data on pupil-teacher ratio.- Pupil-teacher ratios, in turn, are typically lower than average class size figures.

In an August 1974 publication, Educational Research Service reported the results of a staffing survey of a stratified random sample of school systems nationwide with enrollments of 300 or more pupils. ERS found that, in 1972-73, there were 17.7 students per full-time professional staff member. [113:5] Student-staff ratios for the 20 largest school systems in 1972-73 are listed in Table 1.

National pupil-teacher ratios are reported annually by the federal government's National Center for Education Statistics. In the nation's public elementary and secondary day schools, pupil-teacher ratio in enrollment has declined 9.4 percent in the last six years--from 22.3 pupils per teacher in fall 1971 to 20.2 pupils per teacher in fall 1976. [128:23; 133] The Center reports, as noted in Table 2, that at the elementary level public school pupil-teacher ratio nationwide has decreased from 30.2 pupils per teacher in 1955 to 21.7 pupils per teacher in 1975. At the secondary level, the public school pupil-teacher ratio has fallen from 20.9 in 1955 to 18.8 in 1975. Projections to 1985 indicate further declines.

TABLE 1.--Ratio of Students to All Professional Staff Members in the 20 Largest School Systems, 1972-73

School System	Ratio of Students to All Professional Staff Members
1. New York, N.Y.	ND
2. Los Angeles, Calif.	23.4
3. Chicago, Ill.	19.7*
4. Philadelphia, Pa.	21.1
5. Detroit, Mich.	23.7
6. Dade County, Fla. (Miami)	20.8
7. Houston, Tex.	22.1
8. Baltimore City, Md.	22.2
9. Hawaii (entire state)	18.7
10. Prince George's County, Md. (Upper Marlboro)	17.9
11. Dallas, Tex.	22.2*
12. Memphis, Tenn.	20.0
13. Cleveland, Ohio	23.2
14. Washington, D.C.	ND
15. Fairfax County, Va. (Fairfax)	19.0
16. Baltimore County, Md. (Towson)	18.0
17. Milwaukee, Wisc.	19.0
18. Broward County, Fla. (Ft. Lauderdale)	ND
19. Montgomery County, Md. (Rockville)	16.7*
20. San Diego, Calif.	20.8

ND -- No data received.
* -- Incomplete data received.

SOURCE: *Student-Staff Ratios, 1972-73.* Arlington, Virginia: Educational Research Service, August 1974.

Additional breakdowns of pupil-teacher ratios in enrollment and average daily attendance (ADA) from fall 1971 to fall 1976 are given for each state and 20 large cities in the Appendix beginning on page 71.

Pupil-teacher ratio likewise has declined in certain foreign countries, as shown in Table 3. Of the eight developed countries compared with the United States in 1972, only West Germany and the Netherlands had a higher pupil-teacher ratio at the elementary level.

National figures on class size averages, on the other hand, are not as current as those on pupil-teacher ratio. The NEA Research Division conducted class size surveys in 1964 and 1965 and found that average class size in both the nation's elementary and secondary schools was between 29 and 31 pupils per class. [23; 21] In 1967, Educational Research Service reported the results of a survey in which 128 of 159 school systems enrolling more than 25,000 students furnished kindergarten, elementary, and secondary school class size figures. The median of the average class size in kindergartens reported by 91 of these school systems was 28, with a range from 20 to 36. In elementary schools, the median of the average class size was 30, with a range of 24 to 36. Breakdowns of class size figures in 10 junior and senior high school subject areas are reported in Table 4.

A 1969 survey by the NEA Research Division noted that the average national class size at the elementary level was 28 pupils per class and at the secondary level 26 pupils per class. Class size was found to decrease with the size of the school system: in large school systems (25,000 or more enrollment), the elementary class size average was 30 and the secondary average 29; in medium systems (3,000-24,999 enrollment), the elementary class size average was 28 and the secondary average 26; in small systems (less than 3,000 enrollment), the elementary class size average was 26 and the secondary average 24. [19]

RESEARCH DESIGNS

Some reviewers have contended that class size studies have not produced clear, directional guidelines because of the faulty research designs employed. In its 1975 review

TABLE 2.--Pupil-Teacher Ratios in Elementary and Secondary Day Schools, by Control and by Organizational Level: Fall 1955 to Fall 1985[1]

Year (fall)	Public (actual)		Nonpublic (estimated)[2]	
	Elementary	Secondary	Elementary	Secondary
1955	30.2	20.9	40.4	15.7
1956	29.6	21.2	38.9	16.5
1957	29.1	21.3	38.5	17.9
1958	28.7	21.7	38.7	18.2
1959	28.7	21.5	38.8	18.5
1960	28.4	21.7	[3]36.0	18.3
1961	28.3	21.7	37.4	18.6
1962	28.5	21.7	36.3	18.5
1963	28.4	21.5	35.3	18.5
1964	27.9	21.5	34.3	18.3
1965	27.6	20.8	[3]33.5	[3]18.1
1966	26.9	20.3	32.3	16.1
1967	26.3	20.3	31.1	18.1
1968	25.4	20.4	[3]29.8	[3]17.3
1969	24.8	20.0	27.9	17.1
1970	24.4	19.8	[3]26.5	[3]16.4
1971	[4]24.9	[4]19.3	25.1	[5]16.2
1972	[4]24.0	[4]19.1	23.9	[5]15.6
1973	[4]22.9	[4]19.3	23.1	[5]15.5
1974	[4]22.6	[4]18.7	22.9	[5]15.7
1975	[4]21.7	[4]18.8	22.8	[5]15.5
			Projected[6]	
1976	21.4	18.6	22.3	15.3
1977	21.1	18.5	21.8	15.2
1978	20.9	18.3	21.4	15.0
1979	20.6	18.2	21.0	14.9
1980	20.4	18.1	20.7	14.8
1981	20.2	17.9	20.4	14.7
1982	20.0	17.8	20.2	14.7
1983	19.8	17.7	19.9	14.6
1984	19.6	17.6	19.7	14.5
1985	19.4	17.5	19.6	14.5

[1]Includes full-time and the full-time equivalent of part-time classroom teachers (in 1974, 99 percent of teachers in the public schools were full time). Prior to 1969, the data include some part-time teachers who were not converted to full-time equivalents. Does not include teachers in independent nursery and kindergarten schools, residential schools for exceptional children, subcollegiate departments of institutions of higher education, Federal schools for Indians, federally operated schools on Federal installations, and other schools not in the regular school system.

[2]Instructional staff and classroom teachers are not reported separately. All data unless otherwise indicated are estimated.

[3]Reported data from Office of Education surveys. [4]Estimated.

[5]Estimates based on revised nonpublic enrollment. These revised estimates of nonpublic classroom teachers differ from figures shown in 1975 and earlier editions.

[6]The projections of pupil-teacher ratios are based on the assumption that the ratio of enrollment to the number of teachers will follow the 1965-75 trend to 1985.

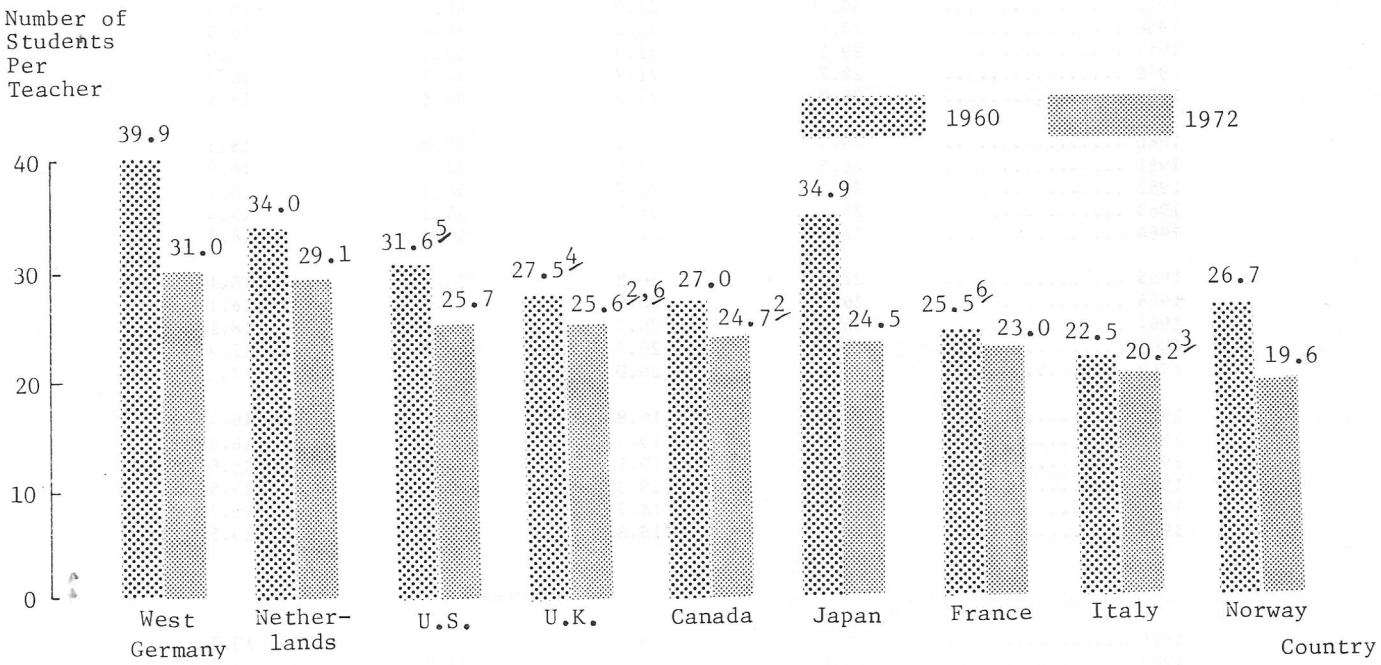
Decreases in the pupil-teacher ratios in public elementary and secondary schools due to the Elementary and Secondary Education Act of 1965 are included in the trend projections.

NOTE: Data are for 50 States and the District of Columbia for all years. Because of rounding, details may not add to totals.

SOURCES: Classroom teacher data and estimates are based on (1) U.S. Department of Health, Education, and Welfare, National Center for Education Statistics, publications: (a) *Statistics of Public Schools*, fall 1965 through 1975, (b) *Statistics of Public and Nonpublic Elementary and Secondary Day Schools, 1968-69*, (c) *Statistics of Nonpublic Elementary and Secondary Schools, 1965-66*, and (2) National Education Association publications: Research Reports, *Estimation of School Statistics*, 1972-73, 1973-74, and 1974-75.

SOURCES: U.S. Department of Health, Education, and Welfare, National Center for Education Statistics. *The Condition of Education 1976* (1976), p. 247. *Projections of Education Statistics to 1985-86* (1977), p. 49.

TABLE 3.--Pupil-Teacher Ratios in Primary Education in Nine Developed Nations [1/]



[1] Excludes part-time pupils and part-time teachers

[2] 1971

[3] 1973

[4] 1965

[5] 1959

[6] Estimated

SOURCES: Organization for Economic Cooperation and Development, Paris, France, *Educational Statistics Yearbook, 1974 and 1975*, vols. I and II; and information supplied by the OECD Secretariat.

SOURCE: U.S. Department of Health, Education, and Welfare, National Center for Education Statistics. *The Condition of Education 1976*. Washington, D.C.: U.S. Government Printing Office, 1976. pp. 168, 264.

TABLE 4.--Average Class Size in Junior and Senior High Schools in School Systems with 25,000 or More Enrollment, 1966-67

Subject	Junior High				Senior High			
	Number of systems reporting	Low	High	Median	Number of systems reporting	Low	High	Median
English	96	24	36	29	110	21	32	28
Mathematics	95	24	36	30	110	23	34	28
Foreign Languages	94	18	36	27	111	16	32	25
Social Studies	95	24	36	30	110	23	42	29
Science	95	24	40	29	108	21	35	28
Business	66	20	38	30	109	15	45	28
Industrial Arts	94	14	32	24	108	11	30	23
Physical Education	90	21	66	38	102	24	60	38
Music	90	13	60	35	103	17	68	38
Art	94	19	45	28	108	16	45	26

SOURCE: *Class Size in Large School Systems, 1966-67.* Circular No. 4, 1967. Washington, D.C.: Educational Research Service, July 1967, p. 4.

of the literature, the New England School Development Council (NESDEC) observed that "[t]he real breakdown in class size research is due more to faulty research design than to any other factor. Most studies have attempted to deal with class size as an isolated variable, when the consensus of opinion is that it is only one of many intricately related variables." [18:36]

The NEA Research Division (1968) noted that, even with the many studies that have examined the question of class size:

> it may not be so much that research is not conclusive, as many have thought, as it is that research has not been comprehensive. Many variables are present in the classroom environment--the pupils, the teacher, the subject matter, and the teaching methods, to name a few. Although the study of classroom environment is a multivariate problem, most class size research conducted to date has tended to use a single variable approach. [17:5]

Using the four variables noted above as the basis of a general outline, the following list illustrates some of the related variables affecting class size research:

I. The Pupils
   - A. Age
   - B. Sex
   - C. Grade Level
   - D. Grouping Arrangement
   - E. Ability Level
   - F. Socio-economic Variables

II. The Teacher
   - A. Ability
   - B. Experience
   - C. Education
   - D. Role Perception and Teaching Philosophy
   - E. Availability of Other Instructional Personnel
     1. Teacher Aides
     2. Student Teachers
     3. Interns

III. Subject Matter
   - A. Content
   - B. Complexity
   - C. Goals

IV. Teaching Methods
   - A. Team Teaching
   - B. Individualized Instruction
   - C. Large Group Instruction
   - D. Use of Educational Media
   - E. Differentiated Staffing
   - F. Innovative Instructional Techniques

"In general," the 1968 NEA report stated, "both opinion and research tend to agree that in order to produce optimal results--for both pupils and teachers--the size of class must be appropriate to the intellectual-emotional needs of the pupils, the skills of the teacher, the type of learning desired, and the nature of the subject matter." [17:5]

In his analysis of the literature on class size, William S. Vincent (1969) found three aspects that have influenced the control of variables used in studies on class size:

> ...the first dimension of the class-size question is the measure of the variable itself, the control of all personnel resources contributing to achievement, or some other criterion, being measured. The studies noted generally failed to do this.
>
> The second dimension relates not to the quantity but to the quality of staff. Almost without exception the studies done appear to adopt the mythical view that all teachers are equivalent...
>
> A third dimension concerns materials and equipment--the tools of teaching. No study that has come to the attention of this writer injects any such control into the analysis of the relative effectiveness of large and small classes. [135:141-142] (Copyright, 1969 American Educational Research Association, Washington, D.C. All rights reserved.)*

Given the criticism aimed at research analyses that use class size as the only variable under observation, education production function studies, in examining many variables thought to influence pupil learning, may prove to be an additional source of information for directions in class size policy. A number of production function studies are reviewed in this ERS Research Brief.

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Review of Research on Class Size

Research into the class size question began with a study by J. M. Rice in 1893. [17:5] Since then, class size has been a frequent topic of discussion among educational researchers.

Often cited as the beginning of the most recent era of class size research, Howard V. Blake's 1954 inquiry analyzed the literature written on class size prior to 1950. From the 267 reports located, he chose 85 of those based on original research which dealt with elementary and secondary school students. From these 85 studies, 35 indicated that small classes were better, 18 that large classes were better, and 32 that the author did not consider to support either conclusion. In further analyzing these studies, Blake established six criteria to test their scientific acceptability: scientific control, adequacy of sample, adequacy of measurement of variable, adequacy of measurement of criterion, rigorousness of examination of data, and appropriateness of the conclusions. Only 22 of the 85 previously acceptable studies met these minimum requirements: 16 favored small classes, three favored large classes, and three were inconclusive. [7]

Blake's findings favoring smaller classes can be compared with a literature review conducted by the New York State Education Department in 1973 that focused on certain school and nonschool variables thought to improve student performance. One section of the study explored class size. The level of teacher experience, teacher socioeconomic status or verbal ability, and class size were isolated for comparison. The results appear in Table 5.

The study made these conclusions about the effects of class size on achievement:

> Class size is frequently considered to have an effect on the ability of the school to educate students. However, evidence to support this assumption was not strong. Overall, class size was found to be significantly related to student performance in only 37 percent of the 19 studies in which it was used. In the cognitive studies, class size was found to be significant less than half the time it was subjected to testing. In the noncognitive area, four studies were reviewed. None showed a significant relationship between class size and noncognitive achievement. Extremely small or large classes, which fall outside the range found in public schools, may make more difference, however.
>
> New open school and team teaching arrangements with technological support may make class size studies <u>per se</u> obsolete. Improving teacher <u>quality</u> (as indicated by degree status, socioeconomic level, verbal ability, and to some extent experience) rather than teacher <u>quantity</u> may be the administrative strategy most likely to produce desired changes in students. [146:12]

TABLE 5.--Percent of Studies in Which Teacher-Related Factors Were Found Significant and the Number of Studies in Which They Were Used

Variables Examined	Type of Study		
	All Studies	Cognitive Outcomes	Noncognitive Outcomes
Level of Teachers' Education	83% (12)	75% (6)	100% (3)
Teacher Experience	57% (23)	43% (14)	75% (8)
Teacher Socioeconomic Status or Verbal Ability	100% (6)	100% (4)	100% (2)
Class Size	37% (19)	42% (12)	0% (4)

SOURCE: *What Research Says About Improving Student Performance. A Manual for Administrators.* Albany, New York: The University of the State of New York, The State Education Department, Bureau of School Programs Evaluation, March 1973. p. 10.

These two reviews of research would seem to indicate that the only consensus thus far reached on the class size question is that there is none.

The literature reviewed in this Research Brief is divided into two major sections: (1) how class size affects pupil achievement and (2) how class size affects the classroom environment--in particular, its consequences on instructional methods and student behavior. Only studies dealing with class size or pupil-teacher ratio at the elementary and secondary levels are included in this review. A discussion of optimum class size and interpretations of the literature then follow.

THE EFFECTS OF CLASS SIZE ON PUPIL ACHIEVEMENT

Included in this section are 24 studies analyzing the impact of class size on pupil achievement at the elementary level, 14 at the secondary level, and three more general studies.

