

IS THERE A RELATIONSHIP BETWEEN  
CLASS SIZE AND STUDENT ACHIEVEMENT?

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## **Abstract**

This paper takes a look at several different class size reduction studies and their findings. The first study is Project STAR (Student-Teacher Achievement Ratio) which took place in Tennessee beginning in 1985. The Lasting Benefits Study (1989) and Project Challenge (1989) were continuation studies of Project STAR. Project Prime Time took place in Indiana during the 1984-85 school year. It was a state-supported program to reduce class size in kindergarten through third-grade classes. The Farmingham Heart Disease Epidemiology Study (1948) and the Follow-up Study links education issues from Project STAR and health issues together. Student Achievement Guarantee in Education (SAGE) was Wisconsin's initiative to reduce student-teacher ratios for low-income students in kindergarten through third grades to 15:1. California's Class-Size Reduction (CSR) Program committed more than \$1 billion a year to provide a powerful incentive for school districts to reduce the number of students in kindergarten through third grade classes. The Glass and Smith Study, which took place in 1978 and 1979, presented the results of statistical integration of class-size and student achievement research. Nevada's Class Size Reduction Act was designed to reduce the pupil-teacher ratio in several steps. It is concluded from these studies that students as well as teachers do benefit from smaller class sizes in primary grades. However, for a class-size reduction program to be successful other factors besides just lowering the number of students in a classroom also need to be implemented into the program. Among the factors that appear to contribute to the success of class size reduction programs were ones such as teacher preparation, curriculum and early childhood education.

## **Introduction**

One of the most frequently discussed school reform topics today is the reduction of class sizes. Teachers and parents are firm believers that students who are in smaller classes have higher achievement levels. It is intuitively obvious that students would be expected to do better in a class where 30 to 35 of them are not vying for the attention or direction of one teacher.

Does class size affect student achievement? Research does show that lowering class size in the early grades will produce significant and lasting benefits for students.

This conclusion tends to be suggested by the following studies:

- Project STAR (Student-Teacher Achievement Ratio), Tennessee, 1985
- The Lasting Benefits Study, Tennessee, 1989
- Project Challenge, Tennessee, 1989
- Project Prime Time, Indiana, 1984
- Framingham Heart Disease Epidemiology Study, Massachusetts, 1948
- Framingham Heart Disease Follow-up Study
- SAGE (Student Achievement Guarantee in Education) Study, Wisconsin, 1996
- CRC (California Research Consortium) Study
- The Glass and Smith Study which identifies 77 studies containing 725 different comparisons
- Nevada's Class Size Reduction Act, 1989
- Harold Wenglinsky's Smaller Class Size Research Studies
- Results of Four-State Study: Smaller Schools, Georgia, Montana, Ohio and Texas
- Smaller studies on class size research

The research shows that there is a substantial relationship between class size and student achievement.

### **The Glass and Smith Study**

In 1978 and 1979, Glass and Smith (1980) of the University of Colorado, Boulder presented the results of statistical integration of the research. They drew from 80 studies on the relationship between class size and achievement demonstrating what they felt was a substantial relationship between the two. Glass and Smith used the “meta-analysis” technique that involved all existing statistical data. They obtained 300 reports, publications and theses to use in their study. The data set was based on nearly 900,000 students and lasted over a half a century (Cahen & Filbey, 1979).

According to Glass and Smith (1980) the studies that employed rigorous control, yielded results that “. . . showed that the difference in being taught in a class of 20 versus a class of 40 is an advantage of 10 percentile ranks.” The study found that the curve starts to rise dramatically when class size is reduced to below 15 pupils. The average pupil in class sizes of 40, 20, 15, 10 and 5 would be expected to score at the 50<sup>th</sup>, 58<sup>th</sup>, 65<sup>th</sup> and 75<sup>th</sup> percentile. Karen Klein (1985) interprets this by saying that the greatest gain in achievement occurred among students who were taught in classes of 15 pupils or less.

### **Project STAR**

Tennessee also conducted research beginning in 1985 (Achilles and others, 1996) into the question of whether class size had an effect on student achievement. Project STAR (Student/Teacher Achievement Ratio) analyzed student achievement and development in three types of classes: small classes (13-17 students per teacher), regular classes (22-25 students per teacher), and regular classes (22-25 students) with a teacher

and a full-time teacher aide. Project STAR followed students from kindergarten in 1985-86 through third grade in 1988-89. The project included 17 inner-city schools, 16 suburban schools, 8 urban schools, and 39 rural schools. Students and teachers were randomly assigned to class types.

Two main rules guided STAR (Achilles, 1996):

- 1) students should not in any way be penalized by being in STAR and
- 2) researchers touched nothing except class size and random assignment.

All analyses were conservative. Researchers recognized the influence of teachers and classmates on a pupil's scores and used the class average as the unit of analysis because this was a study of class size (Achilles and others, 1996).

The focus of the study was on student achievement as measured by the Stanford Achievement Test (K-3), STAR's Basic Skills First Criterion Tests (grades 1-2), and Tennessee's Basic Skills Criterion Tests (grade 3). The study's most important finding was that students in the small classes made significantly higher scores both statistically and educationally on the Stanford Achievement Test and on the Basic Skills First Test in all four years (K-3) and in all rural, suburban, urban and inner-city schools. Other relevant findings included (Pate-Bain and others, 1992, p254):

- The greatest gains on the Stanford were made in inner-city small classes.
- The highest scores on the Stanford and Basic Skills first were made in rural small classes.
- The only consistent positive effect in regular classes with a full-time aide occurred in first grade.
- Teachers reported that they preferred small classes in order to identify student needs and to provide more individual attention, as well as to cover more material effectively.

