

## **Appendix B.**

### **Review of Literature**

To date, there have been inconclusive and conflicting findings relative to research on class size. Some studies have supported smaller class size while others have not. Reviewers have found the literature complex and incomprehensible. Some reviewers have become pessimistic about the value of smaller classes. Previous reviews have described the limitations of past studies of class size and explained how research in the area depicted the problem as interactive -- a function of student characteristics, teacher characteristics and quality of teaching, subject matter taught, etc. (Cahen et al., 1979).

A 1975 Teacher Opinion Poll conducted by the National Education Association indicated that lowering class size was named by more teachers than any other item as the one improvement that would create better teacher morale and job satisfaction. It is the opinion of teachers that smaller classes mean that student attitudes toward learning and motivation are more positive resulting in higher academic achievement (Hallinan, et al., 1985).

In addition Filby et al., (1980) found that teacher attitudes in smaller classes were those of being able to get to a child and help him/her when he/she needed help; in larger classes the teachers felt that they could not get there to help. These teachers stated that their work load was heavy, with large class assignments. Such overloading decreased as smaller classes became a reality, and as a result, the teachers were able to relax more, feel less frustrated, and were able to create a more positive climate which discouraged disruptions within the classroom (Filby et al., 1980).

In this same study by Filby et al. (1980), there was a conclusion that class size reductions do not alone necessarily bring about change. However, teachers experience a relief, and this relief brings about greater enthusiasm on the part of the teacher. Such enthusiasm can lead to changes which benefit everyone. Teachers usually do what they are inclined to do anyway; however, smaller classes allow them to do a better job (Filby et al., 1980).

Empirical research has not produced consistent results regarding the relationship between class size and student achievement in spite of the amount of research that has addressed this question. In 1978 the Educational Research Services published a review of 41 studies of the effects of class size on achievement, concluding that reducing class size alone would not increase student achievement. In classes of 25-34 students at the primary level, the studies show some support for the hypothesis that smaller classes are related to higher achievement in reading and mathematics, particularly if the students are socially or economically disadvantaged or remain in small classes for at least two years (ERS, 1978).

Robinson and Wittebols suggest a Related Cluster Analysis approach designed to: (1) identify and summarize all of the research studies available on the effects of class size, and (2) group the research findings into clusters related to each of several major areas in which problems, issues, and decisions relating to class size are likely to occur. The advantages of this approach, according to Robinson and Wittebols, are that it sorts out from the large body of research findings on class size those findings that relate directly to specific areas and it makes the research understandable and useful for application to specific decisions. It differs from the Smith and Glass Meta-Analysis in that Meta-Analysis removes decision makers from familiarity with the research by giving them only broad generalizations (Robinson et al., 1986).

Class size is among the most thoroughly researched topics in public education. Over 250 separate studies dealt with class size by 1950. Since that time related research has increased proportionately. Often cited as the beginning of the most recent era of class size research, Howard V. Blake's 1954 inquiry analyzed the literature 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. Of these 85 studies, 35 indicated that small classes were better, 18 indicated that large classes were better, and 32 did not support either conclusion. In further analyzing these studies, Blake established criteria to test their scientific acceptability: scientific control adequacy of sample, adequacy of measurement of the independent variable, adequacy of criterion variable measurement, rigorousness of data examined and appropriateness of the conclusions. Only 22 of the 85 previously acceptable studies met these minimum requirements. Of these, 16 favored small classes, 3 favored large classes, and 3 were inconclusive (Robinson et al., 1986).

The first meta-analysis by Glass, Cahen, and Smith (1978) dealt with the impact of class size on student achievement. By combining 77 studies which yielded 725 comparisons of achievement in classes of different sizes, they were able to spot trends that did not show up clearly in every study. Glass, Cahen, and Smith (1978) summarized their findings in these words:

As class size increases, achievement decreases. A pupil who would score at about the 63rd percentile on a national test when taught individually, would score at about the 37th percentile (when taught) in a class of 40 pupils. The difference in being taught in a class of 20 versus a class of 40 is an advantage of ten percentile ranks.