The Effects of Class Size on the Achievement of Elementary Pupils (K-8)

Perhaps the most recent research on the effects of class size on pupil achievement at the elementary level is contained in a 1977 study by Lynne M. Johnson and her associates at the South Carolina Department of Education. With a $250,000 allocation from the state legislature, the Department of Education conducted a pilot program aimed at reducing pupil-teacher ratio in South Carolina's first grade classes. The purpose of the study was to explore:

(1) the effect of class size on the reading and mathematics achievement of first grade pupils;

(2) the effect of teacher in-service training on the reading and mathematics achievement of first grade pupils; and

(3) the effect of the interaction of class size and teacher in-service training on the reading and mathematics achievement of first grade pupils. [58:1-2]

Data were gathered on 13 variables:

- two independent variables: class size and teacher inservice training
- four dependent variables: post-test reading, mathematics, language, and overall achievement (as measured by the *Comprehensive Tests of Basic Skills, Form S (CTBS/S), Level B,* administered in May 1976)
- two covariates: pretest reading and mathematics achievement (as measured by *CTBS/S, Level A,* administered in September 1975)
- one classification variable: school district
- four extraneous variables: teacher race, utilization of teacher aides, student Title I classification, and student kindergarten experience. [58:26-31]

Fifty project classes in 23 of the state's 92 public school districts formed the basis for the data analysis. In these 50 classes, there were 25 pairs of classes matched on the student body's racial composition, students' socioeconomic status, and the school curriculum. Each pair of classes contained one experimental (small) class, averaging 19.9 students, and one control (large) class, averaging 26.7 students. Of the teachers involved in the project, nearly half received in-service training. Within a given pair of classes, both the experimental and control class teachers either did or did not receive in-service training. [58:viii]

Results of the study indicated that smaller classes significantly affected the reading and overall achievement of the first graders sampled. However, the differences between pupils' mathematics achievement in smaller and larger classes, the authors stated, were so small that they might have resulted from chance alone. [58:viii-ix]

Teacher in-service training had no effect on pupil achievement in either reading or mathematics. Combined with class size, teacher in-service training affected first graders' reading achievement, i.e., "[s]tudents in large classes whose teachers received in-service training, students in small classes whose teachers did not receive in-service training, and students in small classes whose teachers received in-service training scored significantly higher than students in large classes whose teachers had not participated in the in-service training sessions." [58:ix] No combination of these two variables were found to influence mathematics achievement more than any other combination. Neither class size, teacher in-service training, nor class size and teacher in-service training taken together affected the pupils' language achievement or (another variable later examined) overall achievement. [58:ix-x]

Mandated by the 1973-74 collective negotiation agreement between the Board of Education and the Teachers Association, the Madison (Wisconsin) Metropolitan School District (1976) conducted a research study to measure the effects of class size on the reading achievement of pupils in grades 1-3. A representative sample of 517 pupils was included in a three-year longitudinal analysis. Data were collected at the end of school years 1973-74, 1974-75, and 1975-76. The following variables were measured:

1. Pupils' personal characteristics
   a. sex
   b. age at entry into first grade
   c. socioeconomic status
2. Reading achievement
   a. measured at the end of the first year by the *California Achievement Test, Reading Subtest, Level 1, Form A*

b. measured at the end of the second year by the *California Achievement Test, Reading Subtest, Level 2, Form A*

c. measured at the end of the third year by the *Reading Test of the Sequential Tests of Educational Progress (STEP), Form B*. These STEP scores determined the measure of pupils' final reading achievement.

3. Intelligence

a. measured during the first year only by the *Short Form Test of Academic Aptitude, Level 1*

4. Pupil attitude

a. measured at the end of the second year by an attitude-toward-reading test

b. for the third year, this test was modified; in addition, pupils were asked two other questions on their reading attitudes

5. Parents' ratings of their children's attitudes toward reading

6. Teachers' ratings of their pupils' attitudes toward reading

7. Class size

a. measured three times, once for each of the three grades, and defined as "the average of the four quarterly enrollment figures for that student for that year." [37:10]

The results indicated that class size, by itself, was virtually nonpredictive of third grade reading achievement. The best individual predictors of final reading achievement were: first, prior reading achievement scores; second, teachers' ratings of student interest in reading; and third, IQ. The researchers then wondered if students who spend their first three years of school in small classes read better than those spending three years in large classes. [37:13-15] A major obstacle to this analysis was encountered: how should a "small" and a "large" class be defined? Two definitions were attempted. First, the Board proposed that a "small" class be equal to or less than 20 pupils. Using this criterion, only one of the 517 pupils in the sample was in a "small" class for each of the three years. Conversely, 401 pupils were in classes equal to or more than 20 pupils for three consecutive years. Therefore, the following definitions were used: "small" classes would be equal to or less than the median class size for a particular year; "large" classes would be greater than the median class size for a particular year. Under this definition, "small" classes contained between 23 and 24 pupils for each of the three years studied; "large" classes were anything above this. The following results, presented in Tables 6 and 7, were obtained from this analysis:

1. There was a slight trend toward lower STEP scores as the number of years that pupils spent in small classes increased.

2. There was a small but significant difference between the reading abilities of pupils who spent all three years in small classes and those pupils who spent all three years in large classes.

3. Students consistently enrolled in small classes had lower reading abilities than those enrolled in large classes. [37:16, 19]

The researchers then investigated the possible causes of the findings, looking at attendance areas and pupil IQ scores. They found that all but four pupils in the "small" size category attended schools in the LaFollette Attendance Area and all students in the "large" size group attended schools in the West Area. The mean IQ for pupils in the LaFollette district was 10.5 points lower than the IQ for pupils in the West Area. The researchers believed that these IQ differences were most probably associated with the effects of special education programs in Madison. [37:16-19]

Due to the confounding with attendance area and special education programs, the report made these final conclusions:

> [I]t is impossible to know if placing students, in general, in small classes,

TABLE 6.--STEP Scores by Patterns of Class Sizes for Years 1, 2, and 3

Pattern	Number of Students	Mean STEP Score
small, small, small	21	31.81
small, small, large	76	29.24
small, large, small	81	31.27
small, large, large	75	33.02
large, small, small	81	28.71
large, small, large	69	31.26
large, large, small	42	28.50
large, large, large	72	34.15
TOTAL	517	30.94

SOURCE: *Effects of Class Size on Reading Achievement in Grades 1-3 in the Madison Metropolitan School District (1974-1976).* Madison, Wisconsin: Madison Metropolitan School District, Instructional Services Division, September 1976. p. 18.

TABLE 7.--STEP Scores by Years Spent in Small Classes

Years in Small Classes	Number of Students	Mean STEP Score
0	72	34.15
1	186	31.35
2	238	29.75
3	21	31.81

SOURCE: *Effects of Class Size on Reading Achievement in Grades 1-3 in the Madison Metropolitan School District (1974-1976).* Madison, Wisconsin: Madison Metropolitan School District, Instructional Services Division, September 1976. p. 18.

> grades one to three, would have any effect on their reading achievement scores. So, whether small classes in the early grades can boost reading achievement cannot be predicted from the recent experience of Madison Metropolitan School District. A conservative conclusion from this study is that there is no evidence to support the hypothesis that Madison students enrolling in small classes will do better in reading than students enrolling in large classes. [37:24]

Reporting a study conducted for the Federal Reserve Bank of Philadelphia, economists Anita A. Summers and Barbara L. Wolfe (1975) tried to find those school resources in the Philadelphia public schools that are most beneficial to student learning. They specifically observed certain socioeconomic and school variables and aspects of school climate that are thought to affect student learning.

Of the school inputs studied, Summers and Wolfe found that class size, size of school, teacher experience, and rating of teachers colleges influenced learning. Scores from the *Iowa Tests of Basic Skills* were analyzed from a sample of 627 students in 103 elementary schools between the end of the third and sixth

grades and 553 students in 42 schools between the end of the sixth and eighth grades. A typical student in the study came from a family with less than $10,000 annual income. In addition, one-fourth of the black students came from families averaging less than $6,000 a year. The entire sample averaged achievement scores well below grade level. [114:5, 7]

From their analysis, Summers and Wolfe obtained the following results for sixth and eighth grade pupils:

- Sixth grade: Being in a class of 34 or more reduces achievement growth by 2.1 months. Being in a class of 28 to 33 rather than a class of less than 28 has no effect on students who scored at grade level in the third grade, a negative effect on low achievers, and a positive effect on high achievers. The negative effect is 1.6 months for a pupil who scored 2.0; the positive effect is 2.4 months for a pupil who scored 5.0. [114:25]
- Eighth grade: Being in a class of 32 or more, compared to a class of less than 32 has a negative effect on those with family incomes of $10,000 or less. The negative effect is 2.4 months for a $10,000 income pupil, 4.3 months for a $5,000 income pupil. [114:27]

Summers and Wolfe caution that "[t]he findings on class size should be regarded as indications for possible directional changes, rather than as literal indicators." [114:11]

The Summers and Wolfe study has been challenged by the Philadelphia School District's Office of Research and Evaluation which maintains that the data used were too limited in scope to be valid. "[T]heir study represents, to our way of thinking," the Office of Research and Evaluation argues, "only a first step and conclusions may not be drawn legitimately, at least until the study is repeated (cross-validated) and the same results are found [emphasis in the original]. . . Failure to cross-validate such a study leaves it open to the possibility that its findings are merely artifacts of the particular sample drawn." [32:1; 90] Summers and Wolfe recognize this need, yet still contend that "the broad findings . . . are firm enough in this study and supported enough by other studies to warrant confidence." [32:1; 100]

Richard J. Murnane (1975) hypothesized in a study involving 875 inner-city black children that larger classes would lead to decreased pupil achievement. Three samples were studied: the first group was in the third grade in 1970-71, the second group was in the second and third grades in 1970-71 and 1971-72. Reading and mathematics progress were analyzed from scores on *Metropolitan Achievement Tests*. Class size was defined as "the average of the number of students registered as class members on October 15 and April 15." [77:39] Murnane's results indicated that class size had no influence on achievement in either reading or mathematics in all three samples. But since almost all the pupils involved in the study were in classes of less than 28, the researcher believed that the insufficient variation in class sizes may account for this finding. [77:44]

Murnane later cautioned against focusing on pupil achievement only in the short run. He noted that, although arguments against class size reduction often stress the minimal impact of small classes on achievement, small classes may influence teachers' morale enough to keep them from leaving the profession over seemingly trying working conditions. Thus a pupil's future achievement may be positively affected

by having a "superior, experienced" teacher. [77:80]

J. Robert Coldiron and Eugene W. Skiffington (1975) described the initial results from the first four years of a study attempting to assess student progress toward ten goals of quality education in Pennsylvania. The following cognitive and noncognitive output measures were developed by the Pennsylvania State Department of Education and administered to fifth and eleventh graders between 1969 and 1973:

Cognitive Measures

- Basic skills--verbal
- Basic skills-math
- Vocational development

Noncognitive Measures

- Attitude toward school and learning
- Citizenship (attitudes only)
- Self-understanding [27:23-26]

Student background variables, community variables, and school staff characteristic variables also were developed.

Among indicators related to performance of fifth and eleventh graders studied in Pennsylvania were:

- instructional expense per average daily membership
- school attendance
- school innovations
- accessibility to the counselor
- continuing education
- holding power of the school [27:34-56]

Among the nonsignificant indicators were:

- teacher age, present position, locale, stability, career, or satisfaction
- books-to-pupil ratio
- *staff-to-pupil ratio* [27:58-59]

John Heim and Lewis Perl, in *The Educational Production Function: Implications for Educational Manpower Policy* (1974), also sought to find which educational resources most influence student achievement. They looked at the cost effectiveness of expenditures on different policy and program variables used to increase cognitive outputs, in particular reading and arithmetic achievement. [53:14]

Heim and Perl compared the gains in student achievement that seem to occur when per pupil expenditures are increased by various amounts for inputs such as teacher training, teacher experience, pupil-teacher ratio, and principal degree status. Separate estimates were calculated for the early elementary grades (K-2), late elementary grades (3-5), and secondary grades (9-12). [53:14]

Data for 63 New York State school districts, almost nine percent of the state's districts, were compiled to analyze educational production at the elementary school level. Educational output was measured by reading and arithmetic test scores for beginning third and sixth graders. Most variables were from the 1967 school year. Multiple regression techniques were used to relate each input to reading and math achievement scores. [53:14-16]

In comparing the effect of different educational policies and programs on student test scores, Heim and Perl imposed a fixed $100 per pupil per year increase in the cost to the school system even though policies involving different inputs were chosen. In this way, they attempted to determine how much of an increase in educational output an additional $100 per pupil per year would buy. Table 8 details their findings.

At the early elementary level, only pupil-teacher ratio had any impact on pupil achievement. The results suggested that a 2.0 percentile gain in reading and a 1.3 percentile gain in arithmetic might occur by using $100 per pupil in additional revenue to hire enough new teachers to reduce pupil-teacher ratio by

TABLE 8.--The Cost Effectiveness of Manpower-Related Inputs by Educational Level and Subject

Educational level and subject	Percentile point gain associated with an additional $100 per pupil expenditure on upgrading			
	Teacher degree status	Teacher experience	Pupil-teacher ratio	Principal degree status*
Early primary (K-2)				
1. Reading	None	None	2.0	Not estimated
2. Arithmetic	None	None	1.3	Not estimated
Late primary (3-5)				
1. Reading	9.0	0.7	1.0	14.0
2. Arithmetic	5.3	None	None	12.0

*Caution should be used in interpreting the principal-degree-status findings (see original text.)

SOURCE: Heim, John and Lewis Perl. *The Educational Production Function: Implications for Educational Manpower Policy*. IPE Monograph No. 4. Ithaca, New York: Institute for Public Employment, New York State School of Industrial and Labor Relations, Cornell University, June 1974. p. 25. (Copyright 1974, Cornell University. All rights reserved.)

four pupils per teacher. No increases in reading or arithmetic achievement would be found if the money was used to employ either more educated or more experienced teachers. Data limitations prevented Heim and Perl from including principal degree status in this analysis. [53:26-27]

At the late elementary level, each of the four inputs were related to at least one type of achievement, but not all were cost effective. Using an extra $100 per pupil to lower pupil-teacher ratio would yield a 1.0 percentile point gain in reading achievement and no improvement in arithmetic achievement. However, upgrading principal degree status and teacher degree status would seem to result in the most improvements for the $100 spent per pupil. [53:26] The money to pay for more teachers with graduate training, Heim and Perl suggested, could be derived from allowing pupil-teacher ratio to rise somewhat and by decreasing the amount paid for teacher experience. [53:30]

Heim and Perl stated that because the model used in their analysis is oversimplified, many variables undoubtedly were omitted from their study, and many interactions among variables ignored. Thus, policy makers are advised to view the results "with substantial caution, and more work needs to be done before they can be seen as more than tentative." [53:31]

William B. Moody, R. Barker Bausell, and Joseph R. Jenkins (1972) reported the results of the impact of class size on the learning of 10 mathematics objectives. They randomly assigned 83 fourth grade students to 20 groups

of one, 10 groups of two, four groups of five, and one group of 23. Three schools were used in the study and seven teachers presented one lesson. Tests were administered immediately afterwards. The researchers found that students in each of the three smaller groups did significantly better on the tests than those in the class of 23 students. Furthermore, one-to-one instruction was found superior to one-to-five. [76]

Reviewing this study, the NESDEC authors commented that Moody and his associates found that instructional outcomes were affected by class size extremes. "The finding that one-to-one instruction can be superior to other teacher-pupil ratios has been widely accepted for some time," NESDEC stated, "but this superiority is probably restricted to those learning outcomes that do not require any degree of pupil-pupil interaction." [18:21]

Irving Flinker (1972) studied the language arts and mathematics achievement of seventh graders in two "small" classes of 34 pupils each and one "large" class of 55. Those in the large class were found to have made more gains in achievement than those in the smaller classes. [39] Since the large class was taught by the department chairman who was helped by a teacher aide, Stanley Shapson (1972) questioned if "the results obtained in Flinker's study [were] attributable to the effects of class size, or quality of instruction, or teacher load? Because of the inadequacy of the experimental design, this question cannot be answered." [97:12; 104]

The Cleveland (Ohio) Public Schools implemented a three-year longitudinal study in two elementary buildings from school years 1969-70 to 1971-72 called the More Effective Schools program (MES). According to the evaluation of the program by its authors Derek B. Taylor and Margaret Fleming, the purpose of MES was "to attack the poor achievement patterns of inner-city children through the alteration of organizational and instructional patterns across all grades within a given school." [115:1]

It is hoped that individualizing instruction would create optimal situations for learning and instruction by:

- reducing class size
- expanding instructional and supportive staff
- expanding supplemental services
- expanding in-service development of teachers
- increasing the quantity of instructional materials and equipment
- establishing a team approach to instruction
- providing increased parental involvement in the schools [115:2]

Besides establishing the instructional improvements listed above, class size was reduced to an average of not more than 25 pupils. [115:9]

Results of the evaluation indicated that classroom observers found that MES teachers more extensively and effectively used teaching aids than teachers in Control schools, their lessons were better organized and prepared, and they gave more individual attention to their students. MES teachers also devoted less time to nonteaching duties than they did before they started the program and increased the number of contacts they made with parents. However, observers noted that student interest was not significantly different in MES schools. [115:9-10]

In analyzing pupil achievement gains, Taylor and Fleming reported that:

> After three years of operation, the question "Has the MES Program had a measurable impact on improving achievement levels in reading and math?" must be answered with a resounding "...Perhaps." During the first

> two years, MES children demonstrated a decided superiority in achievement over Control children. Analysis of the performance of just those children who had been in the program for the full two years (the longitudinal samples) showed even more impressive results. In the third year of operation, however, there was slippage. MES children still outperformed Control children on several tests, but not many. Analysis of longitudinal data showed MES superiority in fewer instances than before and Control superiority in a few more. Cross-sectional analysis of changes in performance over time at given grade levels did show some evidence of a gradual improvement in certain instances, but performance was still well below norm levels. [115:20]

Martin T. Katzman (1971) based his education production function study on data from 56 elementary school attendance districts in Boston during 1964-65. [61] Information on six output measures of pupil performance were collected on pupils' aspirations and scholastic achievement and on the districts' "holding power":

(1) median math score of fifth grade pupils in each district
(2) difference between median reading scores of second and sixth grade pupils in each district
(3) percentage of sixth grade pupils who took and
(4) passed the entrance exam to Latin High, a superior secondary school in Boston
(5) average daily attendance in each district as a percentage of total enrollment
(6) percentage of elementary school graduates from each district who completed high school [77:14]

Nine input variables were used in the stepwise regression analysis:

(1) percentage of teachers accredited
(2) percentage of teachers with master's degrees
(3) percentage of teachers with 10 or more years of experience
(4) teacher turnover rate
(5) percentage of classrooms with 35 students or less
(6) *student-staff ratio*
(7) age of buildings
(8) total enrollment
(9) percentage of males in the district with white collar occupations [77:14]

The effects of crowding (percentage of classrooms with 35 students or more) did not clearly and consistently correlate with attendance. The effects of noncrowding (percentage of classrooms with 35 students or less) were found to correlate with differences in median reading score and percentage of sixth graders who passed the Latin High entrance exam. Student-staff ratio consistently and significantly was associated with average daily attendance and output measures of school persistence. [49:41]

Katzman emphasized two factors that school officials should recognize when dealing with educational efficiency studies: (1) Tradeoffs between different outputs may occur, e.g., increasing the percentage of teachers with master's degrees may increase attendance and students' aspirations, but it also would decrease math scores (as was the case in his study); (2) efficient allocation of resources likewise is dependent on financial considerations as well as their effects on outputs, e.g., the class size question involves, together with its result on pupil achievement, the high cost that lowering the number of children in a class would have on policy making. [77:15]