During the course of the STAR study, more than 1,000 teachers participated in year-end interviews. The reported (p.254):

- Basic instruction was completed more quickly, providing increased time for covering additional material.
- There was more use of supplemental text and enrichment activities.
- There was more in-depth teaching of the basic content.
- There were more frequent opportunities for children to engage in firsthand learning activities using concrete materials.
- There was increased use of learning centers.
- There was increased use of practices shown to be effective in the primary grades.

Project STAR found that reduced class size in grades K-3 significantly enhanced student achievement. The Tennessee State Department of Education appointed the Center of Excellence for Research in Basic Skills at Tennessee State University to conduct a Lasting Benefits Study (LBS).

### **The Lasting Benefits Study**

All students who participated in Project STAR third-grade classes were eligible for Lasting Benefits Study observation (1989) in the fourth grade. The Lasting Benefits Study fourth-grade sample consisted of 4,230 students in 216 classes. For consistency in statistical analysis, the Lasting Benefits Study fourth-grade sample was categorized by the location of the school the students had attended in third grade. Academic achievement of Lasting Benefits Study fourth-grade students was measured by the Tennessee Comprehensive Assessment Program (TCAP) test battery. Seventeen schools that had participated in Project STAR had not administered the Tennessee Comprehensive Assessment Program test battery during the 1989-90 school year and therefore could not participate in the Lasting Benefits Study.

The Tennessee Comprehensive Assessment Program includes both norm-referenced test and a criterion-referenced test. The Lasting Benefits Study showed clear and consistent results from both the norm-referenced test and the criterion-referenced test that students who had previously been in small STAR classes demonstrated significant advantages on every achievement measure over students who had attended regular classes. The results were consistent across all school locations. The Lasting Benefit Study found the positive effects of involvement in small classes are pervasive one full year after students return to regular-size classes (Nye, 1991).

### **Nevada's Class Size Reduction Act**

In 1989, Nevada Legislature enacted the Class-Reduction Act (CSR). The act was designed to reduce the pupil-teacher ratio in the public schools. The program was to be put into place in several steps. The first step reduced the ratio in selected kindergarten and first grades for the 1990-1991 school year. The second step was to improve second grade ratios, which would be followed by third grade, and broadening kindergarten assistance.

The CSR program was evaluated in 1993 by Nevada's State Department of Education. The following conclusions were made (Sturm, 1997, p.5):

- Principals, teachers, and parents were very positive in their attitudes toward class-size reduction, and the dynamics created within the classroom contributed to an improved learning environment;
- School districts reported fewer special education referrals (a decrease of 5 percent); and less teacher absenteeism (a decline of 7.1 percent); and
- Achievement data did not produce exceptional results, except among certain subgroups.

Possible reasons the data did not produce exceptional results are one of the districts, Clark County School District, which accounts for almost 65% of the state's

students were tested in the Fall, while all other districts were tested in the Spring. This was also the first year the state was using a new CTBS/4 test. Test scores are usually lower the first year of a new assessment. There was also team teaching taking place in the higher growth/higher income areas while in the lower income/less affluent areas self-contained classrooms were used (Sturm, 1997).

The 1995 Evaluation Report concluded (Sturm, 1997, p.7):

- Second grade reading scores tended to be lower in smaller (1-15) classrooms than in larger (over 15 students), while mathematics scores tended to be higher in smaller classrooms.
- Third grade students who had attended Nevada schools in the second grade versus students who did not, the graduates of the State's second grades scored significantly higher in both reading and mathematics.
- Students who attended Nevada schools during the first grade had significantly higher second grade reading and mathematics scores than did students who did not attend first grade in Nevada or for whom first grade attendance could not be determined by the teacher.

### **Project Challenge**

In Project Challenge (Tennessee, 1989), state policy persons provided funding so that 16 of the state's poorest systems could apply STAR findings and reduce class sized K-3 to about 1:15. On average, the Challenge systems that started the 1:15 treatment in 1989 ranked well below the state average performance are now (1995) near or above the state average. Challenge is not an experiment; it is a policy application of experimental results. The way Challenge was phased in provided some important information for future considerations. Most important is the conclusion that the small class size treatment seems most useful if it is applied as early as possible in a pupil's school experience. Small classes beginning in K or grade 1 seem to prevent later school problems, but later application of small class size apparently has limited remedial value (Achilles and others, 1996).



## **Project Prime Time**

Indiana funded an initiative—PRIME TIME—in 1984 to reduce class sizes in first grade through third grade to an average of 18 pupils or to 24 pupils if an instructional assistant was in the classroom (Mueller, Chase & Walden, 1988). The main intervention took place over three years, beginning with first grade in 1984, adding second grade in 1985 and third grade in 1986. The positive outcomes were found for small classes on such things as time on task, individualized instruction, well-behaved classes and teacher satisfaction. The academic achievement results were mixed. Small classes were found to have higher outcomes at times while the large classes performed better other times. An important note about PRIME TIME is that it was designed as a demonstration project and did not follow rigorous procedures for a thorough evaluation. There was no control implemented to equalize or match smaller and larger classes at the outset of the project. Small classes may not have been kept small for the entire school day, different achievement tests were administered in different schools, and other local, state, and federal programs were going on in some schools but not in others.

Tillitski, Gilman, Mohr and Stone (1987) in an analysis demonstrated that PRIME TIME had resulted in gains for first grade classes in each year of its implementation. David A. Gilman (1988) conducted a further study to determine whether the original gains of the first grade classes in a state-sponsored reduced-size classroom were being maintained. Gilman wanted to find what could be done to improve student achievement and attitudes. The study sought to determine whether first grade students who participated in the PRIME TIME program had

- > higher achievement scores,
- > mastered more skills,

- had a higher self concept,
- had a better attitude toward school, and
- higher total affective scores

than those students taught in larger classes (Gilman, 1988, p.7).

