Evidence From Project STAR About Class Size and Student Achievement

John Folger
Carolyn Breda

When considering the adoption of any change or new program a policymaker has three major questions to answer. First, how effective will the change be? Second, how much will it cost? And third, what are the problems of implementation, including the support or opposition of the clients and staff (teachers) who implement it? When looking at the issue of class size reduction, policymakers (legislators, school boards, and superintendents) have had clear answers to two of the three questions.

The Gallup Poll results (summarized in Table 1 in the introductory article) show that about 75% of parents and over 80% of teachers believe that reducing class size greatly improves student achievement. Surveys of Project STAR teachers indicate that almost all of them believed that smaller is better. Two-thirds of the teachers said they would prefer a one-third smaller class to a $2,500 a year raise. Political problems about the desirability of class size reduction are practically nonexistent.

It is also clear that reducing class size substantially is very costly (Mitchell, Carson, & Badarak, 1989). Project STAR estimated that when class size is reduced by a third, operating costs, mostly for additional teacher salaries, will rise by 24%-28% annually and capital costs for extra classrooms, amortized over 30 years, will add another 5%-7% to costs annually. Cutting class size is a very expensive alternative. The preferences of teachers and parents about small classes are restrained by budget considerations.

JOHN FOLGER *is Professor Emeritus of Education and Public Policy Studies at Vanderbilt University, Nashville, TN.*

CAROLYN BREDA *is a Research Associate with the Vanderbilt Institute for Public Policy Studies, Vanderbilt University, Nashville, TN.*

This has led to a search for less costly ways of achieving the benefits of smaller classes. Reducing class size just for selected classes, such as reading, or providing small classes just for low achieving students are suggested ways of targeting class size reduction.

The most important question Project STAR was designed to answer was: How effective will class size reduction be in increasing student achievement? The evidence from prior research is somewhat ambiguous about the size of the class size effect. Previous research was also unclear whether the small class advantage is uniform for different subjects (math, reading, or science, for example), different kinds of students, or different grades. Is the effect additive so that gains from a small class in one grade can be added to gains from a small class the next grade, or does the effect "level off" after a year or two? Project STAR was designed so that it could provide evidence about these questions. It was to be a definitive study of the effects of class size as well as the use of a full-time teacher aide on student achievement in the early elementary grades.

In any large field study, especially a longitudinal one, there are a number of problems which may arise to threaten the validity of the findings. Project STAR was no exception. Measures had to be taken to assure that the essential conditions of the study were met in all of the 325 plus classrooms in the 75 schools. Teachers were randomly assigned, pupils were randomly assigned by the schools in accordance with instructions which were audited, and testing was monitored. Because there were 328-346 classes at each grade level, when small classes got too large, or large classes too small, they could be excluded from the analysis. Most of the analysis was performed on 305-310 classes that met the criteria for inclusion. With the elimination of known threats to the validity of the study's results, we believe this is a definitive study of class size effects in Grades K to 3. While the results can only be generalized to Tennessee schools teaching the Tennessee curriculum, Tennessee schools may be similar to those in other states in a number of important ways.

Tennessee students score about 5%-8% above the national norms of the Stanford Achievement Test. Studies have shown that almost all states score above the national norms, hence Tennessee students may be about "average" in their ability. There is a state-prescribed set of learning objectives, the Basic Skills First program, which is taught in the primary grades in all schools including those that participated in Project STAR. There is a great deal of drill and practice in teaching reading and math. Whole class instruction was dominant in math, and reading instruction was done in reading groups in almost all classes. To the extent that reading and math are taught by these methods to average students by experienced, certified teachers, the results reported below should be relevant.

Project STAR provided for an average reduction in class size from 23 to 15, an approximately one-third reduction. Small classes varied from 13-17, regular from 21-28. Because of pull-outs and absences, the average number of students in class for reading and math instruction (the part of the curriculum covered by the tests) was 8%-15% lower than the number of pupils on the rolls (see introduction). Small and regular classes were affected similarly by pull-outs and absences.