In reporting the results of the San Francisco South East Education Development Project,

James Counelis (1970) found that class size did not significantly relate to the monthly reading achievement rates of disadvantaged, primarily black first grade classes. [31]

Marshall S. Woodson (1968) examined 95 school systems to observe the effects of class size on the reading and arithmetic levels of fourth and sixth grade pupils. Three measures of class size were taken: average class size of the district, class size range, and the ratio of small classes (less than 22) to large classes (more than 27). Residual scores (the difference between actual standardized test scores and scores predicted in intelligence tests) were used to calculate achievement. A score of 500 was assigned whenever achievement equaled prediction; a score over 500 denoted achievement exceeded prediction; a score under 500 denoted prediction exceeded achievement. Woodson found that "there is a small inverse relationship between the academic achievement of pupils and class size; but:

1. This relationship tends to be smaller for pupils of higher scholastic potential than for pupils of lower scholastic potential.
2. This relationship tends to be smaller for criteria based upon total achievement test batteries or arithmetic sub-tests than criteria based upon reading sub-tests.
3. This relationship tends to be more uncertain of measurement at the sixth grade level than at the fourth grade level.
4. This relationship reflects an interplay with school district size. The relationship was essentially obliterated with a group of small, relatively sparsely populated, school districts. However, there was little evidence that district size *per se* reflected itself in the magnitudes of the achievement criteria.
5. All of these conclusions are subject to the kinds of class size measures used. The findings from this study raise the possibility that the practice of using "average class size" as the lone measure of class size tends to oversimplify the study of the relationship with pupil achievement." [148:6]

NESDEC questioned the value of Woodson's study by saying:

1. The findings are apparently not generalizable because the sample of school districts was not randomly selected.
2. The absence of any control on the teacher variable raises questions about the findings and about the participating districts.
3. Districts with a significant number of elementary level classes under 22 may differ markedly in other important characteristics from districts whose class sizes average 27 or more. For example, if the former districts are indeed more affluent, they may pay teachers more and may demand teachers with superior education and experience. In that case, the teacher variable assumes major importance. The most insightful of Woodson's conclusions may be that "the findings from this study documented the fact that the relationship between pupil achievement and class size is not a simple one (p. 6)." [18:21]

Mauritz Johnson and Eldon Scriven (1967) analyzed results from the *Iowa Tests of Basic Skills* for 7,500 seventh and eighth grade pupils in 130 English and 135 mathematics classes. Initially, they classified "small" classes as

those with less than 29 pupils for the seventh grade and less than 28 for the eighth grade. "Large" classes in both seventh and eighth grades contained 29 students or more. Two-thirds of the classes studied consisted of 22 to 32 students, so the researchers also studied the smallest (less than 24) and the largest (over 34) classes. In both cases they found class size to have no significant effect on achievement gains. "The results," Johnson and Scriven said, "suggest that uncritical worship of small classes for all subjects, grades, and ability levels is unjustified." [59:309]

Begun in 10 New York City elementary schools in 1964 and enlarged to 11 more schools the following year, the More Effective Schools (MES) program sought to improve educational quality by focusing on integration, heterogeneous grouping, team teaching, and community-school relations. Class size could not exceed 22 pupils. [41; 17:28]

In evaluating the MES program of instruction and its effect on participating pupils with eight control schools, David J. Fox (1967) related that in October 1966, average class size for grades 1-8 in MES was 20.1. Control schools averaged 28.5 pupils per class, special service schools 27.2, and citywide elementary schools 27.7. He reported that "the MES program has made no significant difference in the functioning of children, whether this was measured by observers rating what children did in class, or how they do it, or whether it was measured by children's ability in mathematics or reading on standardized tests." [41:121]

Irving H. Balow (1967) conducted a three-year longitudinal study on the effects of class size on reading achievement in the Riverside (California) School District, employing the same sample of children from grades 1-4. Six hundred fifty-six children comprised the experimental group and 602 made up the control group. "Small" classes contained 15 students and "large" classes 30. Results were obtained from scores from the *Metropolitan Readiness Tests* (grade 1), the *California Short Form Test of Mental Maturity* (grade 2), *Metropolitan Achievement Test* (grades 2-3), and the *School and College Aptitude Test* (grade 4). Balow found that when students were in small classes for two or more consecutive years, size of class influenced achievement rates. In addition, he determined that the first grade was crucial to reading achievement. But by the third grade, class size alone was not the determining factor in achievement. [5]

Orlando F. Furno and George J. Collins (1967) conducted a five-year longitudinal study on the effects of class size on the reading and arithmetic achievement of 16,449 Baltimore City Public School students who were enrolled in grade 3 in 1959. Their research was cross-classified by pupil intelligence and occupation of the father, or in the father's absence, the occupation of the mother. Other breakdowns in the data included whether or not students were enrolled in the regular or special education curriculum and the student's race. Six variables were controlled:

- number of different home addresses of the child
- highest grade obtained by the father (or in his absence, the mother)
- reading score (computed from projected and actual test scores)
- average percent of nonwhite faculty in schools attended by each child
- Baltimore teachers examination score
- teachers' years of experience [43:16]

Reading achievement was measured by scores from the *Metropolitan Elementary Reading Test*, *Stanford Elementary Reading Test*, and *Stanford*

Intermediate Reading Test. Arithmetic achievement was measured by scores from the *Metropolitan Elementary Arithmetic Test, Stanford Elementary Arithmetic Test,* and *Stanford Intermediate Arithmetic Test.* Class sizes of 1-25, 26-31, 32-37, and 38 and above were established for the project, although not artificially. [43:16-18]

As Table 9 indicates, Furno and Collins found that smaller classes translated into reading and arithmetic achievement gains. Comparisons were made for smaller and larger classes in the regular and special education curricula. The ratio of comparisons favoring smaller to larger classes was 3.4:1 in the regular curriculum and 12.7:1 in the special education curriculum. Moreover, the smallest classes (1-25) were favored 7.3:1 over the larger (26 students or more) in 192 comparisons; in 96 comparisons involving nonwhite students, the ratio increased to 21.3:1.

The authors of the NESDEC study contend, however, that the Furno and Collins findings actually implied that differences in intelligence, rather than differences in class size, act as better indicators of achievement. Using data from tables in the Furno and Collins study, they compared the statistical significance of the differences between means for small (1-25 students) and large (26-31 students) class groupings of white students at different IQ levels in reading and arithmetic achievement. For gains in reading achievement, NESDEC found four comparisons favoring small classes, four favoring large classes, and eight that were not significant. Yet three of those comparisons favoring small classes were taken from children in the 79 and below IQ range. For those in the 80 and above IQ category, reading achievement gains were noted in one comparison for small classes, three for large classes, and eight were not significant. [18:23-26]

Results in arithmetic achievement were similar. For all students, six comparisons favored small classes, four favored large classes, and six were not significant. For those with IQs of 79 and below, four comparisons favored small classes, with none favoring large classes, and none having no significanc. For those students with IQs of 80 and above, the number of comparisons favoring small classes was two, the number favoring large classes was four, and six were not significant. Moreover, for those with IQs of 95 and above, the results seemed to favor large classes. [18:23-26]

NESDEC further contends that the Furno and Collins study may have contained an urban bias and that implications from the data on significant differences were dismissed too hastily. [18:23, 30-31] NESDEC's authors did agree with Furno and Collins that class size remains an important policy issue:

> Concern for class size may well be justified, particularly in the City of Baltimore if the reported distribution of class sizes with only 8% in the range of 1-25 is representative of the city as a whole. If, as the report suggests, over 75% of the classes in Baltimore comprise 32 or more students, class size warrants attention. Classes of 32 or more students may be significantly detrimental to achievement, especially in the case of non-white students... though this conclusion is not so clear cut in the case of white children. Other variables may be equally important and more deserving of intense study to ascertain why, in reading and arithmetic, the pupils in this study on the average tended to fall further behind the national norms over the five-year period. [18:26]*

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*Furno, Orlando F. and Collins, George J., *Class Size and Pupil Learning:* Baltimore Public Schools, 1967 (EDRS No. ED 025003). Attention is drawn to the period 1959-64 when the conditions described were said to have prevailed in the Baltimore Public Schools.

TABLE 9.--Achievement Gains in the Baltimore Sample of Furno and Collins, 1959-64

REGULAR CURRICULUM

Subject	Comparisons Favoring Small Classes	Comparisons Favoring Large Classes	Ratio of Comparisons Favoring Small Classes to Large Classes
Reading	92	26	3.5:1
Arithmetic	96	29	3.3:1
Total[1]	188	55	3.4:1

SPECIAL EDUCATION CURRICULUM

Subject	Comparisons Favoring Small Classes	Comparisons Favoring Large Classes	Ratio of Comparisons Favoring Small Classes to Large Classes
Reading	18	2	9:1
Arithmetic	20	1	20:1
Total	38	3	12.7:1

COMPARISONS FAVORING SMALLEST CLASSES

Number of Comparisons	Comparisons Favoring Smallest Classes (1-25)	Comparisons Favoring Larger Classes (26+)	Comparisons Favoring Neither Smallest Nor Larger Classes	Ratio of Comparisons Favoring Smallest Classes to Larger Classes
192[2]	117 (61%)	16 (8%)	59 (31%)	7.3:1
96[3] (nonwhite)	64 (66%)	3 (3%)	29 (30%)	21.3:1

[1]"These results were attained even though in most instances the pupils in large classes benefited more significantly from such favorable supporting characteristics as parental education, faculty knowledge, and faculty teaching experience."

[2]Goals were attained even though the three "favorable supporting characteristics" listed above were present in only 32 percent of the comparisons.

[3]Goals were attained even though the three "favorable supporting characteristics" listed above were present in only 20 percent of the comparisons.

SOURCE: Furno, Orlando F. and George J. Collins. *Class Size and Pupil Learning.* Baltimore, Maryland: Baltimore City Public Schools, 1967. pp. 142-143.

Daniel J. Menniti (1964) studied the effects of class size on reading and mathematics achievement in elementary schools in the dioceses of Harrisburg, Pennsylvania and Evansville, Indiana. "Small" classes were defined as those with less than 36 pupils and "large" as those with 40 or over. Menniti concluded that large classes significantly favored achievement gains for average pupils in mathematics in both dioceses and for average pupils in reading in the Harrisburg diocese. Low IQ groups were affected similarly in both

subject areas, though not as much as the average students. High IQ groups exhibited no real differences in achievement when in large groups. [72; 17:29]

In "The Effect of Class Size Upon Reading Achievement in First Grade," Jack R. Frymier (1964) administered the *Williams Primary Reading Achievement Test (Form D)* to 420 pupils in one central Florida school district. Two hundred nineteen children in nine "small" classes (less than 30) and 201 children in six "large" classes (more than 36) were given the test. Pupils' age, physical health, visual and auditory acuity, and sex were controlled. Frymier found that:

> In terms of reading achievement ...first grade students in small classes achieved at a significantly higher level than students in larger classes. Further, there were fewer retentions among the students in smaller classes, despite the fact that their attendance record was somewhat lower than for those enrolled in larger groups. In effect, there seems to be clear evidence here that class size influenced achievement in reading for these first grade students. [42:93]

NESDEC's review of class size research noted three "defects" in Frymier's study:

> First, the only controls for the teacher variable were length of formal education and extent of experience. These and other "incidental differences" the author judged "were probably not significant" (p. 91). Second, though the classes were equated for sex, age, physical defects, and attendance, the variability in intelligence was not assessed. And lastly, for purposes of this discussion, large classes were defined as those with more than 36 children, while small classes contained fewer than 30 students. Such "small" classes are now more generally considered to be of regular or even large size for the first grade. [18:19]

Edwin C. Clark's review (1963) detailed four class size studies conducted in other countries. In the first, 4,000 eight-year-olds were tested for mechanical reading ability and intelligence, with no significant differences noted between different class sizes. "Good reading ability [was] significantly associated with large schools, superior buildings, urban areas, and large classes" in a second study of a sample of 7,000 seven to eleven-year-olds in 51 primary schools in the English county of Kent. Little relation between median scores in English comprehension and class size was found in a third study conducted in Scotland of 76,000 ten-year-olds. In a fourth study of fifth and seventh graders in Western Australia, performance in reading and arithmetic classes was found to be best in classes of less than 30 pupils, followed by groups of 40-49, 30-39, and 50 and more. [15; 17:30]

Sixten Marklund (1963) reported the findings of a Swedish study that attempted to measure the effects of class size on reading, writing, mathematics, English, history, geography, and mature knowledge. The population of the study included a national sample of 150 sixth grade classes of 3,691 students together with a sample of 39 sixth grade classes of 1,223 pupils in south Stockholm. Class sizes of 16-20, 21-25, 26-30, and 31-35 were compared. From standardized test results in the seven areas examined, Marklund stated that class size alone would not influence achievement. [65; 62:26]

In trying to assess the effects of class size on 76 third grade classes and 72 sixth grade classes in Iowa cities with a population of 5,000 or more, Herbert F. Spitzer (1954) studied data taken from scores of the 1953 administration of the *Iowa Every-Pupil Tests of Basic Skills*. This test measured four areas of achievement: reading comprehension, study skills, language skills, and arithmetic skills. Spitzer defined a "small" class as one containing 26 or fewer pupils and a "large" class as

one containing 30 or more. Only in the analysis of reading comprehension at grade six did class size influence achievement, and this at the 20 percent level of significance. Thus Spitzer concluded that, in this study, class size was not a factor in achievement. [110]

Profile of class size studies--Grades K-8.--The studies on the effects of class size on pupil achievement in grades K-8 that have been reviewed in this Research Brief are outlined in Table 10. Table 10 groups these studies according to the following factors: author and year the study was published, subject areas and grade levels examined, the sample employed, definition of "small" and "large" classes used, findings, and criticisms of the study contained in the literature.

THE EFFECTS OF CLASS SIZE ON THE ACHIEVEMENT OF SECONDARY STUDENTS (9-12)

Joseph DeAngelis, Jr. (1977) conducted an experiment to see whether or not class size affected the achievement of ninth grade students in a science laboratory course. Two classes of average ability students were formed from the results of Scholastic Testing Service achievement tests, 1975 edition. Twenty-three students were randomly assigned to a "small" class and 46 students to a "large" class. Both sections were taught Introductory Physical Science. To eliminate differences in the teacher variable and the method of presentation, the same person taught both classes. Students worked in pairs. The teacher gave individual attention to those students requesting it. At the end of six months, both sections took a standardized achievement test. DeAngelis found that the achievement of students in the small class was not significantly different from that found in the class of 46. [34]

In addition to their findings on class size as it relates to elementary school pupil achievement, Summers and Wolfe (1975) also studied secondary level English classes in the Philadelphia School District. Seven hundred sixteen students in five senior high schools between grades 9 and 12 were included in the sample. Achievement was measured from the outcomes of three standardized tests: *Cooperative School and College Abilities Test*, *California Achievement Test*, and *Comprehensive Test of Basic Skills*. The researchers noted the following effects of class size on the English achievement of twelfth graders:

> Larger classes have a negative effect on low achievers, no negative or positive effect on average achievers, and a positive effect on those who scored at the 50th national percentile or above. For those at the 10th percentile, the negative effect of having one additional student in a pupil's English class is .7 percentile points. For those at the 5th percentile, the negative effect is .92 percentile points. The negative effect is most pronounced comparing class sizes of above 26 to those below 26. [114:28]

It again should be noted that the research methods used in this study have come under attack (see page 14).

As summarized on page 15, Coldiron and Skiffington (1975) found that staff-pupil ratio was not a significant indicator in the sample of eleventh graders studied in Pennsylvania. [27:58-59]

Besides the studies they conducted of New York State school districts at the elementary level (see page 15), Heim and Perl (1974) analyzed data relating to individual students who were seniors in 1960 from a stratified random sample of 1,000 U.S. high schools. Output measures were tests of general verbal and quantitative ability. Although the researchers

TABLE 10.--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 School 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)

TABLE 10 *(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		1) Class size greater than 34:1 negatively affected achievement. 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.	The data used were too limited in scope to be valid. [32; 90]
		6-8	553 students in 42 schools		Achievement of students with family incomes of $10,000 or less was negatively affected in classes of 32 or more.	
Murnane (1975)	reading and mathematics	2-3	875 inner-city black children		Class size had no effect on pupil achievement. However, insufficient variation in the class sizes examined may be the reason for this finding.	
Coldiron and Skiffington (1975)	cognitive and noncognitive output measures	5			Staff-to-pupil ratio was found to be a nonsignificant indicator of student performance.	
Heim and Perl (1974)	reading and arithmetic	K-5	63 New York State school districts		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.	

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.	
Counelis (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)

TABLE 10 *(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 study of smallest and largest classes: "small": less than 24 "large": over 34	No significant achievement gains were found in either study between small and large classes based on the results from the *Iowa Tests of Basic Skills*.	
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.	