The sample for this study consisted of 866 first graders from three schools in North Gibson School Corporation of Princeton, Indiana. The PRIME TIME group consisted of 142 students with an average class size of 17.5 students for the school year. The group was the fourth first grade class to participate in PRIME TIME. The scores of the four PRIME TIME groups were compared to the scores of the 190 students of the larger classes of the 1983-84 school year.

There were four basic skills test studies done. The basic skills tests studies compared results on locally constructed tests of basic skills for the two-year period in an attempt to determine whether significant gains in scores could be attributable to class size (Gilman, 1988).

- Study 1 compared the mean percentage of the total raw score on the Mathematics Skills Test (p.9).
- Study 2 compared the mean percentage of the total raw scores on the Reading Skills Test (p.9).
- Study 3 compared the mean number of skills mastered for each of the two groups (p.10).
- Study 4 compared the mean number of reading skills that had been mastered for the two groups (p.10).

The study also included an affective measure, which was developed to ascertain whether significant differences existed between the attitudes and values of the two groups.

The results of the study are contained in the following table. (Gilman, 1988, p.12).

Table 1

<b>Summary Statistics for School Years</b>					
1983-84 to 1987-88					
Comparison	Large Class	School Years			
	1983-84	1984-85	1985-86	1986-87	1987-88
Average Class Size	23.7	19.9	16.1	16.6	17.5
Math Mean Percent	75.5	86.0	83.5	80.6	91.8
Mean Reading Percent	74.8	83.2	81.6	80.3	82.7
Mean Math Skills Mastered	8.5	11.8	11.3	10.9	12.4
Mean Reading Skills Mastered	10.6	13.6	13.3	13.1	13.6
Mean Self Concept	11.4	16.5	15.5	16.0	16.4
Mean Attitude Toward School	11.7	12.1	11.5	13.1	13.0
Total Affective	22.9	28.6	27.0	29.1	29.3

It can also be noted that the PRIME TIME classes of the 1987-88 school year also possessed a higher score than the means of classes from the previous years.

The unexpected result of the study (Gilman, 1988) was the achievement gains experienced by students in the last year of the study. Students of the 1987-88 school year scored higher on all achievement measures than PRIME TIME students of the preceding years. Similar, although less dramatic, gains were also experienced by the 1987-88 students on some of the affective measures.

From the results of the statistical tests performed on the data obtained in the study, Gilman (1988) concluded that the gains experienced by PRIME TIME students during the early years of the project have not only been maintained but they have also been strengthened. The gains experienced by students during the last year of the study provide evidence that the fine tuning of teachers toward the objectives of their instruction has caused them to obtain their instructional goals more effectively.

## **SAGE**

Class size does matter is what Wisconsin found in its first-year results from the state's Student Achievement Guarantee in Education (SAGE) project. SAGE was an initiative to reduce student-teacher ratios for low-income students in grades K-3 to 15:1. The first graders in SAGE schools scored significantly higher in reading, language arts and math than students in comparison schools. The SAGE researchers not only looked at test scores but they also observed classes and had teachers keep logs and complete questionnaires. The researchers found that there was much less time spent on discipline and classroom management. Teachers were completing the required curriculum early and were able to return to topics to cover them more in depth or move to more advanced material. There was more individual attention and chances to use more varied types of instruction.

## **California's Class-Size Reduction (CSR) Program**

In July 1996, the California legislature passed S.B.1777. S.B.1777 is an education reform initiative that committed more than \$1 billion a year to a class-size reduction (CSR) program. This voluntary measure provided a powerful incentive for school districts to reduce the number of students in K-3 classes. This financial incentive along with strong public support encouraged school districts to implement CSR with astonishing speed. By the time students started school in the fall of 1996, the majority of California's school districts had already begun to shrink their first-grade classes from a statewide average of nearly 30 students to a new maximum of 20. By the end of the third year, 98.5% of eligible school districts and 92% of eligible K-3 students were participating in CSR (Stecher, Bohrnstedt, Kirst, McRobbie and Williams, 2001).

In 1996-97, the first year of the program, districts were reimbursed a flat rate of \$650 for each child in a reduced-size class. In 1997-98, the per-student rate was raised to \$800 and increased to \$832 for the third year of the program. During the first year of the program, the state also provided \$200 million to help overcrowded school districts install portable classrooms (up to \$25,000 per classroom) and in the second year it reallocated any “unused” CSR funds for additional facilities grants.

Although California’s program was based largely on Tennessee’s STAR program, the two were very different. Tennessee’s STAR program was a very controlled experiment while California’s was a statewide program. Tennessee’s teachers were fully qualified, their curriculum was standardized and there were adequate teaching facilities. Because California implemented their CSR program on a much larger scale, they experienced a shortage of qualified teachers, teaching facilities and its curriculum was still being developed.

Realizing the importance of evaluation of the new law’s impact, the CSR Research Consortium was organized. The Research Consortium headed by the American Institutes for Research (AIR) and RAND also included Policy Analysis for California Education (PACE), WestEd and EdSource. The Research Consortium agreed that the evaluation of California’s program needed to be comprehensive. They not only wanted to consider the effect of reduced class size on student achievement, but also examine the effects of the reform on special populations, the staffing requirements districts face, and what state teaching qualifications will be affected (McRobbie, 1996).