An important outcome of the Glass/Smith meta-analysis was the finding that the greatest gains in achievement occurred among students who were taught in classes of 15 students or less. Prior to Glass/Smith, several studies were conducted relative to class size and student achievement.

A follow-up study by the Far West Laboratory for Educational Research and Development using "meta-analysis" was published in 1979. Non-achievement effects on class size such as effects on students, effects on teachers, and effects on the instructional environment and processes were investigated. The results indicated that decreasing class size had a beneficial effect on the classroom environment. In the review, class size was shown to have a more "substantial effect" on teachers than on students or the instructional environment. The effect of class size was more significant for students below the age of twelve (Smith et al., 1979).

In trying to assess the effects of class size on 76 third-grade classes in Iowa cities with a population of 5,000 or more, Herbert F. Spitzer studied data 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 students and a "large" class as one containing 30 or more. Spitzer concluded that class size was not a factor in achievement (Spitzer, 1954).

Orlando F. Furno and George J. Collins conducted a five-year longitudinal study on the effect of class size on the reading and arithmetic achievement of a cohort group of 16,449 Baltimore City Public School students who were tested at the end of grade 3 in Spring 1960. Class size ranges

of 1-25, 26-31, 32-37, and 38 or more were established for analysis. Their research was cross-classified by student IQ score, occupation of the mother, whether the student was enrolled in the regular curriculum or the 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 non-white faculty in schools attended by each child
- \*Baltimore teachers examination score
- \*teachers' years of experience

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 to 1 in the regular curriculum and 12.7 to 1 in the special education curriculum. The smaller classes (1-25) were favored 7.3 to 1 over the larger (26 or more) in 192 comparisons; in 96 comparisons involving non-white students, the ratio increased 21.3 to 1 (Furno et al., 1967).

The Cleveland, Ohio Public Schools conducted a three-year longitudinal study in two elementary buildings. The "More Effective Schools Program" was designed to improve achievement of disadvantaged inner-city students by "reorganizing organizational and instructional patterns across grade levels." Ultimately, "individualization of instruction" was to be increased by reducing class size to no greater than twenty-five, increasing instructional staff, equipment and materials, in-service training, and parent involvement. Forty-eight percent of the teachers surveyed through a questionnaire felt the most valuable aspect of the program was small class size. For the first two years of the study, the students in the two target schools demonstrated higher achievement than the control students. In the third year, overall achievement gains were not as great (Taylor et al., 1972).

Irving H. Balow conducted a three-year longitudinal study concerned with the effects of class size on reading achievement in the Riverside, California School District. The sample of children remained constant from grades 1-4. The experimental group was comprised of 656 children, and the control group 602 children. "Small" classes were limited to 15 children and "large" classes contained 30 children. Results were obtained from scores on the Metropolitan Readiness Tests (grade 1), California Short Form Test of Mental Maturity (grade 2), Metropolitan Achievement Test (grades 2-3), and School and College Aptitude Test (grade 4). Balow found that class size influenced achievement rates when students were in small classes for two or more consecutive years. He determined that small classes were crucial to reading achievement in first grade but by third grade, class size was not the determining factor in achievement (Ballow, 1969).

Lynne M. Johnson and her associates at the South Carolina Department of Education (1978) conducted a pilot program whose purpose was to explore:

- \*the effect of class size on the reading and mathematics achievement of first grade students
- \*the effect of teacher in-service training on the reading and mathematics achievement of first grade students
- \*the effect of the interaction of class size and teacher in-service training on the reading and mathematics achievement of first-grade students

Fifty project classes in 23 of the state's 92 public school districts formed the basis for the data analysis. There were 25 pairs of classes matched on the student body's racial composition, socioeconomic status, and the school curriculum. The experimental classes averaged 19.9 students while the control classes averaged 26.7 students. Results of the study indicated that smaller classes significantly affected the reading and overall achievement of the first grades sampled while the differences in the mathematics achievement was so small that they might have resulted from chance alone (Johnson et al., 1978).

Wagner tested reading achievement for second graders in two schools in three large classes of more than 25 and five small classes of 15 or less. The one-year study used the Metropolitan Achievement Test and Spache Diagnostic Reading Scales to measure achievement. The smaller classes scored significantly higher in all areas of reading skills. Students in smaller classes also scored about five months higher in global reading skills and eight months higher in oral reading comprehension and word identification (Wagner, 1981).