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.	1) Achievement gains may be more attributable to differences in pupil intelligence than class size. 2) The study may have an urban bias. 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	Smaller classes positively affected reading achievement.	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)

TABLE 10 *(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	50 small classes; 26 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.	
		6	55 small classes; 17 large classes			

were unable to control for the student's entry level of ability, their results primarily reflected the impact of resources used at the secondary school level. [53:21]

For the class size inputs examined, Heim and Perl discovered a pattern approximating those results found in the late primary grades. "Reducing class size within the observed range appears to have little, if any, effect on student performance," they said. "To the extent that this variable has any effect, it tends to influence verbal rather than quantitative ability." [53:23]

In their comparisons of cost effectiveness, Heim and Perl learned that increasing teacher degree status was the most cost effective method to raise the quality of education. Reducing class size or increasing teacher experience had no significant effect at the secondary school level. [53:26]

An article in the October 1972 *Bulletin* of the Massachusetts Association of School Counselors reported that class size made no difference in two experimental high school English composition programs. A former Pittsburgh (Pennsylvania) superintendent of schools, Dr. Louis Kishkunas, said that students in both programs showed no improvement over others in the school district when either class size was reduced and teacher load lightened (from five classes a day to four) or when lay readers helped teachers grade papers. [66; 18:16]

Samuel S. Bowles (1969) gathered information from test scores in mathematics and reading achievement and general academic ability of a sample of black twelfth grade students for which Project TALENT data were available. (Project TALENT examined a random sample of 400,000 secondary students across the United States in 1960 to collect information on students' interests, abilities, and backgrounds.) After controlling for students' social environment, Bowles found the following relationships for the three output measures examined:

Output Measure	Input Variables Positively Related	Input Variables Negatively Related
1. student achievement on reading tests	level of teacher training	class size; ability grouping
2. student achievement on mathematics tests	level of teacher training; per pupil expenditure	ability grouping; age of school building
3. student achievement on test of general academic ability	level of teacher training	class size; ability grouping [9; 49:43]

A study conducted by George A. Jeffs and Brian M. Cram (1968) at Ed W. Clark High School in Las Vegas, Nevada, examined the effects of class size on achievement in business law, introductory business, and government classes. Two hundred twenty-four students randomly were placed in "average" (24-26 students) and "above average" (45-52 students) classrooms. Findings of pre- and post-test scores on teacher-made examinations indicated no significant differences in achievement for either group in the two business courses. There was a significant difference, however, in favor of the average class group in the government course. The authors believed that this difference may have been a result of older students being enrolled in the government course, the subject matter of the course, or the teaching methods used. Student satisfaction with the learning environment was not affected by class size differences in any of the three courses. [56]

J. Vincent Madden (1968) studied the effects of class size on the general mathematics achievement of average ability ninth-graders. Students in "small" classes of 25-40 and in "large" classes of 70-85 were given the *Contemporary Mathematics Tests, Junior High School Level,* to measure pre- and post-test achievement levels. The findings indicated no significant differences between the small and large groups at the beginning of the semester. At the end of the semester, the large classes scored significant gains in achievement. [63]

Simon Haskell (1964) tried to determine the effects of class size on the geometrical drawing achievement of 102 first year students in a British secondary school. Two "small" classes of 17 pupils each and two "large" class of 34 pupils each took part in the study. IQ, age, sex, pupil intelligence, pre-test knowledge, instructor differences, and facilities all were controlled. Except for the third term, class size made no difference in achievement. Haskell concluded that this exception was not enough to show that class size affects achievement in geometrical drawing. The size of class likewise made no difference on the attitudes of students toward this subject. [52] In his analysis of Haskell's findings, Bruce M. Mitchell observed that: "It is significant to note, however, that students were allowed to choose whether they wished to be placed in a large or small class. Since the students entered the experimental situation with a favorable attitude toward either a small or large class, it seems conceivable that a kind of 'halo' effect might have been in evidence. [74:33]

Frank H. Anderson and his associates (1963) attempted to measure the impact of class size on two groups of superior students of intermediate algebra. One hundred twenty students were grouped into two one-semester classes--a "small" class of 40 and a "large" class of 80. Two aides helped the one instructor who taught both classes. The *Sequential Test of Educational Progress* was used to measure achievement. The researchers found no significant achievement differences between the small and large classes when students were tested after the end of one semester. [1]

Analyzing the effects of class size on the English achievement of twelfth-graders, John T. Warburton (1961) grouped students into classes of 100 and over and into classes of 30-35. He found that the large groups were superior in composition, reading, and listening. [142]

Robert H. Johnson and M. Delbert Lobb (1961) reported on a three-year study of class size in eight Jefferson County, Colorado senior high schools. One thousand seventy-five students in tenth and eleventh grade English III, plane geometry, American history, and biology were grouped into classes of 10, 20, 35, 60, and 70. The two largest groupings had two certified teachers each, except in two cases. From achievement tests administered at the end of the year, the researchers concluded that class size made no appreciable difference in student achievement. They added that:

- There were no significant differences in the achievement of pupils in classes of 20, 35, 60, and 70.
- Small groups of high capacity learners were not academically or economically feasible.
- Students had not been harmed by participating in large group work. [60:61]

In a nationwide sample of 9,000 ninth graders in 100 schools and 8,357 twelfth graders in 106 schools, William G. Mollenkopf and S. Donald Melville (1956) collected aptitude and achievement test data in an early study on

school effectiveness for Educational Testing Service. Thirty-four variables were constructed from the responses of principals to a questionnaire on students' and their parents' socioeconomic status, the availability of educational opportunities provided by the community, and the quality of available school services. By organizing these three main categories, Mollenkopf and Melville attempted to assess the school's effect on pupil performance, and at the same time, to control for nonschool influences. They advised their readers of the difficulty of keeping socioeconomic factors from spoiling the analysis of the school service influences. Their work found four school service variables to significantly influence pupil achievement:

- number of special staff in school (e.g., counselors, psychologists, etc.)
- *class size*
- *pupil-teacher ratio*
- per pupil instructional expenditure [75; 49:32]

Analyzing final examination grades taken from 73 high school chemistry classes in nine states, Kenneth E. Anderson (1950) found that students in smaller classes scored better than those in large classes. [3]

Profile of class size studies--grades 9-12.--The studies on the effects of class size on pupil achievement in grades 9-12 that have been reviewed here are outlined in Table 11 on pages 34-36. Table 11 profiles available information in the following areas: author and year the study was published, subject areas and grade levels examined, the sample employed, definition of "small" and "large" classes used, findings, and criticisms of the study contained in the literature.

GENERAL STUDIES ON THE EFFECTS OF CLASS SIZE ON STUDENT ACHIEVEMENT

Two recent general reports on educational quality and cost effectiveness and a replication of one of these studies have investigated the class size question.

A cost effectiveness study conducted by Education Turnkey Systems (1975) for the Michigan State Department of Education examined compensatory education reading programs in 48 Michigan school districts. Twenty-five "unusually successful" and 23 "unusually unsuccessful" programs were studied. Results indicated that 30 percent of the achievement differences were correlated to the amount of money spent per pupil. Reallocating resources, instead of finding new sources of revenue, also was found to be significant. Neither class size nor teacher's salary, experience, or age had any effect on achievement. [99]

In a study by Herbert J. Walberg and Sue Pinzur Rasher (1974), pupil-teacher ratio was one variable found to have affected the Selective Service examination scores of military draftees. The percentage of Selective Service draftees examined for military service who failed the mental test in 1969 and 1970 in each of the 50 states was compared with nine statewide socioeconomic and educational variables collected by public and private agencies on complete populations or on strict random samples:

1. Number of murder and non-negligent manslaughter crimes per 100,000 population
2. Number of public library books per capita
3. Cost-adjusted personal income per capita
4. Percent of population subscribing to daily newspaper

TABLE 11.--The Effects of Class Size on the Achievement of Secondary School Students (9-12)

Author and Year of Study	Subject Areas	Grade Level	Sample	Definition of "small" and "large" classes	Findings	Criticisms Contained in the Literature
DeAngelis (1977)	laboratory science	9	69 students of average ability	"small": 23 "large": 46	Achievement of students in the small class was not significantly different from the achievement of students in the large class, when tested at the end of six months.	
Summers and Wolfe (1975)	English	9-12	716 students in 5 senior high schools		Larger classes negatively affected achievement of low achievers, positively affected those scoring at the 50th percentile or above on 3 standardized tests, and had no effect on average achievers.	The data used were too limited to be valid. [32; 90]
Coldiron and Skiffington (1975)	cognitive and noncognitive output measures	11			Staff-to-pupil ratio was found to be a nonsignificant indicator of student performance.	
Heim and Perl (1974)	reading and arithmetic	12	students who were seniors in 1960 from a stratified random sample of 1,000 U.S. high schools		Reducing class size appeared to have little effect on student performance or on increasing a school system's cost effectiveness.	
Massachusetts Association of School Counselors (1972)	English	experimental high school	2 programs: 1) Class size was lowered and teachers were made responsible for 4 classes a day instead of 5. 2) Lay readers were used to help teachers.		Both groups failed to improve on achievement.	

Bowles (1969)	mathematics, reading, and general academic ability	12	black students for which Project TALENT data were available		Class size was negatively related to student achievement in reading and general academic ability but had no significant correlation with mathematics achievement.	
Jeffs and Cram (1968)	business law, introductory business, government	9-12	224	"average": 24-26 "above average": 45-52	No achievement differences in average or above average classes in the business courses were noted, but average classes in government showed higher achievement than above average classes.	
Madden (1968)	mathematics	9		"small": 25-40 "large": 70-85	Large classes showed significant achievement gains at the end of one semester.	
Haskell (1964)	geometrical drawing	secondary, first year	102	2 "small" classes of 17 each; 2 "large" classes of 34 each	No significant differences were found between the small and large groups.	Students favoring being placed in a small or large class may have biased the results. [74]
Anderson and Others (1963)	intermediate algebra	superior high school freshmen	120	"small": 40 "large": 80	No significant differences between the two groups were noted from scores on the *Sequential Test of Educational Progress* at the end of one semester.	
Warburton (1961)	English	12		"small": 30-35 "large": 100 and over	Large groups showed greater achievement in composition, reading, and listening.	
Johnson and Lobb (1961)	English III, plane geometry, American history, biology	3-year study of students in grades 10-11	1,075 students in 8 senior high schools	classes of 10, 20, 35, 60, 70 were measured	1) Insignificant achievement differences in the four largest class sizes were noted. 2) It was not academically or economically feasible to have small groups of high capacity learners. 3) Large group work did not harm students.	

(Continued)

TABLE 11 *(Continued)*

Author and Year of Study	Subject Areas	Grade Level	Sample	Definition of "small" and "large" classes	Findings	Criticisms Contained in the Literature
Mollenkopf and Melville (1956)	aptitude and achievement test data	9	9,000 students in 100 schools		Class size and pupil-teacher ratio both were found to significantly influence achievement.	
		12	8,357 students in 106 schools			
Anderson (1950)	chemistry		73 selected high schools in 9 states		Students in smaller classes scored higher on final exams than students in larger classes.	

5. Number of symphony orchestras per 100,000 population
6. Percent of total urban (urbanized areas and places of over 2,500 inhabitants) population
7. Ratio of public school enrollment to population of 5-17 years old
8. Ratio of public school pupils to teachers
9. Ratio of cost-adjusted public school expenditures to personal income per capita [139:4]

Values were assigned to these variables (including average years of adult education) in each of the 50 states. Through regression analysis, the authors denoted these estimates of significant associations:

INDEPENDENT VARIABLES	*ASSOCIATED DIFFERENCE IN PERCENTAGE FAILING*
Socioeconomic and Cultural Variables	
Median Income: $1,000 higher per capita	34% lower (3 to 66%)
Homicide Rate: 10 more per 100,000 population	151% higher (111 to 191%)
Urban Index: 100 units squared deviation in percentage urban from the mean of 66%	7% higher (2 to 12%)
Educational Variables	
Public School Enrollment: 10% higher percentage of age-eligible children attending public schools	43% lower (17 to 69%)
Pupil/Teacher Ratio: one more pupil per teacher	10% higher (7 to 14%)
Educational Expenditures: 1% higher percentage of median per capita (cost-adjusted) income allocated to public school education	14% lower (3 to 24%)

Note: The estimates (and the plus-and-minus, two-standard-error confidence intervals in parentheses) are descriptions of concurrent associations, not forecasts of what would happen if the values of the independent variables were changed to the stated extents.

SOURCE: Walberg, Herbert J. and Sue Pinzur Rasher. "Public School Effectiveness and Equality: New Evidence and Its Implications," *Phi Delta Kappan*, 56 (September 1974), p. 8.

Walberg and Rasher concluded that "the three educational input measures are all significant...high pupil/teacher ratios, low rates of per-pupil expenditure in the public schools, and low rates of age-eligible children enrolled in public schools are associated with high rates of test failures." [139:8]

In the May 1977 issue of *Phi Delta Kappan*, Walberg and Rasher reported a continuation of their 1974 research. This time the percentage of Selective Service draftees who were examined for service and failed the mental test in 1970 were compared with 18 socioeconomic and educational variables for each of the 50 states. Of the 10 variables examined in 1974, all but the number of symphony orchestras per 100,000 population and the number of library books per capita again were analyzed. In addition to these eight variables, the following 10 variables were studied in their 1977 research:

1. Percent of population that is of the black race
2. Percent of population that is of Spanish origin

3. Total population of state
4. Population density
5. Percent of population living in areas of fewer than 2,500 persons
6. Cost-adjusted receipts available from all sources per pupil for public school systems
7. Ratio of total public school population to the total number of public schools
8. Ratio of pupils attending ungraded schools to the total pupil population
9. Ratio of public one-teacher schools to the total number of public schools
10. Product of average length of school term with percent average pupil daily attendance [140:704-705]

Through regression analysis, high rates of failure on the mental test among draftees in the 50 states were correlated with low levels of adult education, small population size, and high percentages of black and Spanish-origin residents of the state. Of the school variables analyzed, taken either separately or together, high percentages of children enrolled in public schools and low pupil-teacher ratios were significantly associated with low rates of failure. [140:704]

Profile of general class size studies.--General studies on the effects of class size on pupil achievement that have been reviewed here are outlined in Table 12. This table lists the author and the year of the study, sample, and findings.

THE EFFECTS OF CLASS SIZE ON CLASSROOM ENVIRONMENT

Although the debate on the effects of class size on achievement continues, much of the recent research has tended to focus on the impact of class size on the classroom and learning environment of students, especially its influence on the kinds of instructional techniques used in the classroom. This section reviews the research on class size and instructional methods, as well as how class size affects student behavior.

The Effects of Class Size on Instructional Methods

Several studies on the effects of class size on instruction have been published by Teachers College, Columbia University and the Institute of Administrative Research (now the Horace Mann-Lincoln Institute) located at Columbia University. *Class Size: The Multi-Million Dollar Question* by Donald H. Ross and Bernard McKenna (1955) summarized the research conducted in the mid-1950s. [92:7-11]

Testing teachers' knowledge of 15 items concerning their students' mentality, school history, health history, and family background, C. Frederick Pertsch (1943) determined that teachers of small classes knew more about their students as individuals than did teachers of large classes. In the 100 New York City elementary schools used in the study, more individualized instruction took place in small classes of reading and arithmetic than in large classes. [83]

Clarence A. Newell (1954) was the first to examine how the ability of a school to adopt innovative practices was affected by class size. [78] A summary of Newell's findings by Ross and McKenna indicated that:

- Teachers of small classes invent more new practices.
- In small classes new practices invented by others tend to be taken on more readily.

TABLE 12.--General Studies on the Effects of Class Size on Student Achievement

Author and Year of Study	Sample	Findings
Education Turnkey Systems (1975)	compensatory reading programs in 48 Michigan school districts	Class size had no effect on pupil achievement in 25 "unusually successful" or 23 "unusually unsuccessful" programs studied.
Walberg and Rasher (1974)	Selective Service draftees who failed the mental test in 1969 and 1970 in each of the 50 states	High pupil-teacher ratio was one of three educational variables that was significantly associated with high rates of test failure.
Walberg and Rasher (1977)	Selective Service draftees who failed the mental test in 1970 in each of the 50 states	Low pupil-teacher ratio was one of two educational variables that was significantly associated with low rates of test failure.

- *But,* small classes are no guarantee of adaptability. Many other conditions exert an influence, and not the least among these is the quality of the personnel employed.
- *And,* there is no evidence that money for small classes is better than money for better teachers.
- *Therefore,* only when a capable teaching staff has been secured will small classes produce the kinds of results that are expected of small classes. [92:7-8]

However, Ross and McKenna concluded that "there is no doubt that with a given, generally competent staff, *the smaller the classes the greater the chances for inventions and early adoptions of newer and better practices.*" [92:8] (italics in the original)

Using a 62-item checklist of selected teaching practices, Harold Richman (1955) studied the middle elementary grades of certain school districts that had consciously lowered or increased their class sizes. [91] Through observations and interviews he attempted to discover how often differences in class size affected the use of these desirable practices. In deliberately reduced classes, Richman found that desirable practices, e.g., greater understanding of their students as individuals, were increased. For the classes that were deliberately increased the opposite occurred, and "the situation'hardened' as the teachers took refuge in routine procedures to make sure that the children got drill in fundamental skills." [92:9] The following effects on teachers' performance likewise were noted when the teachers were made aware of an administrative change on class size policy:

> 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. Where class size had been increased and the teachers had been informed of the inevitability and imminence of this change, had been asked to give some thought to reducing the negative effects expected, and had been offered help by supervisory and administrative personnel to find ways of easing the methodological adjustment, the loss in good practice

> was not as great as where nothing had been done except to assign more pupils to each teacher. Richman also found that there is probably as much as a three-year lag in teachers' adjusting to the advantages of small classes. [92:9]

Robert C. Whitsitt (1955) observed high school social studies and English classes in 35 school systems. Forty "small" classes contained less than 24 students and 39 "large" classes more than 34 students. In small classes Whitsitt found that teachers used a greater variety of instructional methods than in large classes. Small classes were more group-oriented and more informal than large classes and tended to use other materials besides the regularly assigned textbooks. (Seventy-five percent of the large classes used nothing but the textbook.) Moreover, subject matter was treated in a more detailed, up-to-date, and concrete way in small classes. [147]

Using the scores from the "Growing Edge" (an observation list of desirable educational practices employed by the Metropolitan School Study Council), Bernard McKenna (1955) compared observations taken in a number of elementary and secondary schools. He found that, in small elementary classes, teachers spent a good deal of time noting children's individual interests, recording their achievements, discussing their work with parents, and providing extra supervision for exceptional pupils. Small high school classes exhibited these same types of trends, though to a lesser degree. [69]

Ross and McKenna (1955) offered the following conclusions, based on the above studies and others they reviewed, on the effects of class size on instruction:

1. The research studies of the recent past favor smaller classes over larger classes at the ratio of two to one. Most of the research between 1900 and 1940 used some short-term, immediately-measurable pupil achievement as a criterion. The new studies . . . have tended to use desirable classroom conditions as the criterion. They unanimously favor smaller classes, with some words of caution.
2. Individuals are more apt to get attention in small classes. The strongest and best supported argument for small classes is that they are a guarantee against "educational accidents."
3. Small high school English and social studies classes tend to have more variety in instructional methods used than do large classes in those subjects.
4. Desirable elementary classroom practices tend to be dropped when class size is increased; desirable practices are added when class size is reduced.
5. Educational inventors and early followers are more apt to be found where there is a small-class policy.
6. It is patently indefensible to argue for any arbitrary, common size. Local conditions, purposes, quality desired in education, and the abilities of the teachers must be weighed. The question, "Class size for what end and under what circumstances?" must always be asked.
7. Class size that deviates too markedly from that which might be expected of a system in light of its financial provisions tends to have negative results.
8. Nonclassroom personnel are at least as important as classroom teachers.
9. There is a lag between changing of class size and adjustment of the teacher to the new size.