Evaluations after the second and third years of CSR in California confirm that students enrolled in smaller classes do perform slightly better on standardized tests than students in larger classes do (Stecher, Bohrnstedt, Kirst, McRobbie and Williams, 2001).

The Consortium has now completed two evaluations of the reform. The first covered the first two years of the program (1996-97 and 1997-98) and the second covered the third year (1998-99). The data suggest that CSR is having positive effects on parent attitudes and student achievement. However, the gains to date have come at a substantial cost in terms of equity. School districts serving most of the state's historically disadvantaged students have received fewer benefits and may even have been hurt by CSR. These districts found it more expensive to implement CSR. They saw a disproportionate decline in their average teacher qualifications and they were forced to take more facilities and resources from other programs to create additional classroom space (Stecher, Bohrnstedt, 1999 and 2000).

The overall impact of CSR in California will not be known for a few more years; however, much can be learned from early results. Smaller classes do seem to have positive effects on student achievement and they definitely increase the amount of individual contact between students and teachers. Yet the reform also places large demands on schools for extra facilities and additional staff. Unless great care is taken to design and implement CST reforms thoughtfully, these added demands can fall unevenly on rich and poor districts, leading to greater inequities and undermining the reform's potential (Stecher, 2001).

### **Wenglinsky's Studies**

Researcher Harold Wenglinsky of the Educational Testing Service also performed a study in 1997. Wenglinsky analyzed the relationship between school district spending patterns and student performance. He combined data from three different databases generated by the National Center for Education Statistics. Wenglinsky found that class size served as an important link between school education spending and student

mathematics achievement at both the fourth- and eighth-grade levels, but in different ways. At the fourth-grade level, lower student-teacher ratios were positively related to higher mathematics achievement while at the eighth-grade level, the lower student-teacher ratio improved the school social environment, which helped lead to higher achievement. Fourth graders in smaller-than-average classes were about half a year ahead of the students in larger-sized classes. In a subgroup of urban schools, the advantage for students in smaller classes increased to about three-quarters of a year (Pritchard, 1999).

### **Framingham Heart Disease Epidemiology Study**

The Framingham Heart Disease Epidemiology Study is STAR's comparison to major research in another field (Achilles, Nye, Zaharias, Fulton, 1996). The federal government began supporting a longitudinal study of heart disease in 1948. The study involved no specific treatment, but built upon a carefully developed database that allowed generalizations to be made over time. The study has the following characteristics:

- standardized biennial cardiovascular examination,
- daily surveillance of hospital admissions,
- death information and
- information from physicians and other sources outside the clinic.

The study has followed a representative sample of 5,209 adult residents in Framingham, Massachusetts. These people have been traced using the above listed characteristics.

The study was designed to find out how those who develop cardiovascular diseases differ from those who remain free of the diseases over a longer period of time.

## **Framingham Heart Disease Follow-up Study**

In letters to a SERIOUS Education President, Sarason (1993) states that education can have one of two purposes, to repair and to prevent. Until now educators have seemed to emphasize repair, using a hodge-podge of band-aid-like projects geared to remediation, rather than emphasizing the potential of education to prevent through an improved program base. The sort of information presented from Farmingham clearly triggers changes in medicine. Based on results emphasizing prevention of CHD, doctors have been urging better lifestyles, improved diets and increased exercise. There have been marked improvements in preventing and treating CHD. In education, what action have educators taken on at least equivalent data (Achilles, Nye, Zaharias, Fulton, 1996)?

## **Smaller Studies**

Washington D.C. used their Class-Size Reduction funds to support local efforts to turn around low-performing schools. The District targeted its \$5.6 million allocation to 32 schools identified as low achieving. Each site that received a grant hired one additional teacher. Hendley Elementary used its money to hire an additional teacher for the first grade, allowing it to reduce class sizes from 24 to 18 in all four of its first grade classrooms. The school met all six of its performance objectives for the 1999-2000 school year, including a decrease in the number of students in first grade scoring below the basic level. The District also registered an increase in the number at the proficient and advanced levels in both reading and math. First-grade teachers at Hendley report greater satisfaction with students' achievement, motivation and skills when they are able to provide instruction to a smaller number of children (Cohen, Miller, Stonehill, Geddes, 2000).



Anne Arundel County, Maryland, coordinated the use of its local and federal funds to reduce class sizes in grades one and two from an average of 25 children per class to an average of 15 students per class. Georgetown East Elementary improved their first and second grade reading performance to the point that the school is now among the top three elementary schools in the county (Cohen, Miller, Stonehill, Geddes, 2000).

West Middlesex Area School District in Pennsylvania used its 1999 Class-size Reduction allocation to hire two new first grade teachers. As a result of the two new teachers, each school reduced class sizes in the first grade from 23 students per class to 18. During the 1999-2000 school year, students' scores on the Iowa Test of Basic Skills in reading, language and mathematics improved over the scores from the previous year. The students' overall grade equivalent scores increased from 1.9 to 2.1 (Cohen, Miller, Stonehill, Geddes, 2000).

The Trinity Area School District in Washington, Pennsylvania, used its 1999 allocation to hire two teachers to reduce class size in the first and second grades from 25 to 15 students. After just one year of this intervention, first graders improved by four percentage points over the previous year on the district-level writing standards. The second graders showed a three percent increase. Between 1999 and 2000, the number of first-grade students scoring at 80 percent or higher on performance tasks improved by 12 percentage points while the number of second graders increased by 21 percentage points (Cohen, Miller, Stonehill, Geddes, 2000).