Educational Research Service published findings in 1980 on the effects of class size on student achievement. In these findings, increases in percentile rank achievement was in direct proportion to class size reductions. For example, in a class of forty the average percentile rank was approximately forty-five, in a class of thirty there was an upward trend tendency to fifty, in a class of twenty the percentile was approximately sixty, and classes of less than twenty showed even more dramatic increases (ERS, 1980).

Cahen Filby, McCutcheon, and Kyle did a case study of the early primary grades involving quantitative measures and qualitative observation of the mid-year reduction of classes in the second grade in a rural Virginia and an urban California school. The Virginia classes were reduced from 19 to 13 students and the California classes from 35 to 22 students. The achievement tests from the Beginning Teacher Evaluation Study were used with the results that a large percentage of students in the reduced classes scored higher on the post-testing than had been predicted by the pre-testing. In addition, the classes in the Virginia school advanced further through their textbooks than was "usual" for the years prior to the study (Cahen et al., 1983).

Sindelar et al. found that small group size tends to improve achievement of students because there is maximization of those variables which relate to achievement. One of these variables is what Fisher calls "substantive teacher interacting," and is defined as "presentation of information on academic content, monitoring of work, and feedback about performance." It is suggested that this interaction encourages student "engaged time" and such time is related to the achievement of students. The smaller the class size, the greater the opportunity for "substantive teacher interaction." (Sindelar et al., 1984)

A statewide reduction of classes in grades K-3 was the result of pilot data from the Indiana State Department of Education (1983). The 1981-83 study compared reading and mathematics achievement of 24 K-3 classes at a ratio of 14:1 to K-3 classes averaging 23 students. Standardized reading and math test scores showed that students in the "small" classes exceeded normal growth in greater numbers than comparable students in the "large" classes. Generally, 14 percent more students in smaller classes exceeded the expected achievement than students in larger classes. Teachers also saw improvements in the behavior of students, increased productivity, and more hands-on participatory learning (ISDPI, 1983).

Filby et al. found that the attention rates for students increased as class size decreased. The range of those paying attention was from 56 percent in large classes to 72 percent in the smaller classes. Increased attention span meant less time waiting for help or causing disturbances in the classroom (Filby et al., 1980).

The Better Schools Program was initiated in Tennessee on July 1, 1984 by Governor Lamar Alexander. One component of this program was the Tennessee State University Center for Excellence in the Teaching of Basic Skills to Economically and Educationally Disadvantaged Students. Edward H. Whittington (1984) studied the effects of class size (1:15) on the teaching/learning process in grade one. The experimental group consisted of 105 first grade students divided into seven classes of 15 students each. The control group consisted of 90 students divided among three and one-half teachers with a class size of 25 students each. The blind control group was comprised of 105 students drawn from 35 elementary schools, matched with the experimental group demographically according to five pre-established criteria: (a) sex, (b) race, (c) economic status, (d) date of birth within 45 days, and (e) total pre-reading raw score within four point on the California Achievement Test Level 10. The statistical analysis of pre- and post-test results indicated that the experimental group consistently achieved better results than either control group. The only intervening variable was the reduction of class size from 1:25 to 1:15. Therefore, it was concluded that reducing class size to 1:15 has a positive effect on student reading and math outcomes (Whittington, 1985).

The second year results (1986) of the study in Nashville, Tennessee yielded different results. Ben D. Dennis studied the effects of small class size (1:15) on the teaching/ learning process in grade two. Dennis reported no difference between the groups (experimental, control, and blind) on learning achievement. He cites several possible reasons for this finding, among them:

- (1) Anxiety and pressure among teachers statewide because of the use of a new achievement test (Stanford Primary II)
- (2) Anxiety and pressure among the experimental group students because of the use of a new achievement test
- (3) Different test administration procedures from school to school . . .
- (4) First grade students possibly achieving more in small classes than second grade students (Dennis, 1986).