10. If the teacher is not informed of changes in class-size policy, the results are poorer than if he knows what is going on. [92:22]

Ten years later James B. Pugh, Jr. undertook "an investigation of class size with its specific concern being the kind of teaching and learning procedures that occur in small classes compared to large classes." [87:1] He first reported on a 1962 study conducted by the Metropolitan School Study Council's Associates of the Commission on the 1980 School. "Small" classes of 20 or fewer students and "large" classes of 21 or more in grades K-12 were observed in 111 forty-five minute sessions. Pugh noted that in the following 15 categories, small classes were shown to allow:

1. More individualized instruction to account for individual differences in pupils.
2. More flexibility and more variety of teaching techniques.
3. A more informal and personal atmosphere.
4. Closer relationships between pupils and between pupils and teachers.
5. Pupils to participate more actively in various types of learning activities.
6. Immediate and accurate diagnosis of pupil differences.
7. A greater concern by the teachers for the pupils as individuals.
8. More physical space for the class.
9. The individual, as well as the group, to move at a more rapid pace in all areas of the child's development.
10. A greater concern for the personal development of the pupils.
11. A greater number of parent-teacher contacts.
12. Encourage[ment of] greater responsibility and interest by pupils.
13. Greater opportunity for the social development of the pupils.
14. More opportunity to recognize the talents and interests of pupils.
15. Greater control over the personal safety of the pupils. [87:4-5]

As a result of these findings, the Associates instigated a further study of class size focusing on individualization in teaching. A "Guide for Observation," which included a list of 16 learning activities, was developed "basically to assist the observer in identifying and in recording evidence which would indicate that the teacher feels a responsibility for making certain that each pupil learns." [87:6-7] The Guide was constructed in such a way that observer bias was controlled.

Observations lasted a half hour with two observers assigned to each class. It was advised that the observers visit a large class in the same subject if they first observed a small class in that subject. Twenty visits were made by each observer--half in small classes and half in large classes. Ten observers, who were the Associates of the project and also administrators of participating school districts, made 180 classroom visits in nine school districts in 1963. Ninety observations took place in "small" classes (20 or less) and 90 in "large" classes (30 or more). In both small and large classes, one-third of the observations were made in grades K-3, one-third in grades 4-6, and one-third in grades 7-12. [87:9-10]

The range of pupils in small classes was from 10 to 20, with a median of 18. Large classes ranged from 30 to 43 pupils, with a median of 31. [87:10]

Teachers were aware that the observers were not grading their performance in the classroom; however, they were unaware that the observers were recording information on the degree of individualization of instruction found in their classes.

Pugh listed the ten major findings from the analysis of the observations:

1. A far greater percentage of individual and small group activities is found in small classes than in large classes.
2. A far greater percentage of mass type of instruction is found in large classes than in small classes.
3. Even though there is a high degree of concern for the individual pupil in small classes, a considerable amount of instruction in these classes is mass oriented.
4. Many teachers in both large and small classes depend primarily on four learning activities to develop pupils' concepts--listening, reading, recalling, and observing.
5. The greatest concern for the individual pupil is found at the primary level.
6. In comparing the number of activities in small and large classes, the median occurs in groups of five to nine pupils in small classes. In large classes, however, the median occurs in groups of 10 or more pupils.
7. The chance for arrangements for individualizing instruction in small classes ranges from two in three cases at the primary level to one in two cases at the intermediate and secondary level. In large classes, however, the chance for arrangements for individualizing instruction is only one in three cases.
8. A greater variety of activities takes place within a given period of time in small classes than in large classes.
9. There is a statistically significant difference in favor of small classes in seven of the 16 learning activities. These are: listening, executing manipulative or motor skills, developing or practicing reading skills, outlining, generalizing, analyzing, and creating. There was no significant difference in the other nine activities favoring either small or large classes.
10. From 164 incidents recorded by the observers in the 180 classes, 22 general teaching practices for individualizing instruction emerged. Of the 164 incidents reported, 110 were found in small classes, only 54 in large classes. [87:16]

The NESDEC review on class size, however, criticized Pugh's study for its "absence of operational definitions":

> The 16 learning activities produced by Pugh (1965) to indicate the quality of learning in the classroom seem to require an extraordinary degree of inference on the part of the observer in the classroom. The cognitive processes included in the list are profound and poorly defined in the best of the educational literature. Pugh's guidelines to observers appear exceedingly simplistic compared to the complex behavioral hierarchy constructed by other researchers, e.g., the Bloom et al (1956) taxonomy of behavioral objectives for the cognitive domain. [18:44-45]

The Cleveland More Effective Schools (MES) program (see page 17) provided teachers participating in the experiment with: a pre-service orientation program; additional materials, equipment, and support staff; reduced class size (no more than 25 pupils per class); organization of classes into clusters, with a team of teachers serving each cluster meeting weekly for joint planning; and in-service courses. [115:9] Taylor and Fleming noted that: "Classroom observers found a statistically significant difference in favor of teachers in MES schools in the degree of individual attention given to students." [115:10]

Four later studies published in bulletins of the Institute of Administrative Research and its affiliates at Teachers College, Columbia University have applied the *Indicators of Quality* (IOQ) to measure the instructional effects of class size.

Indicators of Quality were designed to gauge four classroom activities: individualization, interpersonal regard, group activity, and creativity. Trained observers note pupil and teacher behavior, both positive and negative. The instrument itself includes 51 items on a scale ranging from -51 to +51. A mean difference score is calculated by subtracting the negative entries from the positive entries, after which an average is found.

The results of these four studies indicate the superiority of smaller classes in these four areas of activity.

William S. Vincent (1968), in his attempt to find an optimum class size (as described on page 53), found that as class size increases, IOQ scores decrease. The quality of teaching processes drastically declined when class sizes surpassed 15 and 25 at the elementary level and 15 at the secondary level. [136]

Howard Coble (1968) used Vincent's data to further analyze classroom practices in a number of elementary and secondary areas. As shown in Table 13, his findings also showed breakpoints in elementary classes when they exceeded 15 and 25 and in secondary classes when they exceeded 15. [25]

Martin N. Olson (1971) used the IOQ in a total of 18,528 classroom observations in 112 suburban school districts located in 11 metropolitan areas in the United States. Called by its author "in all likelihood...the most extensive survey of American education ever undertaken in one study," [80:64] this report analyzed seven variables that are said to predict school quality: style of educational activity, subject taught, grade level, type of teacher, number of adults, day of the week, and class size. Olson found the following results for two of these variables, style of educational activity and class size:

- At both the elementary and secondary levels, *style of educational activity was the single strongest overall predictor.* As can be seen in Table [14], particularly high scoring styles were *small-group work, individual work, discussion, laboratory work, pupil report,* and *demonstration.* Lowest scoring styles were lecture, question/answer, seat work, tests, and movies. [Note the teachers' heavy reliance on the less effective styles (% column).] School systems could significantly improve their performance scores by increasing the *frequency* or *skill* with which teachers employ the highest scoring styles. [80:64]

- The relationship between *class size* and the criterion scores was well defined and consistent throughout each level of analysis. Any way one tries to slice it, smaller classes produced significantly higher scores than large ones. Table [15] reveals this near-perfect linear relationship for both elementary and secondary classrooms. Special recognition should be given to the critical "breakpoints" between class sizes where sharp drops occur in the performance scores indicated with arrows in the table. With little question, it would be well for school systems to consider altering their class size ratios if close to and on the wrong side of a critical breakpoint, such as 26-1 ratio in elementary or 16-1 in secondary. However, to expend school funds to lower just *any* existing ratio by one or two students seems entirely unjustified in view of this evidence. [80:64-65]

Ernst Auerbacher (1973) described another study by the Institute of Administrative Research in 25,000 classroom observations in 21 states. Auerbacher compared IOQ scores from samples of 66 upstate New York Central School Districts with districts from a representative national sample. Scores in grade level, class

TABLE 13.--Elementary and Secondary School IOQ Mean Scores by Size of Class

Number of Students	Elementary N	Elementary Mean	Secondary N	Secondary Mean
Under 5	14	10.00	16	6.23
5-10	34	10.09	162	8.90
11-15	71	10.04	351	7.66
16-20	376	8.72	566	4.51
21-25	999	8.18	553	4.55
26-30	494	6.89	320	4.51
31-35	69	6.60	74	3.99
36-40	10	9.10	37	5.65
41-50	15	4.70	32	6.13
Over 50	14	2.07	64	4.91
Total Observations	2106		2181	
Mean Difference = Score for Total	7.99		5.41	

SOURCE: Coble, Howard. "Some New Insights on Class Size and Differences in Teacher/Pupil Performance in the Various Subjects," *APSS Know How*, 20 (September 1968). p. 1.

TABLE 14.--Elementary and Secondary Observations Scored by Style of Educational Activity

Style	Elementary N	Elementary %	Elementary Scores	Secondary N	Secondary %	Secondary Scores
Question/answer	1,580	16	3.93	1,547	19	3.69
Discussion	765	8	7.79	923	11	7.63
Lecture	180	2	1.03	813	10	1.09
Small-group work	618	6	11.66	333	4	9.80
Library work	91	1	6.73	34	--	6.68
Individual work	1,357	14	8.76	1,149	14	8.76
Demonstration	318	3	7.12	294	4	5.60
Laboratory Work	115	1	9.01	431	5	8.42
Test	321	3	2.06	599	7	1.16
Movie	126	2	2.93	247	3	1.32
Television	85	1	3.01	13	--	3.96
Other	939	10	4.80	735	9	4.38
Seat work	2,942	30	5.22	941	11	2.17
Rehearsal	79	1	1.65	118	1	4.72
Pupil report	231	2	7.16	166	2	7.50
Total observations	9,961			8,567		
Mean Scores			5.96			4.83

SOURCE: Olson, Martin N. "Ways to Achieve Quality in School Classrooms: Some Definitive Answers," *Phi Delta Kappan*, 53 (September 1971). p. 64.

TABLE 15.--Elementary and Secondary Observations Scored by Class Size

Class Size	Elementary N	Elementary Scores	Secondary N	Secondary Scores
Under 5	155	> 10.61	77	8.31
5-10	218	8.34	505	> 8.45
11-15	310	> 8.34	1,248	> 6.25
16-20	1,395	7.26	2,032	4.77
21-25	3,736	> 6.45	2,427	4.25
26-30	2,898	4.73	1,361	3.93
31-35	931	4.66	361	3.51
36-40	129	3.17	136	4.41
41-50	64	4.38	121	3.65
50+	94	2.22	260	3.22
Total observations	9,961		8,567	
Mean scores		5.96		4.83

SOURCE: Olson, Martin N. "Ways to Achieve Quality in School Classrooms: Some Definitive Answers," *Phi Delta Kappan*, 53 (September 1971). p. 64.

size, style of educational activity, and subject matter area were analyzed. [4]

Tables 16 and 17 indicate that IOQ scores decreased as class size increased at the elementary level in both the national and the Central School samples. An exception appeared in the 41-50 class size interval. Auerbacher explained this by saying: "Class sizes of that magnitude are rare and these situations probably represent the merger of two sections for special presentations or programs." [4:5] In secondary classes from 5 to 30 students the inverse relationship again was evident. However, fluctuations in the data in the very large (31-50 students) and the very small (under five students) categories could not be explained by the administrators of the districts of this study. [4:5]

The results of these studies conducted by the IAR have received criticism. The NESDEC authors believe that "the four criteria proposed by Vincent (1967) as Indicators of Quality manifest a distinctly inherent bias in favor of smaller size groups, where individualization, group activity, and interpersonal regard are more likely to appear by the very nature of the social organization alone." [18:44] They added that:

> This research on the characteristics of classroom activity, traits of teachers, and the like, without validation from objective tests of student achievement or teacher effectiveness, has provoked widespread discontent with such subjective foci. The press for educational accountability is little satisfied with rationalized optimism. Rossi (1971) accuses the research group at Teachers College, presumably the Institute of Administrative Research, of biased research that dismissed achievement testing as the criterion of the goodness of the school system when those tests no longer supported the innovative practices that the group had sponsored (p. 99). Biased or not, a research approach that focuses upon modes of instruction or methods of teaching is essentially a means-oriented perspective on instruction, rather than a goals-oriented approach. There is simply no justification for establishing

TABLE 16.--Population Subgroup Elementary Grade Level Observations Scored by Class Size

Size of Class	National Sample (N=12,533) Relative Frequency	Mean Score	Standard Deviation	Central School Sample (N=2,403) Relative Frequency	Mean Score	Standard Deviation	Total (N=14,936) Relative Frequency	Mean Score	Standard Deviation
Under 5	.01	10.72	6.63	.01	9.08	7.29	.01	10.44	6.78
5-10	.02	8.47	7.91	.02	12.02	7.56	.02	8.99	7.96
11-15	.03	8.03	8.03	.04	6.93	8.54	.03	7.82	8.14
16-20	.11	6.65	8.44	.16	7.58	8.20	.12	6.85	8.40
21-25	.34	6.19	8.35	.42	6.74	8.80	.35	6.29	8.44
26-30	.33	5.33	7.94	.28	7.10	8.43	.32	5.58	8.03
31-35	.12	5.51	8.08	.04	6.64	7.94	.11	5.58	8.08
36-40	.02	4.54	7.59	.01	3.65	7.74	.02	4.46	7.61
41-50	.01	4.52	8.01	.01	6.71	9.31	.01	4.84	8.25
Over 50	.01	2.95	6.15	.01	.13	6.10	.01	2.62	6.21
Total	1.00	5.97	8.17	1.00	7.05	8.55	1.00	6.14	8.25

SOURCE: Auerbacher, Ernst. "Quality Indication in Central School Districts," *Central Ideas*, 23 (May 1973). p. 5.

TABLE 17.--Population Subgroup Secondary Grade Level Observations Scored by Class Size

Size of Class	National Sample (N=9,123) Relative Frequency	Mean Score	Standard Deviation	Central School Sample (N=1,738) Relative Frequency	Mean Score	Standard Deviation	Total (N=10,861) Relative Frequency	Mean Score	Standard Deviation
Under 5	.01	7.80	6.78	.02	8.82	6.61	.01	8.06	6.75
5-10	.06	8.18	7.60	.10	7.97	8.44	.07	8.13	7.81
11-15	.15	6.11	7.94	.21	6.94	8.01	.16	6.28	7.96
16-20	.23	4.57	7.85	.26	5.91	7.83	.24	4.80	7.86
21-25	.27	3.93	7.72	.25	5.14	8.47	.27	4.11	7.84
26-30	.16	3.79	7.05	.10	3.91	6.60	.15	3.80	7.01
31-35	.05	3.50	6.90	.03	6.72	7.30	.04	3.83	7.02
36-40	.02	4.18	6.08	.01	8.44	8.69	.02	4.59	6.50
41-50	.02	3.74	6.11	.01	5.87	8.99	.01	3.95	6.48
Over 50	.03	2.91	5.06	.02	5.02	6.99	.03	3.19	5.40
Total	1.00	4.63	7.62	1.00	6.03	8.05	1.00	4.85	7.71

SOURCE: Auerbacher, Ernst. "Quality Indication in Central School Districts," *Central Ideas*, 23 (May 1973). p. 5.

> particular teaching methods or means as the best indicators of instructional quality. The research upon teaching methods has yet to designate one method or any group of methods that are superior to any other methods in all situations for all levels of students. (Wallen and Travers, 1963). [18:46]

Discussing the Coble and Olson studies, Lawrence McCluskey and Frank L. Smith (1975) wrote that "it is a fallacy to assume that 'class size' by itself governs the 'Indicators' scores that any particular setting will attain." [67:3] The authors did not claim that class size is unimportant; however, they emphasized that:

> 1) [B]ased on the IOQ data, class size, by itself, is not sufficient to explain variation in process quality or criterion scores and 2) since the *Indicators* study was not designed on any experimental basis, any analysis of the data must be *ex post facto;* that is, explanation of variations in the data must be formulated after the data have been collected with full acknowledgement that some of the intervening variables have not been controlled for. The whole question of class size should be related to the organizational context in which it is observed; that is, a single teacher with access to eight specialists and a team of three other teachers is not the same as a single teacher who is also the sole professional engaged in delivering classroom instruction. [67:4]

Although the studies described above have found that smaller classes lead to increased individualization of instruction, other research refutes this.

Henry J. Otto and his associates (1954) sought to discover what differences existed between small and large classes regarding seven educational conditions:

- Teacher load
- Teacher knowledge and evaluation of pupils
- Pupils' participation in selected classroom activities
- Selected techniques used in classroom teaching
- Building facilities
- Instructional aids and their frequency of use
- Scope and organization of the curriculum [81; 17:24-28]

Thirty-four second grade classes, 34 fourth grade classes, and 32 sixth grade classes were studied, with "small" classes defined as those with 25 or fewer students and "large" with 35 or more. A questionnaire, interviews, and observations were used to obtain answers to 500 items relating to the effectiveness of elementary school programs. "The wisest conclusion which the writers can make," Otto stated, "is that in the 50 small and 50 large classes included in this study, the total educational program for children was not discernably different in small classes from that found in large classes." [81:145]

A study by C. E. Danowsky (1965) [33], reported in Dee Schofield's review for the National Association of Elementary School Principals, observed that less than half of the teachers whose classes contained 20 or fewer students made better use of the opportunity to individualize instruction. [97:9]

James Pugh (1965) noted that even if more individualized instruction is found in small classes, "a considerable amount of instruction in these classes is mass oriented." [87:16]

In his analysis of New York City's More Effective Schools (MES) program, David J. Fox (1967) stated that only 45 percent of teachers observed during the study effectively took advantage of the smaller classes provided by the program to individualize instruction. Fifty-five percent of the teachers made ineffective use of smaller classes. [41:88]

Martin Haberman and Richard G. Larson (1968) examined the classroom activities of

disadvantaged children between the ages of six and 12 in an urban school system in southeastern Wisconsin. During a summer term, 517 observations were made in classes ranging from four to 15 pupils, and 389 observations were noted in the fall term (with the same group of students), in classes ranging from 22 to 34. Though the authors admitted that their study lacked complete controls and standardization, they nonetheless contended that a "single activity, with the teacher speaking or monitoring silence, was the dominant theme of both large and small classes." [50:19] They further added:

> Would cutting class size change instruction? We doubt it. Teachers just don't differentiate assignments or instructional activities; their role perceptions are probably not a function of class size at all. If smaller classes are to make a difference in the classroom behaviors of teachers, it may be that they need to be instructed on how to teach a small class in different ways. [50:19] (Copyright 1968, National Association of Elementary School Principals. All rights reserved.)