David Grissmer examined 1990, 1992, 1994 and 1996 National Assessment of Educational Progress (NAEP) data from representative samples of 2,500 students in 44 states to look at the effect of state characteristics, including class size, on student achievement. The study showed that, controlling for students' family backgrounds, states

with the lowest pupil teacher ratios in the early grades had the highest National Assessment of Education Progress scores.

### **Arising Questions**

The results of these smaller class size research findings bring up other important questions.

- ? What factors or variables are associated with the different degrees of positive results of student achievement in smaller size classes?
- ? Does teacher behavior actually change with smaller class sizes?
- ? What teaching practices achieve the most benefits of a smaller class size?
- ? There is always the financial question—What benefits are associated with what levels of investment?

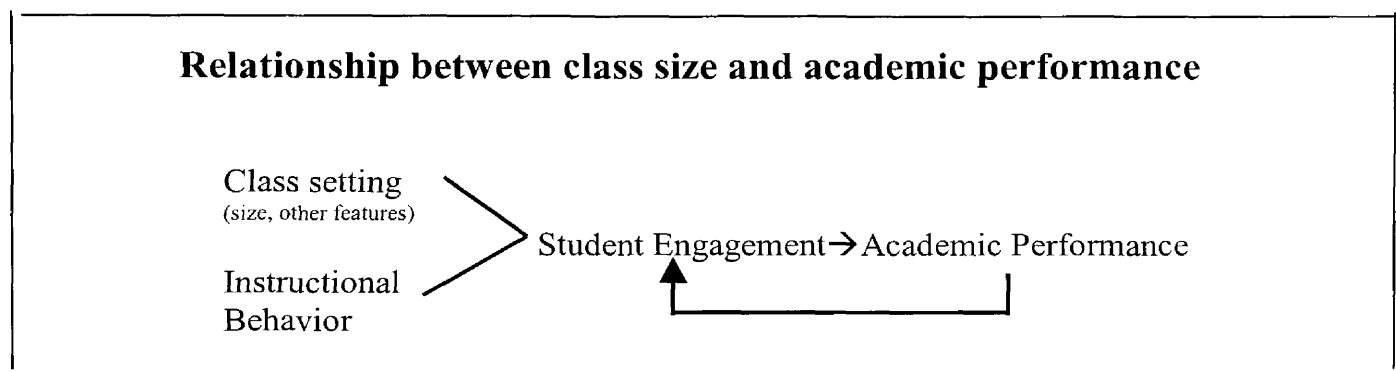
### **Factors/Variables Associated with Positive Results**

Student engagement is a very important factor in a student's performance. Finn (1989) presented a model of student engagement with two central components, participation and identification. Participation is the behavioral component, which includes basic behaviors such as the student's agreeing to school and class rules, arriving at school and class on time, attending to the teacher and responding to teacher-initiated directions and questions. Other levels of participation include initiating questions or dialogue with the teacher, engaging in help-seeking behavior, participation in the social, extracurricular and athletic aspects of school life.

Identification is the affective component, which refers to the student's feelings of belonging in the school setting and valuing outcomes that school will provide. The studies (Finn, 1989; Finn, 1993; Finn & Rock, 1997) have shown that positive engagement behaviors explain why some students perform well in school in spite of the adversities they face. Research has established that small classes have a positive impact

on academic achievement in the early grades. Small classes also have a positive effect on student engagement. A small class setting makes it more difficult for a youngster to withdraw from participating and makes it easier for a teacher to see the needs of particular students. Finn (1998) summarized the relationship between class setting, which includes class size, instructional behavior, student engagement and academic performance in the form of a diagram:

**Figure 1**



The diagram (Finn, 1998, p.2) is intended to show where class size and engagement fit into a larger picture. The arrow from academic performance to student engagement represents the assumption that positive outcomes tend to reinforce productive behaviors.

**Teacher Behavior/Teaching Practices**

A study of teaching practices in year 5 mathematics classes conducted in Melbourne, Australia (Bourke, 1986) found a list of factors related to class size. The 63 classes studied ranged from 12 to 33 students with more than 10 percent of the classes having 20 students or fewer. Significant positive correlation of class size included amount of noise tolerated, non-academic management and teacher lecturing or explaining. The significant negative correlation was more numerous. They included use

of whole class teaching, amount of homework assigned and graded, teacher probes after a question, teacher directly interacting with students and positive teacher response to answer from student. The pattern of results found that in smaller classes there is less time spent on classroom management and there is more interaction between teachers and individual students. Both of these results increase the academic engagement of the students.

The STAR studies also support these conclusions. Observations were made of mathematics and reading lessons in 52 of STAR's second grade classrooms (Evertson, Folger, 1989). The positive findings included:

- “Teachers in the small classes devoted an average of an hour to reading instruction, while teachers in regular classes spent an hour and twenty-four minutes” (p.7). Higher average levels of performance were obtained with less time expenditure.
- In mathematics, students in small classes initiated more contacts with the teacher, for purposes of clarification, giving answers to questions that were open to the whole class and contacting the teacher privately for help.
- In reading, small classes had more students on-task and fewer students off-task and spent less time waiting for the next assignment, compared with students in regular classes.
- Teachers in small classes were rated as better monitors of students' understanding of class material and as more consistent in their management of student behavior.

The interviews conducted with the STAR teachers showed the same findings as the observations. Teachers preferred the small-class setting and felt they were able to provide more individual attention, make greater use of supplemental texts and enrichment activities and provide more frequent opportunities for pupils to engage in firsthand learning activities (Bain,*et al.* 1992)

Success Starts Small (Achilles,*et al.* 1994; Kiser-Kling, 1995)—an observational study done by North Carolina—provides even more support. In this study, trained

observers collected over 7,100 “communication events” in the small and matched regular-size classes. Events were classified as personal, institutional, or task oriented. The study found a greater percentage of on-task events in small classes and a smaller percentage of discipline or organizational events in comparison to regular-size classes. On-task behaviors increased as a percentage of all behaviors between October and April in small classes, and decreased over the same time span in the larger classes. Discipline referrals among first grade students declined in small classes from 38 to 28 to 14 over the three-year period.