An earlier study (1964) in New York City had similar results to Dennis. The More Effective Schools (MES) program, originating in 10 elementary schools in 1964 and enlarged to 11 more schools the following year, sought to improve educational quality by focusing on integration, heterogeneous grouping, team teaching, and community-school relations. Class size did not exceed 22 students. The report of this program states 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." (Fox, 1967)

The results of the San Francisco South East Education Development Project (1970) were that class size did not significantly relate to the monthly reading achievement rates of disadvantaged, primarily black, first grade classes (Counelis, 1970).

Little and others (1971) investigated the reading achievement of eight-year-olds in the Inner London Education Authority. Small but significant differences were seen in reading between classes of 40 or more and classes of 30 or less, favoring the larger classes. This relationship was constant, even when school racial or immigration status and social class were controlled. The factor that revealed the largest reading gap was the absence or presence of a "stimulating" home environment (Little et al., 1971).

Murnane (1975) reported that class size had no influence on achievement in either reading or mathematics in a study involving 875 inner-city black children in grades 2 and 3. All students in

the study were in classes of less than 28 and the researcher believed that the insufficient variation in class sizes may account for this finding. Murnane noted, however, that although arguments against class size reduction often stress 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 student's future achievement may be positively affected by having a "superior, experienced" teacher (Murnane, 1975).

Teacher morale is often perceived to be more positive as class size decreases. The Virginia Beach Class-Load Relief Model was designed to provide reliable data about program impact upon student achievement and attitude and teacher morale. Using a weighted factor, a true teacher load was determined by analyzing the composition of a class according to categories devised by a Class Size Committee. A class of 25, for example, could have a load factor of 40 or even higher, depending upon the nature and concentration of instructional problems identified by the teacher.

The experimental groups consisted of 137 fourth grade students and 64 eighth graders and the control group was comprised of 136 fourth grade students and 42 eighth graders. The results of this study were that attitudes of the experimental teachers and students were basically the same even though the elementary and secondary experimental teachers perceived that their morale was more positive. For student achievement, the program did not appear to have increased student performance. Elementary students, who did or did not participate in the program, appeared to achieve at an equal rate. Secondary students who participated in the program were achieving at or below secondary students who had not been in the program (Carrington et al., 1982).

Research has begun to focus upon what actually happens in smaller classes as opposed to larger ones. The Ministry of Education in Ontario, Canada, was concerned with this question in a two-year study. Students from the fourth grade were assigned, in the first year, to some thirty-four different classes--some with sixteen students, some with twenty-three, some with thirty, and some with thirty-seven. During the second year they were all reassigned to different sized classes. This allowed the researchers to study the same students and the same teachers in different settings and to observe changes in classroom processes. The overall findings indicated that even though class size did not change the degree of individualized instruction, the teacher did spend up to twice as much time per student in the reduced size classes (Klein, 1985).

Over the years findings from class size research have drawn contradictory conclusions about the positive effects of reduced class size on student achievement. In fact, there has been major controversy over these findings. Notably, the attack on the Glass and Smith meta-analysis results by Robinson and Wittebols. Robinson and Wittebols objected that the Glass and Smith findings, which showed a positive relationship between reduced class size and student achievement, were not reliable because the meta-analysis had included college classrooms and individual tutoring arrangements. However, when Robinson and Wittebols did a cluster analysis by grade level they concluded that smaller classes were beneficial in the early primary grades.

The most recent comprehensive review, meticulously conducted by the California Educational Research Cooperative, has concluded:

For all student populations, class size research, while difficult to synthesize offers convincing evidence of an important link between lowered student/teacher ratios and higher achievement (Mitchell, et al., 1989).

Findings from the current major well-designed class size studies, seem to have influenced policy makers toward the institution of reduced class size. Ernest L. Boyer, president of the Carnegie Foundation for the Advancement of Teaching, has laid out a four-point plan to ensure that all children are educated to their full potential, which includes reducing classes to "no more than 15 students per teacher" for the early elementary grades. In addition, the National Association of Elementary School Principals (NAESP) Delegate Assembly has revised their class size policy statement from 20 to 1 down to recommending a student-teacher ratio of 15 to 1.\*

The Review of Literature was compiled by Jayne Zaharias from the doctoral works of Ben Dennis, Jane Eldridge, Roseanne Jacobs, and Mary Parks.