Russell Yeany, Jr. (1976) investigated the relationship between the average ability level and number of pupils in an elementary science class and the teaching practices used by student teachers. Undergraduate elementary education students in the University of Colorado's preservice education program served as the subjects of the study. The subjects were full-time student teachers in grades three through six. [149:249]

Data were gathered from video tapes of the teaching strategies employed by a random sample of 64 subjects. The tapes were analyzed by two trained observers using the *Teaching Strategies Observation Differential*. Data also were collected by using the *Elementary Science Activities Checklist* to gauge the subjects' usual teaching practices as perceived by the pupils in their elementary science classes. Participating schools provided information on class size and average class ability. [149:249-251]

From the results of his study, Yeany found that the elementary student teachers examined did not adapt their teaching strategies to either their students' ability level or class size. He offered two possible explanations for this finding: (1) Student teachers' inexperience may prevent them from adjusting their behavior to the learning environment and (2) student teachers may not command a large enough variety of different teaching methods to help them adjust to these situations. [149:252]

Writing as the education editor of the *Christian Science Monitor*, Cynthia Parsons (1976) dismissed the importance of class size as the telling factor in pupil learning. [107] "The key," she stated, "is not the number of children per teacher, but the methods a teacher uses to work with the number of pupils in a given class. Teachers accustomed to teaching ten students might find 20 an 'impossibility,' while the teacher accustomed to 30 probably would call 20 'heaven.'" [107] Ways she suggested to improve the classroom process include a "buddy-up" system for children in large classes, teacher aides, and the use of a variety of instructional materials. Parsons concluded by saying that "lowering class size may not prove to be anything but a more costly way of doing the same old teaching." [107]

Is this concern that better instruction automatically follows in classes with fewer pupils per teacher still valid in view of the ways instruction is handled in today's classroom? Smith and McCluskey (1975) commented on this situation:

> The instructional meaning of class size is also operationally quite different [than it was during periods of expanding enrollments]. First of all, one of the key claims for smaller classes is that they make it possible

> for the teacher to get to *know* each pupil, thus enabling him/her to design appropriate personalized or individualized instruction. The meaning of "class size" is different from what it was a few years ago, not because the intentions about better instruction have changed, but, because there have been changes in diagnostic support services through specialized staff, more extensive pupil data systems through computers, more homogenized class groupings through special classes for the handicapped, more self-administered instructional media, and, in fact, a vast development of commercially produced, "easily managed," individualized, instructional packets. In short, one can both "know more quickly" about pupils and also provide differential instruction "more easily." Further, the two are not necessarily even related; that is, with built-in, specific, self-administered, diagnostic exercises in curriculum packages, the teacher is not required to diagnose and then prescribe. He may simply pass out two different seat work assignments, knowing very little about either one. In terms of "better" instructional processes, one can apparently put the desirable processes into operation without directly changing the personnel resources present in a given classroom--namely the number of pupils and the number of teachers. [108:2]

Profile of class size studies on instructional methods.--Table 18 briefly summarizes the research reviewed above on the effects of class size on instruction.

The Effects of Class Size on Student Behavior and Attitudes

As in determining the degree to which class size affects pupil achievement and instructional techniques used in the classroom, there is likewise no consensus on how class size influences student behavior and attitudes. Four studies examined below found no relationship between class size and students' attitudes toward their classes.

In testing the relationships of class size to students' attitudes toward science, William H. Ward, Jr. (1976) analyzed data collected by the Minnesota Research and Evaluation Project in 1972 on high school biology, chemistry, and physics classes from 12 states. One teacher and one of his or her classes randomly were sampled at each participating school. A random third of the students in each class responded to achievement and attitude instruments. Eight variables on class size and emotional, intellectual, and composite attitudes of teachers and students toward science were used in the study. Ward noted that, from the results of his analysis, more positive attitudes toward science were not directly associated with smaller classes. [143]

In their three-year longitudinal analysis of the Cleveland Public Schools' More Effective Schools program, Taylor and Fleming reported that "[t]here was no difference between MES and Control schools in the interest and enthusiasm of the students or in the proportion of students volunteering answers to teacher questions." [115:10] (see page 17)

George Jeffs and Brian Cram (1968) found that, for the 224 high school students they tested, class size did not affect student satisfaction with the learning environment in business law, introductory business, and government classes under examination. [56] (see page 31)

Class size made no impact on a sample of British secondary students' attitudes toward geometrical drawing in Simon Haskell's 1964 study. [52] (see page 32)

Yet other persons feel that class size has a definite influence on how students view the educational process.

Dorothy H. Cohen (1966) explored how dependency relates to class size. Throughout a person's educational life, different needs

TABLE 18.--The Effects of Class Size on Instructional Methods

Author and Year of Study	General Findings
Pertsch (1943)	Teachers knew more about the individual child in smaller classes rather than larger classes. More individualized instruction occurred in these smaller classes.
Newell (1954)	Smaller classes can promote new practices with a capable teaching staff.
Richman (1955)	More desirable practices were found in deliberately reduced classes. Teachers took more advantage of small classes when they were informed of this decision. It may take teachers up to three years to adjust to smaller classes.
Whitsitt (1955)	Small classes used a wider variety of instructional techniques than large classes.
McKenna (1955)	Teachers spent more time with students individually in small classes than in large classes.
Pugh (1965)	More individual and group activity, more variety of instruction, and more concern for the pupil were observed in smaller classes.
Taylor and Fleming (1972)	Teachers in the MES program gave their students a great deal of individualized attention.
Vincent (1968) Coble (1968) Olson (1971) Auerbacher (1973)	IOQ were used to show that smaller classes exhibited more positive scores in individualization, interpersonal regard, group activity, and creativity than large classes.
Otto (1954)	No significant difference was found in the educational program of small or large classes.
Danowsky (1965) Pugh (1965) Fox (1967) Haberman and Larson (1968) Yeany (1976)	Most teachers did not use small classes to individualize instruction.

influence his or her learning process: "emotional-social dependency of the learner on the teacher, cognitive dependency on the teacher, and readiness and ability of the learner to assimilate undiluted verbal presentation of content." [26:17] Since the learner's dependency on adults and on concrete-sensory experiences diminishes greatly from infancy through college, Cohen believes that:

> If, given their stage in the learning process, the dependency needs of the students are legitimately great and if we believe in the democratic principle of equal rights, then class size must be so determined that each individual can receive from the teacher that share of emotional and cognitive attention which is a necessary ingredient of his growth as an independent, fully responsible learner who will in time become his own teacher. If the ability to cope with words is subject

> to developmental limitation as well as to experience, and concrete experience requires more supervision, then class size can limit or expand the opportunity for meaningful learning which is most advantageous to any stage of growth. [26:19] (Reprinted by permission of Dorothy H. Cohen and the Association for Childhood Education International, 3615 Wisconsin Avenue, N.W., Washington, D.C. Copyright © 1966 by the Association.)

Gwendolyn McConkie Cannon (1966) reported the results of her 1955 study at the University of Utah on kindergarten class size. The same instructor taught both a "small" class of 23-28 pupils and a "large" class of 34-39 pupils and used the same program and procedures, in the same room with the same equipment. Cannon made the following observations:

- The large group exhibited more aggressive actions than the small group--"more pushing, bumping, crowding, and striking." The teacher had fewer chances to individually help the children in the large class. [11:10]

- The atmosphere of the small group was described as "more relaxed and permissive"--children made several friends, "felt more secure," "made the adjustment to group living more readily," "were more patient and helpful to one another," "less dependent on one friend," and exhibited "more variety and creativity in [their] play." In the small class the teacher spent more time individually with the children. [11:10-11]

Comments from the teacher's diary kept during the experiment described the large group as "*hard, noisy, chaotic*, with the teacher *exhausted* by the end of the day," while the small group was characterized as "*affectionate, relaxed*, and *productive*; the children were observed to be more *spontaneous, creative*, and *happy*." As a result, teacher satisfaction and positive pupil-to-pupil interaction were much greater in the small group. [11:11]

Herbert J. Walberg's study (1969) of secondary level physics classes indicated that students perceived smaller classes as more intimate and more difficult and less formal and less diverse than larger classes. [138] A replication of this study by Walberg and Gary J. Anderson (1972) showed that "cohesiveness and difficulty were negatively correlated with class size; that is, small classes are perceived as more difficult and more cohesive." [2:277]

In a three-year study of an inner-city elementary school in Chicago (1974), researchers at the University of Illinois Department of Psychiatry found that student behavior can be significantly improved by smaller classes and a stabler teaching staff. They noted that "since inner-city schools often have overworked administrators, a high turnover of teachers and large class sizes, the high level of problem behavior in these schools may be related to these factors more than to the 'disadvantaged' situation of the child." [106]

Sylvia Shapiro (1975) studied the relationship between class size and individualization based on observations of 274 four-year olds in 17 classrooms in half-day nursery schools. Two different kinds of child-teacher contacts were examined: those experienced by the child alone and those experienced as a member of a group. Shapiro found that as pupil-teacher ratio decreased, the number of both types of child-teacher contacts increased. However, when the pupil-teacher ratio fell below 8:1, "a continued drop in child-teacher ratio brought a decrease rather than an increase in the number of contacts a child had." [103:438] She explained this occurrence by saying that:

> When the total number of children in a classroom falls below a certain point--sixteen in this study--there is a significant reduction in the complexity of children's behavior.

> The lowered activity level in the classroom is accompanied by a lessening of demands on the teacher to be active. The result is a lower level of teacher productivity and fewer child-teacher contacts. [103:438] (Copyright © 1975 by the University of Chicago. All rights reserved.)

Furthermore, she found that total class size was also important--when there were more than 20 children in a class, the number of child-teacher contacts did not increase when additional teachers were added. From this she concluded: "It seems that the presence of more adults did not outweigh the disadvantages to the child of always being part of a crowd." [103:438]

Profile of class size studies on student behavior and attitudes.--Table 19 below outlines the effects of class size on student behavior and attitudes.

TABLE 19.--The Effects of Class Size on Student Behavior and Attitudes

Author and Year of the Study	Grade Level	Type of Behavior Analyzed
I. Student Behavior Affected by Class Size		
Shapiro (1975)	nursery school	frequency of child-teacher contacts in classes of different sizes
University of Illinois (1974)	elementary	problem student behavior
Walberg (1969)	high school	students' perceptions toward small and large physics classes
Anderson and Walberg (1972)	high school	students' perceptions toward small and large physics classes
Cannon (1966)	kindergarten	students' interpersonal and group relationships in the classroom
II. Student Behavior Not Affected by Class Size		
Ward (1976)	high school	students' attitudes toward science
Taylor and Fleming (1972)	elementary	student interest and enthusiasm toward school
Jeffs and Cram (1968)	high school	students' satisfaction with the learning environment in the business and government classes studied
Haskell (1964)	high school	students' attitudes toward geometrical drawing

Is There an "Optimum" Class Size?

Writing in the *Encyclopedia of Education*, John E. Reisert (1971) provided a historical account of how the concept of optimum class size has developed in American education:

> When the two primary methods of grouping were the self-contained classroom at the elementary level and departmentalization at the high school level, class size was a widely accepted standard for measuring the quality of a school program. Educators, generally using intuitive and experiential judgment, established a rule-of-thumb ratio of so many students per teacher and measured quality against this standard. Traditionally this ratio was 28 or 30 students to one teacher. A class size at this level or lower was considered good; a larger class size was considered progressively poorer the further it deviated from the established level. The practice became so widespread and accepted that it found its way into the professional literature, the objectives of professional organizations, the financial support formulas of the various states, and even the criteria of the various accrediting agencies. The ratio soon took on the characteristics of a magic number that, in and of itself, would insure quality education. The established ratio provided a goal that communities could measure their schools against, and this, in turn, did lead to smaller class sizes than might have evolved had no such limit been established. The ratio was not based upon research in the area of class size, and, as a matter of fact, empirical studies neither support nor dispute the established ratio. [89:158]
>

Opinion studies have been conducted to find what class sizes teachers believe to be the best for pupil instruction. In 1961 and 1972 the NEA Research Division asked a sample of elementary school teachers: "In your opinion, what is the best size for most elementary school classes for effective teaching?" In both years over half of the teachers gave 20-24 pupils per class as the "best" size; about one third said they could do their best teaching with a class between 25 and 29 pupils. [See Table 20]

In a class size report conducted by the New York State United Teachers in 1974, 3,000 NYSUT members were asked "to indicate what they thought would be a satisfactory class size for the subject or subjects they were currently teaching." [16:9] Table 21 details their responses.

In his research on optimum class size, William S. Vincent (1968) attempted to answer the question: "Is the class size/pupil benefit relationship smooth and linear or is there--as seems more likely--some critical breakpoint, such that change in class size above and below this optimum has little effect?" [136:1] He used *Indicators of Quality* to measure classroom behavior in 4,283 classrooms in 47 school districts comprising the Metropolitan School Study Council. From the results of his investigation, listed in Table 22, Vincent noted certain breakpoints in both elementary and secondary classes.

TABLE 20.--Results of Teacher Opinion Polls Conducted by the NEA Research Division on Optimum Class Size

Number of Pupils per Elementary Class	Should Be		Is	
	1961	1972	1961	1972
Less than 15	0.7%	0.8%	2.4%	2.2%
15-19	11.8%	9.1%	4.5%	5.2%
20-24	53.7%	51.4%	12.7%	20.5%
25-29	31.2%	36.4%	28.4%	36.6%
30 or more	2.6%	2.4%	52.0%	35.5%
Mean	---	22	30	27
Median	---	21	30	27

SOURCE: "Teacher Opinion Poll: Class Size in the Elementary School," *Today's Education*, 62 (April 1973), p. 11.

TABLE 21.--Results of the New York State United Teachers Membership Poll on Optimum Class Size

	Median Class Size	
	Satisfactory Class Size	Actual Average Class Size
I. Elementary Level		
A. Elementary (1-6)		26.3
B. Kindergarten	16.1	23.6
C. Grades 1-3	20.1	
D. Grades 4-6	21.1	
II. Secondary English		
A. English 7		26.6
B. Junior High School English	19.1	
C. English 9		26.1
D. English 11		25.5
E. Senior High School English	20.0	
III. Secondary Social Studies		
A. Our Cultural Heritage (7)		25.4
B. Junior High School Social Studies	21.8	
C. Asian/African Culture Studies		26.0
D. European Culture Studies		26.3
E. American Studies		26.0
F. Senior High School Social Studies	21.8	
IV. Secondary Science		
A. General Science (JHS)		29.1
B. General Science	20.6	
C. Earth Science	20.6	
D. Biology	20.6	26.2
E. Chemistry	21.1	23.8
F. Physics	21.7	21.7
V. Secondary Mathematics		
A. Math 7		26.5
B. Junior High School Math	20.4	
C. Math 9 (Basic)		22.0
D. Math 9 (Algebra)		26.5

TABLE 21 *(Continued)*

	Satisfactory Class Size	Actual Average Class Size
V. Secondary Mathematics *(continued)*		
E. Math 11		24.2
F. Senior High School Math	20.6	
VI. Foreign Language		
A. French I		20.5
B. Spanish I		25.3
C. Level I	19.5	
D. Level II	18.5	
E. Level III	17.5	
F. Level IV-V	18.9	
VII. Other Subjects		
A. Health	22.6	
B. Physical Education	25.5	
C. General Art	19.9	
D. Studio Art	16.0	
E. Vocal Music	21.2	
F. Junior High School Home Economics	14.7	
G. Senior High School Home Economics	15.5	
H. Junior High School Industrial Arts	15.1	
I. Senior High School Industrial Arts	15.7	
J. Vocational/Technical Subjects	17.0	

SOURCE: *Class Size*. Educational Issues Report No. 1. Albany, New York: New York State United Teachers, 1976. pp. 10-13.

TABLE 22.--Mean Difference Score, Elementary and Secondary Grades, by Class Size Intervals

Number of Students in Class	Elementary (Grades 3,4,5,6) Total N 2106		Secondary (Grades 10,11,12) Total N 2181	
	N	Mean Difference Score	N	Mean Difference Score
1-5	14	10.00	16	6.23
6-10	34	10.09	162	8.90
11-15	71	10.04	351	7.66
16-20	376	8.72	566	4.51
21-25	999	8.18	553	4.55
26-30	494	6.89	320	4.51
31-35	69	6.60	74	3.99
36-40	10	9.10	37	5.65
41-50	15	4.70	32	6.13
Over 50	14	2.07	64	4.91

SOURCE: Vincent, William S. "Further Clarification of the Class Size Question," *IAR Research Bulletin*, 9 (November 1968). p. 3.

In elementary classes three distinctions appeared on examination of the data: a "very small" class would contain less than 16 pupils, a "medium small" class from 16 to 25 pupils, and a "large" class more than 25 pupils. In secondary classes two distinctions were noted: a "small" class would contain less than 16 students and a "large" class 16 or more. Vincent believes that "a class size study using some other breakpoint between 'large' and 'small' can only provide...results that are inconsequential.... [T]his may in part explain the generally inconclusive results of the corpus of class size investigations." [136:3]

With the exception of Vincent's analysis and other studies using *Indicators of Quality* to delineate class size "breakpoints," there appears to be no research basis for an "optimum" class size. As noted in the NESDEC survey, a number of arguments against the notion of optimum class size can be found in reviews of the class size literature. [18:33-35]

John I. Goodlad (1960) said that since no correlations between class size and pupil acheivement, attention, discipline, self-reliance, attitudes, and work habits have been discovered in the literature, there can be no optimum class size. [48:224] Howard Holland and Armand Galfo (1964), authors of a Virginia State Department of Education study, concluded that:

> There is not an optimum class size ...the so-called "proper" class size is a function of many factors: course objectives, nature of the subject matter, nature of the teaching process used, teacher understanding and morale--to mention a few of the variables which have been studied and found relevant. [54:19]

The NEA Research Division (1968) also rejected the idea of optimum class size, but maintained that:

> It seems clear that in a small class a good teacher can devote more attention to individual pupils and their particular educational and emotional needs than the same teacher can devote in a substantially larger class. It appears that the teacher, his instructional methods, and his personal outlook are important factors that make a difference as class size varies. If a teacher approaches a small class just as he does a large class, the measurable differences may be negligible. On the other hand, a teacher who is a master of effective techniques in instructing pupils in small classes can be completely frustrated and ineffective when faced with a large class. [17:5]

In a Minneapolis, Minnesota study published by the Educational Research and Development Council of the Twin Cities Metropolitan Area, Dwight H. Lindbloom (1970) concluded that "as yet, no set optimum size of class nor best pupil-teacher ratio has been determined. The optimum class size is no doubt dependent upon a host of considerations, not the least of which is the nature of the learning objective sought." [62:36]

The NESDEC authors, in the epilogue of their review, contend that empirical research has failed to support any figure as the best class size, yet in actual practice "the school system that consistently arranges a class size or pupil/teacher ratio at or below 25:1 is providing learning conditions for students and teachers as favorable as those enjoyed in the vast majority of communities in the United States." [18:57]

Teacher and Public Opinion on Class Size

Opinion polls conducted at the national, regional, and local levels all seem to indicate that both teachers and the public perceive smaller classes as an important yardstick in measuring school quality.

TEACHER OPINION ON CLASS SIZE

Most teachers see smaller classes as a major, if not the most important, vehicle for influencing their students' academic and personal development, as well as their own morale and job satisfaction. In his summary of a 10-year project on teacher morale, Henry Harap (1959) found salary and small classes to be the most important factors affecting high staff morale. [51]

Three thousand members of the New York State United Teachers were asked how important they felt the issue of class size was in 1974 (see page 53). The 1,051 persons responding to the questionnaire indicated an overwhelming support for small classes as a necessity for quality education.