Once again, research shows that student engagement and the conditions that promote engagement are affected positively in a small-class setting. Management problems are reduced and instructional interactions are increased.

Another very important factor in the success of a student’s performance is the effectiveness of the teacher. California found that shrinking class size alone did not increase their students’ achievements. Results on California’s standardized tests show the state’s students scoring below national averages in 28 of 43 grade and subject categories. The scores look even worse for the state’s second and third-graders most of who have been in classes of 20 or fewer pupils for the past two years. On a percentile scale in which 50 is the national average, California’s second-graders ranked slightly below national averages in three of four subject areas, and third-graders fell below national averages in all four, with scores of 47 in reading, 46 in language, 46 in mathematics and 40 in spelling. Researchers said California was shrinking classes too quickly at the expense of having qualified teacher in the classroom (American School Board Journal, 1998). Statewide, 21,000 teachers with temporary or emergency credentials have been hired since the 1996 class-size reduction law went into effect.

Lance Izumi (1998), chief of the Center for School Reform at the Pacific Research Institute in San Francisco, says students pay the price for unqualified teachers. “The highest correlation is between teacher qualifications and test scores,” he says. Mary Fulton (1998), a policy analyst at the Denver-based Education Commission of the States who has reviewed research on educational strategies, says “Reducing class size in and of itself isn’t going to do much unless it’s accompanied by other moves such as strengthening teacher preparation, toughening the curriculum and improving early childhood education (American School Board Journal, 1998, p.8).”

In order for educators to make the best use of class-size reductions, they must be aware of what constitutes effective teaching (Bain,*et al.* 1992). The Project STAR “within-school” design, which required each participating school to contain at least one class of each type (small, regular, regular-plus-aide), reduced major sources of variation in student achievement attributable to school effects. The class was the unit of measurement, not the individual student. This design made it possible to identify the effects of teachers and of classroom instruction on student achievement.

STAR researchers observed and interviewed 49 first-grade teachers whose classes had made the greatest gains. The teachers selected for observation and interviews were those whose classes scored in the top 15 percent of scaled-score average gains in reading and math for each of the four school types. The most effective teachers engaged their students through the use of creative writing, hands-on experiences, learning centers and math manipulatives. They provided immediate feedback. They practiced Lee Canter’s assertive discipline or some variation of it and made it clear that they had high expectations for their students. In addition to these common behaviors and

characteristics, class size appeared to have been a contributing factor to the success of the most effective teachers (Bain,*et al.* 1992).

### **Financial Obligation**

The greatest obstacle to the implementation of smaller class sizes is the expense of additional teachers and classrooms. However, the question is not that simple because associated benefits may produce savings and careful planning may be able to contain the expenses. Small classes produce academic and behavioral benefits that have cost-savings value like fewer grade retentions and fewer disciplinary referrals, less need for remedial and special education teachers and fewer students leave school without graduating. There is not a widely accepted procedure for determining the dollar value of particular increments in school achievement. Some districts have found ways to achieve small classes, even within the usual per-pupil expenditures. Some schools have experimented with creative scheduling plans. Other schools have reassigned staff in order to achieve smaller class sizes; for example, by assigning Title I teachers or specialty teachers to small classes, using supplemental state funds for additional teachers, or allocating part-time teacher aide funds to full-time teaching positions (Miles, 1995).

Economist Alan Odden (1990) explored whether the effects of reducing class size on student achievement could be achieved with other lower-cost interventions, or whether larger effects could be obtained through other interventions at the same cost. He concluded that particular uses of small classes are worthwhile, especially in kindergarten through third grade.

In Project STAR, there were certain conditions, which prevailed without which the positive effects of small class sizes may not occur. The conditions were:

- adequate supply of good teachers,

- a change in teaching and learning styles,
- sufficient classroom space,
- a representative student mix in each class and
- teacher access to adequate materials and services.

Where small class size studies have been successful, teachers were state certified and qualified to teach in their assigned grades. In Tennessee, all STAR teachers were state certified and qualified to teach in their assigned grades; however, data taken from the California Department of Education's Language Census Data (Gold, 1997) indicates that California needs approximately 28,000 additional teachers to meet existing needs. According to the Commission of Teacher Preparation and Licensing, between January 1996 and February 1997, the number of emergency permits more than doubled to 8,319; and the Legislative Analyst's Office (1997) reports that 30 percent of classroom-size-reduction hired teachers that did not have the credentials for the positions. The influx of inexperienced teachers makes improved professional development programs and beginning teacher support all the more essential.

Smaller classes do not automatically lead to higher achievement. There also needs to be a change in specific teaching and learning behaviors (Mitchell and Beach, 1990). A telling example comes from Austin, Texas, where 15 schools with poor student performance each got \$500,000 a year for five years starting in 1989. All of the schools used the money to reduce class size. After four years, 13 schools still had extremely low performance and attendance. The other two schools showed dramatic gains. Only those two used smaller classes as an opportunity to change instruction. They adopted new curricula; changed to teaching methods focused on individual attention; mainstreamed students with disabilities into regular classrooms; increased parent involvement and



initiated health services. To Harvard economist Richard Murnane, the Austin example helps explain many teacher's frustration with studies that have concluded that class-size reduction doesn't help. It does, he says, but only in schools able to use the resources effectively (Murnane and Levy, 1996). Greater individual attention, better use of teaching methods and materials, better organization, more varied and imaginative activities, high quality student assessment and a richer curriculum are all more possible in a smaller class.

STAR's participating schools had no problem finding appropriate space to create enough classrooms for the reduction in numbers of students per teacher. In STAR, the mixture of students in the class was determined at random and so mirrored the diversity in the school as a whole. If 17 students with learning or behavior problems were assigned to a small class positive effects are less likely without significant additional resources.

STAR teachers had no change in the materials and services normally available to them. They still had access to reading specialists, school psychologists, special education programs and other school-wide services.

Along with the beginning research done in 1893 by J.M. Rice, another source to disagree with the statement that smaller class size creates greater student achievement is Eric A. Hanushek (1998). Hanushek feels that while calls to reduce class size in schools have considerable popular appeal, the related discussion of the scientific evidence has been limited and highly selective. In the aggregate, pupil-teacher ratios have fallen dramatically for decades, but student performance has not improved. Hanushek's explanations for these aggregate trends, including more poorly prepared students and the influence of special education, are insufficient to rationalize the overall patterns.

Hanushek's interpretation is there are likely to be situations—defined in terms of specific teachers, specific groups of students, and specific subject matters—where small classes could be very beneficial for student achievement. At the same time, there are many other situations where reduced class size has no important effect on achievement, even if it always has very significant impacts on school costs. The situation and the educational outcomes might change dramatically if everybody had stronger incentives to use budget wisely and to improve student performance (Hanushek, 1998).

Is there a relationship between class size and student achievement? Research does show that lowering class size in the early grades will produce significant and lasting benefits for students, but the question needs to be taken a step further. The question is not whether class size can make a difference but how and under what circumstances class size does make a difference. Class-size reduction is one key piece of a comprehensive, creative approach that corrals all resources (EdFact, 1996) and bases all decisions on what, in the long run, will produce the best possible learning environment for children. Smaller classes will make the greatest difference if well-prepared, qualified teachers teach the classrooms, and if their schools are held accountable for helping students reach challenging academic standards.

### **Conclusion**

There is substantial evidence that smaller classes do increase student achievement in the lower grades—kindergarten through 3 grades. However, class size reduction requires a considerable commitment of funds. Therefore, for a class-size reduction program to be successful other factors besides just lowering the number of students in a classroom also need to be implemented into the program. Some of the conditions critical to achieving success are: an adequate supply of good teachers, sufficient classroom

space, a representative student mix in each class, and teacher access to adequate materials and services (McRobbie, Finn, Harman, 1998, p.2).

Teachers need to be certified and qualified to teach in their assigned grades. Schools cannot afford poor teaching. When adding additional teachers to lower class sizes, space can become a problem. Even though class sizes may be smaller, classrooms still need to be an appropriate room—closets and corners in the basement are not appropriate for classrooms. The mixture of students in the smaller class needs to be a representative mix of the school as a whole. Positive results would be less likely with a class of all pupils with a learning or behavior problem. Even with a smaller class size, teachers still need access to reading specialists, school psychologists, special education programs and other school-wide services.

The question is not whether class size can make a difference but how and under what circumstances (McRobbie, Finn, Harman, 1998).

### **Maple Valley Elementary**

Maple Valley Elementary is a K-4 school with class sizes ranging from 14 to 28. Since the above studies show that class size does have an impact on student achievement in lower elementary classes, what would it take to apply the research findings to Maple Valley Elementary?

Maple Valley currently has 27 full-time teachers and 1 half-time teacher. The breakdown of students to teachers is as follows:

<u>Grade</u>	<u>Teachers</u>	<u>Students</u>	<u>Avg. Class Size</u>
Young 5s	½	14	14
Kindergarten	4	96	24
1 <sup>st</sup> grade	5	84	16.8
2 <sup>nd</sup> grade	5	110	22
3 <sup>rd</sup> grade	5	113	22.6
4 <sup>th</sup> grade	5	132	26.4
Total	24 ½	549	