Results of the following national Teacher Opinion Polls conducted by the NEA Research Division consistently indicated teacher concern over class size:

- 1968 poll: 34.7 percent of the teachers responding listed "large class size" as a major problem facing teachers. This issue was ranked second only to "insufficient time for rest or preparation" (checked by 37.6 percent of those teachers surveyed). [64:103]
- 1971 poll: "Large class size" was ranked as the top teacher problem, by 34.7 percent of those responding. [64:103]
- 1974 poll:
  * 8 in 10 of the teachers responding believed small classes were "extremely important" in improving the academic achievement of pupils (2 in 10 considered them "moderately important").
  * 2 in 3 of the teachers responding believed small classes were "extremely important" for the social and personal development of pupils (nearly 1 in 3 considered them "moderately important").

TABLE 23.--Questions and Answers on Class Size from 1974 NYSUT Membership Survey

1. "In regard to the academic achievement of the students, do you think smaller classes make:"

	Number	Percentage
A great deal of difference	965	91.8%
Little difference	79	7.5%
No difference	8	0.3%
No opinion	4	0.4%

2. "In regard to the social and personal development of the students, do you think smaller classes make:"

	Number	Percentage
A great deal of difference	926	88.1%
Little difference	108	10.3%
No difference	11	1.0%
No opinion	6	0.6%

3. "In regard to job satisfaction for the teacher, do you think smaller classes make:"

	Number	Percentage
A great deal of difference	980	93.2%
Little difference	59	5.6%
No difference	11	1.0%
No opinion	1	0.1%

SOURCE: *Class Size.* Educational Issues Report No. 1. Albany, New York: New York State United Teachers, 1976. pp. 8-9.

1974 poll: *(cont.)*

* 3 in 4 of the teachers responding believed small classes were "extremely important" for teacher job satisfaction (2 in 10 considered them "moderately important").
* 49.8 percent of the teachers responding said the classes they were teaching were "too large" or "much too large." 49.4 percent said they were "about right." Less than 1 percent said they were "too small" or "much too small." [116]

• 1975 poll: "Lower class size" headed the list as the one improvement that would lead to better teacher morale, as indicated by 10.9 percent of those teachers responding to the survey. [118]

In 1973 the NEA Research Division prepared a special report, *Problems of City Teachers*, for the National Council of Urban Education Associations. The problem of class size for urban teachers, based on opinion surveys, was mentioned throughout the publication:

- In 1971 "large class size" headed the list of teacher problem areas. 42.9 percent of the respondents indicated it was a "major problem," 32.2 percent listed it as a "minor problem," and 24.9 percent as "not a problem." [86:8]
- In 1972 urban teachers said that their most critical instructional problem was that they work with too many students every day. 11.9 percent of the respondents stated that this was a "critical" problem, 16.0 percent as a "serious" problem, and 28.6 percent as a "moderate" problem. However, 43.5 percent thought crowded classes were a "negligible" problem. [86:9]
- In local surveys conducted in seven large cities from 1970 to 1972, discipline and class size were ranked as the major problems facing teachers in those cities. [86:14]

Class size was listed as the number one issue confronting Los Angeles teachers, according to a 1976 survey conducted by the United Teachers of Los Angeles. [24] Large classes have been a factor in teacher strikes in New York City, Atlanta, Pittsburgh, and elsewhere. Teachers carrying picket signs reading "45 kids per class is no class" express their concern. [121]

Teachers have considered small classes so important that in some localities they have decided personally to help reduce class size. In Nebo, Utah, teachers who failed to negotiate funds from the school board to reduce class size gave the pay raises they received for the employment of more teachers. [85:23]

Teachers in Saginaw, Michigan agreed to take less in salary from the board of education if this extra money would be used to hire more auxiliary elementary teachers in music, art, and other subjects. [85:23]

Teachers in Lodi, California and Denver, Colorado are experimenting with a "weighted formula" approach to class size. To determine class size under this method, a teacher in Lodi groups each pupil in his or her class into one of 15 categories (Denver's plan includes 14 categories), based on the pupil's educational and behavioral background. For example, a "normal functioning" student counts as one pupil under this plan, while a gifted child counts as 1.5 pupils, a child with discipline problems as two pupils, and an emotionally disturbed child as 2.5 pupils. After consideration by a review committee made up of both teachers and administrators, teachers judged as having overcrowded classes are afforded assistance in such forms as teacher aides, half-time substitutes, additional instructional materials, or lay readers. [145]

PUBLIC OPINION ON CLASS SIZE

Many parents and taxpayers are concerned about the quality and cost of education in their community. A study by the New Rochelle (New York) School Study Council and the New Rochelle P.T.A. (1954) showed how important the public perceived class size to be in the past era of expanding enrollments. [71] In summarizing the report, Ross and McKenna said that "communities in general are willing to build new buildings, rent church basements, and even go on half-sessions before departing too markedly from an established class size policy." [92:16]

Gallup Polls of the Public's Attitudes Toward Education conducted from 1972 to 1977 indicate that class size is an important community concern. When a national sample of citizens was asked: "What do you think are the biggest problems with which the *public* schools in this community must deal?" discipline, integration/segregation, and finance were indicated as the top problems. In 1972 "large school, too large classes" ranked fifth. In 1973 and 1974 "size of school, classes" stood sixth; in 1975, fifth; and in 1976 and 1977, eighth. [38:120-121, 152-153; 47:21; 46:228; 44:188; 45:34]

Class size was one of the specific areas surveyed in the Fifth Annual Gallup Poll of the Public's Attitudes Toward Education (1973). The following question was asked:

> In some school districts, the typical class has as many as 35 students; in other districts, only 20. In regard to the achievement or progress of the students, do you think small classes make a great deal of difference, little difference, or no difference at all? [38:159]

As the results in Table 24 indicate, every group in the sample responded that class size is an integral ingredient for pupil achievement.

Methods of reducing school costs were another area surveyed in two Gallup education polls. Seventy-nine percent of those questioned in the 1971 poll and 70 percent of the respondents in the 1976 poll indicated a reluctance to increase class size as a way to reduce expenses. Table 25 details these findings.

It should be noted, however, that in contrast, of the 55 percent of the citizens responding to the Eighth Gallup Poll who indicated a willingness to reduce school expenditures if their schools were to experience declining enrollments, the most frequently suggested way of cutting school costs was that "the number of teachers should be reduced." [44:197]

In a local poll relating to a number of budget-related items, one of which was class size, Tucson School District 1 (Arizona) (1976) surveyed high school students, their parents, and teachers district-wide. From data received from 5,979 respondents, 44 percent of parents indicated agreement with a one pupil per class increase; 52 percent of teachers, on the other hand, favored a reduction of one pupil per class. High school students preferred class size to remain the same or to be increased by one pupil per class. Table 26 presents the question and the results of the Tucson survey.

TABLE 24.--Results of the Fifth Gallup Poll on the Importance of the Effects of Class Size on Pupil Achievement

	National Totals N=1,627	Adults with No Children in Schools 928	Public School Parents 620	Private School Parents 124	Professional Educators 306
A great deal of difference	79%	75%	83%	87%	85%
Little difference	11%	11%	11%	7%	11%
No difference	6%	8%	4%	4%	1%
No opinion	4%	6%	2%	2%	2%
	100%	100%	100%	100%	99%*

(*Due to rounding)

SOURCE: Elam, Stanley (ed.). *The Gallup Polls of Attitudes Toward Education, 1969-1973.* Bloomington, Indiana: Phi Delta Kappa, 1973. p. 159.

TABLE 25.--Reducing School Costs

"With city budgets being squeezed everywhere in the nation, school budgets are being examined critically to see where costs can be cut.

"To see which, if any, reductions meet with public acceptance, a list of eight different ways by which budgets could be cut was presented in this survey. Respondents were asked to give their opinion about each one....

"The question:

> Suppose your local school board were "forced" to cut some things from school costs because there is not enough money. I am going to read you a list of many ways that have been suggested for reducing school costs. Will you tell me, in the case of each one, whether your opinion is favorable or unfavorable.

(national totals)

	1976	1971
1. Reduce the number of administrative personnel		
Favorable	72%	50%
Unfavorable	19%	32%
No opinion	9%	18%
2. Reduce the number of counselors on the staff		
Favorable	52%	32%
Unfavorable	38%	49%
No opinion	10%	19%
3. Reduce the number of subjects offered		
Favorable	39%	30%
Unfavorable	53%	57%
No opinion	8%	13%
4. Cut out the twelfth grade by covering in three years what is now covered in four		
Favorable	36%	29%
Unfavorable	58%	58%
No opinion	6%	13%

TABLE 25 *(Continued)*

5. Cut out after-school activities like bands, clubs, athletics, etc.	1976	1971
Favorable	31%	23%
Unfavorable	63%	68%
No opinion	6%	9%

6. *Reduce the number of teachers by increasing class sizes*	1976	1971
Favorable	23%	11%
Unfavorable	70%	79%
No opinion	7%	10%

7. Cut all teachers' salaries by a set percentage	1976	1971
Favorable	18%	12%
Unfavorable	74%	77%
No opinion	8%	11%

8. Reduce special services such as speech, reading, and hearing therapy	1976	1971
Favorable	10%	10%
Unfavorable	85%	80%
No opinion	5%	10%

SOURCES: Elam, Stanley (ed.). *The Gallup Polls of Attitudes Toward Education, 1969-1973.* Bloomington, Indiana: Phi Delta Kappa, 1973. pp. 85-88.

Gallup, George. "Eighth Annual Gallup Poll of the Public's Attitudes Toward the Public Schools," *Phi Delta Kappan,* 58 (October 1976). pp. 196-197.

TABLE 26.--Class Size Segment of Tucson School District 1 Budget Survey, 1976

Class size in District One now averages one teacher for 25 students at the kindergarten level, one teacher for 29 students at the elementary and junior high level, and one teacher for 28.5 students at the high school level. Adding one student per class at all levels would release approximately $780,000. Such an action would increase average class size, but individual classrooms could be larger or smaller. MARK ONE ANSWER ONLY. The average number of children per classroom should:

	Parents District-Wide	Teachers District-Wide	High School Students District-Wide
Remain the same	27%	26%	43%
Be reduced by not more than 1 student	26%	52%	18%
Be increased by not more than 1 student	44%	17%	34%

SOURCE: "Choices for Our Children: Results of Tucson District 1 School-Community Partnership Council Budget Questionnaire," *TPS News,* 18 (April-May 1976).

The Budgetary Impact of Altering Class Size

Whenever class size is reduced or increased, the school district's budget will be significantly affected. Staff salaries, fringe benefits, building costs, maintenance, clerical assistance, and other costs all must be weighed in the decision. The National Education Association (1965) reported the financial effects of reducing class size in a survey of 618,910 elementary classes in school systems enrolling 3,000 or more students. If all the classes in this sample which contained more than 25 pupils were grouped instead into classes of 25, then 118,629 additional classrooms and teachers would have to be added (a 17 percent increase). In the very large school districts (over 100,000 in enrollment), a 26 percent increase in the number of classrooms and teachers would be needed. [21]

In its research summary on class size, the NEA Research Division (1968) described the budgetary impact of class size reduction in a hypothetical situation:

> Let us assume that in a medium-sized school system enrolling 15,000 pupils, the average class size is 30 pupils and the average teacher's salary is $7,000. A reduction in average class size from 30 to 29 pupils would require 17 additional teachers and a budget increase of $119,000 per year. If classes were reduced from 30 to 25 pupils per class, 100 additional teachers would be required. Teachers' salaries alone would add $700,000 to the annual budget requirements of this system. [17:5]

Furno and Collins (1967) estimated what would have happened a decade ago if a large school system the size of the Baltimore City Public Schools reduced the size of its classes:

> In 1966-67, Baltimore City had over 2800 elementary classrooms in which 30 or more children were enrolled; at the secondary level, almost half of all subject classes had 30 or more pupils. An administrative decision to increase the professional staff to 50 members per 1000 pupils and to reduce class size to 30 pupils would have the following effects:
>
> (1) 940 new educational staff members would have to be employed.
>
> (2) Approximately 19 new elementary schools and 6 new secondary schools would have to be built.
>
> (3) 381 additional classified workers (secretaries, custodians, cafeteria workers, etc.) would have to be employed.
>
> Such developments would subsequently have the following budget implications:
>
> (1) An additional $9,500,000 would be needed each year for current operating expenses.
>
> (2) The school construction budget would have to be increased by $86,000,000. [43:1-2]

In 1976-77, Fairfax County (Virginia) Public Schools estimated that, with an enrollment of 132,365 students, to reduce its pupil-teacher ratio from 25:1 by one pupil per class would

cost $2.8 million for employing 219 additional teachers. [123]

In *Choices for Our Children: A Budget Discussion Guide,* the Montgomery County (Maryland) Public Schools (1968) indicated that the average county-wide elementary and academic secondary class contained 28 pupils. To reduce class size by one-pupil increments at the elementary level would have required:

- 155 additional teachers at a salary cost of $1,220,800 for a class size of 27
- 310 additional teachers at a salary cost of $2,441,600 for a class size of 26
- 465 additional teachers at a salary cost of $3,662,400 for a class size of 25

In other words, to have increased the staff in order to reduce to 28 all classes larger than that would require:

- at the elementary level: 130 additional teachers at an approximate cost of $1,025,000
- at the secondary level: 122 additional teachers at an approximate cost of $961,000. [13:15,23]

If class size were to be *increased* by one pupil per class in the Montgomery County Public Schools in 1977-78 from the 1976-77 average of 27 pupils per class, it is estimated that a savings of nearly $1.75 million would be realized, based on the current salary schedule:

Grade level	Number of teachers no longer needed	Cost savings
Elementary	62.5	$ 729,625
Middle/junior high	45.5	531,167
Senior high	42.1	491,473
TOTAL	150.1	$1,752,265

When fringe benefits and cost-of-living increases are entered into the calculation, the figure exceeds $2 million. [122]

As discussed on page 60, Tucson Public Schools (1976) estimated that an increase of one pupil per class would result in a savings of $780,000. [14]

Albuquerque (New Mexico) Public Schools (1976) published a planning document, *Consequences of Declining Enrollment,* to explore various options available for dealing with reduced enrollments. It was estimated that the following savings in staff salaries and benefits could be realized if the ratio of students to all staff (excluding bus drivers) were increased:

From	To	Approximate savings
14.1:1	14.2:1	$ 300,000
14.1:1	14.3:1	800,000
14.1:1	14.4:1	1,300,000
14.1:1	14.5:1	1,800,000
14.1:1	14.6:1	2,200,000

[30:31]

Class size reductions across an entire state would be extremely costly. In the October 1975 *Phi Delta Kappan,* Fred Heddinger, executive director of the Pennsylvania School Boards Association, explained that "a recent study by our association has shown that statewide reduction in class size by one student per class costs $64 million in personnel costs alone." [55:94]

Some Policy Implications

How does inconclusive research help school officials decide class size policy? Peter Coleman (1971) argued that "research is an appropriate guide to policy when it is cumulative and roughly unidirectional. It is inappropriate as a guide to policy when it is inconsistent and confused." [29:6] The authors of the NESDEC study (1975) advised that:

> In the absence of valid research, it behooves teachers and school officials to react with care on this matter of class size. Teachers who may feel inclined to attribute mediocre pupil achievement to a large class size when that size numbers 30 or less might be well advised to put less faith in that explanation of low achievement and turn their efforts to other variables in the process of instruction. School officials would do well to avoid all legal restrictions with respect to class size since 1) grouping flexibility so necessary to effective instruction could be seriously impeded by numerical limits on class size, and 2) expensive and meaningless adjustment in school staffing could become mandatory or contentious. [18:37]

Ross and McKenna (1955) examined a number of studies that discussed the making of class size policy. [92:13-20] Stuart Binion (1954) found that class size actually has a negative influence when it varies too widely within a given school system. If expenditures are concentrated on securing many teachers to reduce the size of classes, then instructional quality may decrease. If money is spent for hiring and keeping more experienced staff, then the pupil-teacher ratio increases. [6]

Bernard McKenna (1955) urged a balance between the number of staff employed and how they are assigned, since "it would be unwise administration to keep salary schedules low or to raid other parts of the school budget with the sole design of maintaining small classes or high numerical staff adequacy figures." [69; 92:13]

In examining administrative policies on class size, Frank B. Stover (1954) concluded that "class size policy in most school districts is a matter of expediency." [112; 92:14] Local factors, such as the birth rate, finances, and physical facilities, usually decide the policy--not research, outside agencies, or measures taken in other districts. Moreover, he found that as long as administrators tended to keep fairly close to a certain desired point, large variations occurred in actual practice. Six generalizations from Stover's work are noted below:

1. Experimentation on the local level offers promise for discovering the optimum class sizes for various instructional groups. Policy needs to come out of tested situations which have produced the most satisfactory results.

2. Such experimentation should consider overall development of pupils and not merely academic achievement.

3. Professionals should not expect to discover one "magic" number with which to frame useable policy for all situations.

4. A good catalyst for developing policy is a school building program. If a curriculum study designed to lay out objectives accompanies the whole process, so much the better.

5. *Ranges* are more effective determinants than *means* in establishing class-size policy. *Means* present a distorted picture; an acceptable mean may be accompanied by a number of very large and very small classes.

6. Community understanding, participation, and acceptance are prerequisites for any consistent and genuine policy on class size. [92:15]

Although written in 1955 during a time of expanding enrollments, Ross and McKenna had five pieces of "wisdom" for administrators that may apply today:

(1) Don't rob all other items of the budget to reduce class size.

(2) Don't overemphasize uniformity in developing class-size policy.

(3) More imagination and experimentation in school organization and building utilization can relieve the class-size factor of having to absorb the whole impact of enrollment outrunning facilities [or in today's situation, enrollment not filling up the schools].

(4) Give teachers the help they need in adjusting to take advantage of small classes and adjusting to mitigate the undesirable effects should class size increase.

(5) Be aware that class-size policy established today by administrative decision will have its impact on local traditions that may freeze the policy for the future. Whatever your decisions on class size, they will be important ones. Few areas of administrative judgment have such large and so immediate cost and quality implications as do the discrete acts and generalizations that go to make up your system's class-size policy. [92:20]

R. G. Stennett (1973) provided a list of alternatives which could be implemented to lower class size:

1. Increase Manpower
   a) Hire more teachers and/or hire more experienced teachers
   b) Hire teacher aides
   c) Use volunteers
   d) Have capable older students assist in teaching younger ones
   e) Reduce some of the clerical load on teachers by hiring additional secretarial staff and/or employing computers for such tasks as test scoring, report cards, attendance records, etc.
2. Change instructional practices
   a) Use more self-instructional materials
   b) Increase the availability of ETV, resource centers, listening centers, etc.
   c) Use tutorials in certain subject areas with certain classes
   d) Allow independent study for credit in certain subjects for selected senior classes
3. Redistribute Pupils and/or Time
   a) Amalgamate existing small classes into larger ones by transporting children
   b) Have staggered starting times for instruction

4. Redistribute and/or Reallocate Attenuators
   a) Ensure where possible that large classes do not contain disturbed children
   b) Assign more experienced teachers to larger classes
   c) Focus teacher helpers primarily in schools where the classes are large, etc. [111:8-9]

In its study on the effects of class size on the reading and mathematics achievement of first grade pupils, (see page 10) the South Carolina Department of Education (1977) found that when class size was reduced from 26.7 pupils to 19.9 pupils, net reading achievement per pupil increased by 28 percent. But to reduce class size, funds needed for additional teaching positions would have to rise by 35 percent. [58:63-64]

Declining enrollments would appear to present school officials with a "perfect opportunity" to reduce class size. Commenting on this point, Smith and McCluskey stated that:

> [S]uch a reduction would entail maintaining, or even increasing, educational costs during a time of recession inflation. In other words, educators have an unparalleled chance today to decrease class size as student enrollment continues to decline, but they must spend scarce, inflated dollars to do so. On the horns of this dilemma, educators find themselves faced with painful decisions. [108:2]

So the ultimate question remains: "Is the financial-political cost worth the instructional-performance benefit?" [108:2]

Summary and Conclusions

The continuing debate over class size poses hard questions for school policy makers and school administrators today. 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. For more than two decades, the broad question "Do smaller classes result in increased educational quality?" has dominated the debate concerning class size. Frequently the number of studies favoring smaller classes have been counted and compared to the number of studies favoring larger classes, with many costly decisions having been based on the outcome.