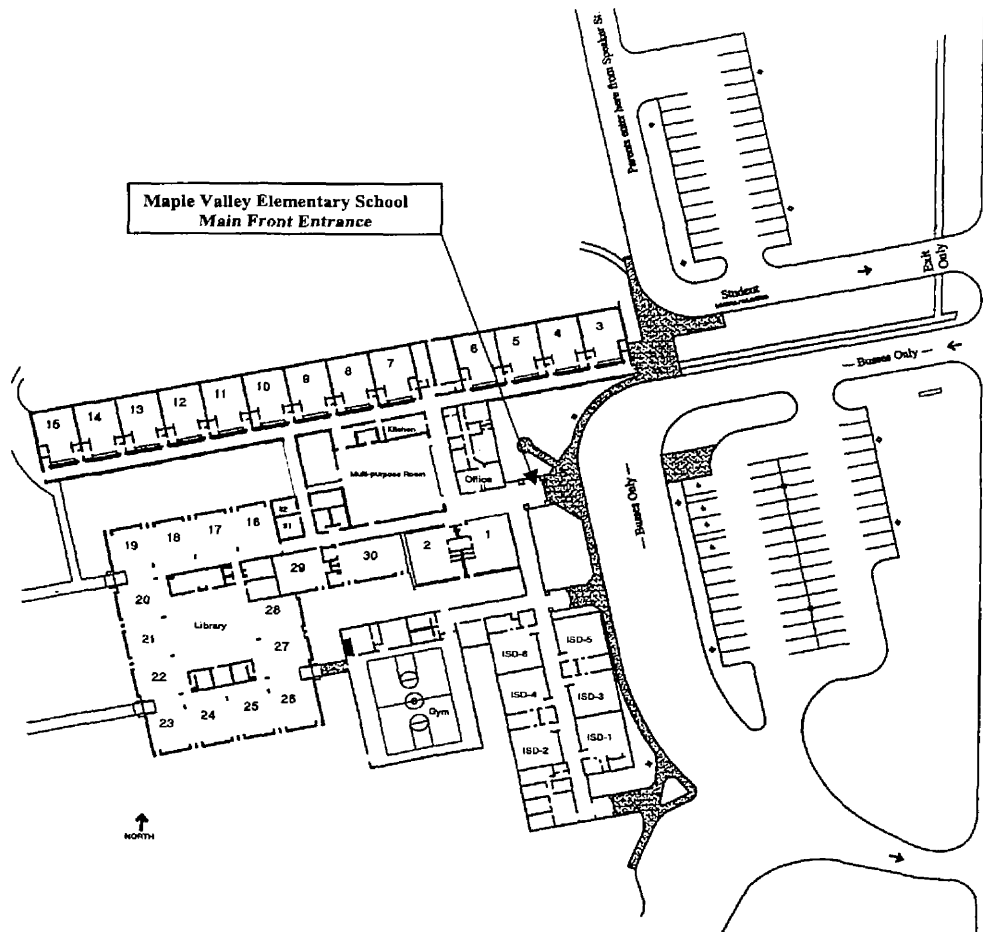
The salary expense is \$1,226,801.00 for all regular classroom teachers and a gym teacher, music teacher and media specialist. The board-paid annuity expense is \$16,800. The longevity expense is \$27,013. There are five teachers who receive an incentive for not carrying insurance through the school, which amounts to \$3,900. The cost for insurance for the other 22 teachers is approximately \$873.00/month per teacher, which amounts to \$19,206/month or \$230,472/year. With total expenses of \$1,504,986.00 and a student body of 549, the cost per student is \$2,741.32.

For Maple Valley to move to an 18 to 1 student-teacher ratio there would need to be one teacher added in Kindergarten, 1<sup>st</sup> grade and 3<sup>rd</sup> grade, while two would need to be added in the 4<sup>th</sup> grade. With the addition of these teachers, the student-teacher ratio would be as follows:

<u>Grade</u>	<u>Teachers</u>	<u>Students</u>	<u>Avg. Class Size</u>
Young 5s	½	14	14
Kindergarten	5	96	19.2
1 <sup>st</sup> grade	5	84	16.8
2 <sup>nd</sup> grade	6	110	18.3
3 <sup>rd</sup> grade	6	113	18.8
4 <sup>th</sup> grade	<u>7</u>	<u>132</u>	19
Total	29 ½	549	

By adding five teachers, the salary expense would increase by \$150,060. If all five teachers required insurance, the insurance expense would increase \$4,365.00/month or \$52,380.00/year. With an increase of \$202,440 in expenses, the yearly expense would increase to \$1,707,426.00/year increasing the per student expenditure to \$3,110.07.

These additional five teachers also need a classroom. Following is a picture of the current building layout.



<b>KEY:</b>			
<u>Room Number</u>	<u>Grade</u>	<u>Room Number</u>	<u>Grade</u>
1, 2, 3	Kindergarten	19, 20, 21, 22, 23	4th grade
4	Young 5s	24, 25, 26, 27, 28	3rd grade
5	4 year old program	29	Music
6, 7, 8, 9, 10	1 <sup>st</sup> grade	30	Kindergarten
11, 12, 13, 14, 15	2nd grade	31	Speech
16	Title 1	32	Counselor
17	empty	ISD-1-6	Intermediate School District Wing
18	Special Education		

There is currently only one empty classroom at Maple Valley. This would mean there would need to be four additional classrooms added. There is the option of portable classrooms, which have been used in the past. Utilizing bid proposals from April 2001, the least amount a four room portable unit could be installed for is \$47,414 for a three-year lease or \$135,263.00 cash payment.

The other option is to add on to the current building. The cost to add on four classrooms is approximately \$120.00 a square foot. With the average classroom being 900 square feet, the approximate cost of the four classrooms would be \$432,000. There are four different avenues that could be taken to finance a building project. The first avenue being to pay for the project from the General Fund. By paying from the General Fund, the school would not have to pay prevailing wages to the contractors working on the project. The school would be free to negotiate wages.

The second avenue the school could take in paying for the project would be to borrow the money from a financial institution like anyone else would in building a home. This avenue would cause the school to follow stricter guidelines, pay prevailing wages and pay the going interest rate.

The third avenue that the school could take is to do a Bond Issue. The Bond Issue has to be voted on by the public. If the public voted down the Bond Issue, then the school does not have that option. If the public passed the Bond Issue, then the school would have to build to the specific specifications of the bond and pay prevailing wages to the contractors.

Due to the current financial situation of the school and the recent completion of a \$1.9 million building and renovation project that was funded by a Bond Issue passed in the Winter of 2000, the school can not consider a building project or the adding of portable units at this time. The school is, however, looking at utilizing the one empty classroom by adding an additional Kindergarten class. The cost of this modest, but beginning step towards reducing class size would equal \$40,488 increasing yearly expenses to \$1,545,474. The per student expense would increase from \$2,741.32 to \$2,815.07. This is a good start for the school in reducing class sizes since research shows

this is a critical age in a student's future success in education. With the addition of another Kindergarten teacher and classroom, the average class size would go from 24 students to 19 students. A very positive move for the teachers, students and school as well.

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