This analysis of original research studies and reviews of research on class size and pupil-teacher ratio indicates clearly that the cause and effect relationships pertaining to the class size issue are highly complex and interlocked with many other variables.

The research provides no clearcut guidelines for an "optimum" class size covering all types of students at all grade levels. Students at different levels of personal and academic development require different learning conditions in order for optimum gains in achievement to occur. Therefore, it may be more beneficial for school officials, educators, and others to go beyond the customary generalities regarding class size and address the question of: "Which types of students might benefit the most from smaller classes?"

It is difficult to summarize the results of the array of studies and reviews of research on class size included in this Research Brief. Certainly more careful research is needed to answer conclusively many of the important questions about the effects of class size on pupil learning, on the teaching process, on teacher morale and job satisfaction, and on cost/quality relationships. But more specific data are not available and yet many important decisions regarding class size cannot wait. Thus, we must carefully draw conclusions from the data at hand. The accumulated evidence to date would appear to support the following *tentative* conclusions for consideration when school officials formulate educational policy:

- Research findings on class size to this point document repeatedly that the relationship between pupil achievement and class size is highly complex.
- 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.

- Research to date provides no support for the concept of an "optimum" class size in isolation of other factors. Rather the indicators are that efficient class sizes are a product of many variables including: subject area, nature and number of pupils in the classroom, nature of learning objectives, availability of materials and facilities, instructional methods and procedures used, skills and temperament of the teacher and support staff, and budgetary constraints.
- Existing research findings do not support the contention that smaller classes will of themselves result in greater academic achievement gains for pupils. The evidence is that within the mid-range of about 25 to 34 pupils, class size seems to have little if any decisive impact on the academic achievement of most pupils in most subjects above the primary grades.
- There is research evidence that small classes are important to increased pupil achievement in reading and mathematics in the early primary grades.
- There is also some evidence of a positive relationship between small class size and pupil achievement when primary grade pupils are taught in small classes for two or more consecutive years.
- There is evidence that pupils with lower academic ability tend to benefit more from smaller classes than do pupils with average ability.
- Some research indicates that smaller classes can positively affect the scholastic achievement of economically or socially disadvantaged pupils.
- Research on class size suggests the importance of an emphasis on the methods and quality of instruction in the classroom rather than on the quantity of pupils in the classroom.
- There is considerable and consistent research evidence that certain teaching procedures and practices perceived by some educators as conducive to a productive learning environment (e.g., more individualization, creativity, group activity, and interpersonal regard) occur more frequently in smaller classes than in larger classes. But not enough research has been done to validate the presumed superiority of these activities in terms of pupil achievement.
- Few if any pupil benefits can be expected from reducing class size if teachers continue to use the same instructional methods and procedures in the smaller classes that they used in the larger classes.
- Some studies have found that even when teachers have small classes, many teachers do not take advantage of them to individualize instruction.
- Smaller classes appear to have a positive effect on pupil behavior in the elementary grades. At the secondary school level, some studies, but not others, have indicated that smaller classes influence student perceptions about their courses and their satisfaction with them.
- Researchers who have attempted to measure achievement gains in smaller classes over a relatively short period of time may not have allowed

enough time for the desired changes to occur. Since some researchers have found that smaller classes must bring with them changes in instructional methods and teacher behavior before improved learning can take place, more longitudinal studies are needed to measure the effects of such possible changes over time.

- Opinion polls have consistently indicated that most teachers perceive large classes as a major factor negatively influencing teacher morale and job satisfaction plus the academic performance, personal development, and social development of pupils. 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 to 24 pupils and about one third believed they could do their best teaching with a class containing 25 to 29 pupils.
- Opinion polls show that the majority of the public perceives small classes as being of major importance to pupil achievement and progress.
- Class size is a major determinant of school system budgets. Even small system-wide changes of one or two pupils per class can have major impact on a school system's budget.
- In terms of pupil benefits, research findings fail to justify small overall reductions in class size or pupil-teacher ratio by a school board merely as a matter of general policy without definite pupil-benefit objectives for specific groups of pupils.
- Policy decisions pertaining to class size and pupil-teacher ratio involve factors that are complex, varied, and often emotionally charged. These require the weighing of the possible pupil benefits, the possible teacher benefits, the facilities utilized, the financial costs, and the possible political consequences.

APPENDIX

TABLE A.--Pupil-Teacher Ratio in Enrollment, by State and in Large Cities, Fall 1971 to Fall 1976

State	Fall 1971	Fall 1972[4]	Fall 1973	Fall 1974	Fall 1975	Fall 1976
Alabama	24.3	23.2	22.5	21.6	20.7	[1]20.2
Alaska	20.6	20.6	20.4	21.2	19.5	20.4
Arizona	24.4	23.8	24.4	23.0	21.5	[1]21.4
Arkansas	22.7	22.4	25.0	22.0	21.5	21.1
California	23.1	22.7	22.2	21.8	21.6	[1]21.5
Colorado	23.6	23.1	21.7	20.9	21.3	[1]20.0
Connecticut	19.7	19.5	19.2	18.6	18.3	17.5
Delaware	21.7	21.1	21.2	20.5	20.1	19.6
Florida	23.4	22.8	22.8	22.0	21.3	20.9
Georgia	24.4	24.5	23.9	23.3	23.0	23.6
Hawaii	22.3	21.9	22.7	22.7	22.4	22.1
Idaho	23.1	24.1	22.9	21.9	21.8	21.6
Illinois	21.6	21.3	20.9	20.4	20.0	[1]20.3
Indiana	23.5	[1]23.3	23.2	24.1	23.3	21.9
Iowa	20.1	19.7	19.3	18.9	18.5	18.2
Kansas	20.3	[1]18.7	18.1	17.6	17.5	17.0
Kentucky	23.2	22.7	22.6	22.1	21.6	[1]21.5
Louisiana	22.9	20.2	20.1	20.0	20.6	20.8
Maine	21.6	20.5	21.1	20.9	20.4	18.8
Maryland	22.0	22.1	21.3	20.9	20.8	20.1
Massachusetts	21.8	20.0	18.2	[1]18.0	18.7	NR
Michigan	24.8	24.4	23.2	23.6	23.1	23.1
Minnesota	20.5	21.0	20.6	20.3	19.7	19.2
Mississippi	23.2	22.6	22.1	21.8	21.5	21.1
Missouri	23.3	22.7	21.8	21.1	19.6	19.6
Montana	NR	NR	19.9	19.1	19.0	17.8
Nebraska	20.0	19.4	18.7	18.4	17.8	17.5
Nevada	24.4	24.3	24.3	24.4	24.3	23.7
New Hampshire	22.0	19.6	20.4	18.4	19.9	18.2
New Jersey	19.6	NR	18.7	NR	18.1	[1]17.8
New Mexico	23.2	23.1	22.6	22.3	21.3	22.1
New York	19.5	[1]19.7	19.1	18.2	18.0	[1]18.9
North Carolina	23.8	23.4	22.9	23.0	22.6	22.5
North Dakota	19.3	19.0	18.3	17.6	17.3	17.1

TABLE A *(Continued)*

State	Fall 1971	Fall 1972[4]	Fall 1973	Fall 1974	Fall 1975	Fall 1976
Ohio	24.2	23.4	22.6	22.3	21.7	21.3
Oklahoma	22.7	22.2	21.8	20.6	20.0	19.7
Oregon	21.0	21.2	21.4	21.4	20.1	19.8
Pennsylvania	21.5	21.5	21.0	[1]20.6	19.3	[1]19.2
Rhode Island	20.7	20.0	19.6	19.2	19.2	18.8
South Carolina	25.2	23.1	23.3	22.6	21.9	20.1
South Dakota	20.0	19.7	19.4	18.9	18.7	18.1
Tennessee	24.9	24.6	24.3	22.2	22.0	21.0
Texas	22.5	21.5	21.3	20.8	19.6	[1]19.8
Utah	26.6	25.3	24.7	24.5	26.0	[1]24.3
Vermont	17.1	17.2	17.0	16.9	16.3	[1]16.5
Virginia	22.0	21.5	21.0	20.5	18.9	18.5
Washington	24.0	24.2	24.1	23.4	23.3	[1]23.2
West Virginia	23.4	22.8	22.1	21.3	20.6	20.1
Wisconsin	22.3	20.7	20.4	20.1	18.6	19.1
Wyoming	18.5	18.2	17.6	17.4	16.9	18.2
TOTAL	22.3	21.8	21.4	20.9	20.4	20.2
Large City						
Baltimore, Md.	23.5	24.3	21.8	21.8	21.2	19.3
Boston, Mass.	21.3	19.7	17.8	17.6	20.1	NR
Chicago, Ill.	26.1	23.9	23.3	22.5	22.1	[1]22.7
Cleveland, Ohio	25.9	27.8	27.7	27.0	23.7	23.1
Dallas, Tex.	24.9	24.2	22.6	23.2	23.1	21.2
Detroit, Mich.	28.0	28.0	26.3	27.4	26.4	26.7
Houston, Tex.	25.5	26.1	25.0	24.0	21.0	NR
Indianapolis, Ind.	24.9	23.5	22.6	23.0	23.9	23.3
Los Angeles, Calif.	22.4	22.5	21.5	20.6	20.7	[1]21.0
Memphis, Tenn.	23.7	25.4	23.7	20.1	20.8	21.2
Milwaukee, Wis.	24.7	23.2	22.8	21.6	20.8	20.3
New Orleans, La.	23.6	20.9	20.9	20.1	23.4	21.3
New York, N.Y.	19.5	18.5	18.4	17.7	17.6	[1]21.1
Philadelphia, Pa.	21.2	23.7	22.6	[1]22.5	19.0	18.7
Phoenix, Ariz.	23.2	24.1	22.7	21.5	22.1	[1]22.2
St. Louis, Mo.	24.3	20.7	21.7	23.6	23.4	26.9
San Antonio, Tex.	22.8	24.7	23.5	22.2	20.7	20.6

TABLE A *(Continued)*

Large City	Fall 1971	Fall 1972[4]	Fall 1973	Fall 1974	Fall 1975	Fall 1976
San Diego, Calif.	23.2	22.8	25.6	22.7	22.6	[1]22.3
San Francisco, Calif.	17.7	17.6	18.3	16.3	17.1	[1]16.8
Washington, D.C.	21.8	21.3	20.7	19.0	19.6	20.8

[1]Estimated by reporting state or large city.

[2]Estimated by U.S. Office of Education.

[3]Does not include kindergarten pupils in ADA

[4]Total includes estimates for nonreporting states.

NA Category exists but data not available.

NR No report

SOURCES: U.S. Department of Health, Education, and Welfare, National Center for Education Statistics. *Statistics of Public Elementary and Secondary Day Schools*. Washington, D.C.: U.S. Government Printing Office.

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TABLE B.--Pupil-Teacher Ratio in Average Daily Attendance (ADA), by State and in Large Cities, Fall 1971 to Fall 1976

State	Fall 1971	Fall 1972[4]	Fall 1973[4]	Fall 1974	Fall 1975	Fall 1976
Alabama	22.8	21.7	21.2	20.3	19.5	19.1
Alaska	19.3	19.4	19.4	19.7	18.4	19.2
Arizona	21.9	21.0	21.6	21.8	20.0	19.5
Arkansas	20.5	20.1	22.8	20.2	19.4	19.0
California	22.4	22.2	21.8	21.3	20.9	21.0
Colorado	21.7	21.6	20.2	19.5	19.7	18.5
Connecticut	18.1	18.2	17.8	17.1	16.9	16.4
Delaware	20.1	19.5	19.5	18.6	18.5	18.0
Florida	21.5	21.0	NA	19.9	20.1	19.0
Georgia	22.4	22.6	21.7	21.1	20.9	21.6
Hawaii	20.7	20.4	21.0	20.5	20.7	20.6

TABLE B *(Continued)*

State	Fall 1971	Fall 1972[4]	Fall 1973[4]	Fall 1974	Fall 1975	Fall 1976
Idaho	22.0	23.0	21.4	20.3	20.4	20.4
Illinois	19.2	19.1	18.7	17.9	17.9	17.7
Indiana	21.3	21.0	20.9	21.6	20.5	20.3
Iowa	19.2	18.9	18.3	17.6	17.0	16.2
Kansas	18.5	17.8	16.9	15.8	16.3	16.2
Kentucky	21.5	21.1	20.8	20.4	20.1	19.7
Louisiana	21.1	19.1	18.4	18.0	18.5	18.8
Maine	20.3	19.0	19.9	18.9	18.5	17.0
Maryland	20.2	20.0	19.3	18.5	18.7	18.1
Massachusetts	20.6	18.4	17.6	15.9	NA	NR
Michigan	22.9	22.4	21.4	21.2	21.9	21.8
Minnesota	19.8	20.3	19.9	19.6	18.9	18.0
Mississippi	21.6	21.1	20.7	20.2	20.1	19.9
Missouri	20.9	20.2	19.4	18.5	17.6	17.5
Montana	NR	NR	18.6	17.7	18.0	16.2
Nebraska	19.0	13.5	17.7	17.2	16.6	16.5
Nevada	22.7	22.4	22.4	22.4	22.1	21.6
New Hampshire	20.3	18.1	18.9	17.0	18.4	16.8
New Jersey	18.3	NR	17.4	NR	16.3	16.1
New Mexico	21.9	21.7	[3]21.0	21.3	20.3	21.0
New York	17.6	17.6	17.2	16.1	16.1	16.8
North Carolina	22.1	21.6	20.8	21.7	21.2	20.7
North Dakota	18.5	18.3	17.6	16.9	16.7	16.4
Ohio	22.2	21.6	20.7	20.3	19.8	19.6
Oklahoma	20.5	19.9	20.2	19.1	18.6	18.4
Oregon	19.3	19.7	20.1	19.6	17.9	17.8
Pennsylvania	20.0	20.0	19.7	19.2	17.7	17.8
Rhode Island	19.1	19.0	17.7	18.0	17.3	17.9
South Carolina	23.0	21.5	21.4	20.4	20.5	18.3
South Dakota	18.9	18.8	18.5	18.0	17.8	17.1
Tennessee	23.6	23.3	23.6	21.0	20.8	20.7
Texas	20.0	19.8	19.3	18.8	17.7	18.0
Utah	25.0	23.8	23.3	22.9	24.4	22.7
Vermont	16.3	16.3	16.1	16.1	15.5	15.9
Virginia	20.6	20.1	19.4	19.0	17.3	17.0
Washington	22.4	22.4	22.2	21.8	21.6	21.5
West Virginia	21.5	21.5	20.6	19.6	18.8	18.1

TABLE B *(Continued)*

State	Fall 1971	Fall 1972[4]	Fall 1973[4]	Fall 1974	Fall 1975	Fall 1976
Wisconsin	19.9	18.7	18.6	18.7	16.6	17.1
Wyoming	17.7	17.2	16.4	16.5	15.1	16.6
TOTAL	20.6	20.2	19.8	19.2	18.8	18.6
Large City						
Baltimore, Md.	20.1	20.9	18.8	16.7	17.5	16.1
Boston, Mass.	20.8	17.0	16.0	16.3	NA	NR
Chicago, Ill.	22.0	20.1	19.7	18.7	18.6	19.0
Cleveland, Ohio	23.7	25.6	24.9	22.7	20.3	20.2
Dallas, Tex.	23.4	22.7	19.8	19.7	20.1	19.0
Detroit, Mich.	25.8	25.6	24.6	26.6	24.9	25.2
Houston, Tex.	22.9	23.3	22.4	21.9	19.2	NR
Indianapolis, Ind.	22.6	20.2	20.1	20.0	20.4	20.5
Los Angeles, Calif.	21.8	22.4	21.3	19.9	19.9	20.6
Memphis, Tenn.	22.8	24.1	22.0	19.1	19.7	19.7
Milwaukee, Wis.	22.0	20.4	19.6	19.1	17.1	16.9
New Orleans, La.	20.7	18.5	17.8	17.9	19.2	18.6
New York, N.Y.	15.8	15.5	15.0	14.3	14.4	17.1
Philadelphia, Pa.	17.1	20.4	20.1	19.4	15.9	16.2
Phoenix, Ariz.	21.2	22.1	21.7	20.5	20.6	20.2
St. Louis, Mo.	23.9	19.0	18.4	19.1	20.3	22.4
San Antonio, Tex.	21.1	21.9	21.6	19.9	18.9	18.4
San Diego, Calif.	22.8	22.7	25.2	22.1	22.1	22.0
San Francisco, Calif.	16.9	16.5	17.7	16.3	16.4	15.8
Washington, D.C.	[2]20.1	19.3	18.7	17.1	17.6	18.8

[1]Estimated by reporting state or large city

[2]Estimated by U.S. Office of Education

[3]Does not include kindergarten pupils in ADA

[4]Total includes estimates for nonreporting states

NA Category exists but data not available.

NR No report

SOURCES: U.S. Department of Health, Education, and Welfare, National Center for Education Statistics. *Statistics of Public Elementary and Secondary Day Schools*. Washington, D.C.: U.S. Government Printing Office.

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Where possible, addresses and prices are given to expedite the ordering of desired materials. Documents for which ERIC Document (ED) numbers are given can be ordered from the ERIC Document Reproduction Service, Computer Microfilm International Corporation, P.O. Box 190, Arlington, Virginia 22210. The price schedule for documents is as follows: *Hard Copy:* 1-25 pages, $1.67; 26-50 pages, $2.06; 51-75 pages, $3.50; 76-100 pages, $4.67. (Add $1.34 for each additional 25-page increment or fraction thereof.) *Microfiche:* 1-5 fiche, 83¢; 6 fiche, $1.00; 7 fiche, $1.16; 8 fiche, $1.33. (Add 17¢ for each additional fiche.)

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