Students in Small Classes Perform Better

Each of the 4 years, small class students scored significantly higher than students in regular classes in reading and math as well as in other subtests of the Stanford Achievement Test. Table 1 shows reading and math scale scores and percentiles. Figure 1 shows these differences expressed as effect sizes.[1] There is a significant positive small class effect for both reading and math at the end of kindergarten, the effect increases at Grade 1, then declines in Grades 2 and 3.

Another way to compare the small and regular classes is by comparing the amount of gain in the scale score during a year in the small class with the gain in the regular class. Analysis of grade-to-grade gains shows that score *gains* in first grade are about 15% larger in small classes than in regular classes, but that after the first grade, gains for both reading and math are as large, or slightly larger, in regular classes as in small classes.

The small class achievement advantage is found in all kinds of schools: inner city, suburban, rural, and urban. However, the small class advantage is largest, on the average, in inner-city schools as compared with other types of schools.

Small Class Effects for the Students in the Project for 4 Years

Project STAR followed a cohort of students over a 4-year period which provides a unique opportunity to study cumulative effects of being in a small class. Only about one-third of the students (2,000) met the criteria of: (a) being in the project all 4 years, (b) being in sizes specifically

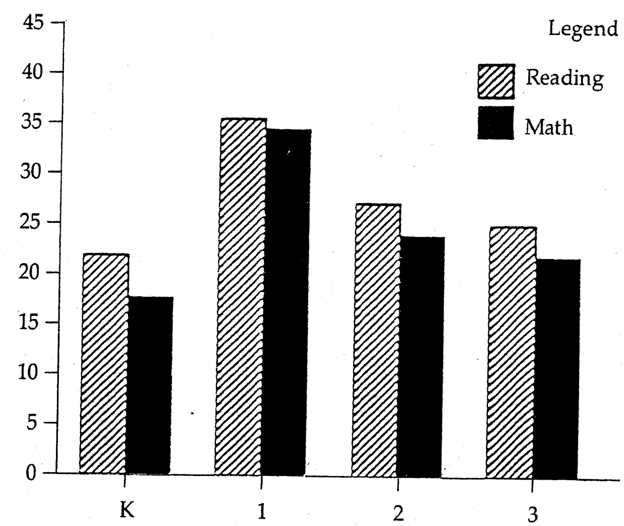
[1]The "effect size" is a way of standardizing the size of the difference between the small class and the regular class by dividing the difference in scores by the standard deviation of the regular class. A negative effect size would mean the regular class had a higher score than the small class.

Table 1
Reading and Math Scale Scores and Percentiles by Grade

	Reading				*Math*			
	Scale Score		*Percentile*		*Scale Score*		*Percentile*	
Grade	*Small*	*Regular*	*Small*	*Regular*	*Small*	*Regular*	*Small*	*Regular*
K	440	434	59	52	491	483	67	61
1	531	513	64	54	539	525	59	47
2	591	579	62	52	586	576	77	68
3	621	612	61	54	623	615	75	69

Note. Out-of-range classes excluded. Based on all students completing the test each year. Number of students included in reading was: K, 5,126; Grade 1, 5,541; Grade 2, 5,494; Grade 3, 5,242. The number of students with math scores is 50-100 higher each year. The class, rather than the individual student, was the unit of analysis for all comparisons.

Figure 1. Effect sizes by grade; small classes compared to regular classes



defined by STAR as "small" (13-17) or "regular" (21-28), and (c) having test scores all 4 years. These students had higher test scores than the total group, and a somewhat different pattern of effect sizes, as shown in Figure 2. Effect sizes are larger for math than reading in all four grades. In both subjects, they rise slightly each year to Grade 2, and then drop sharply in Grade 3.

For the cohort of students who were in the project all 4 years, the gains over the 3 years for which we have gain scores are about the same for the small and regular sized classes (see Table 2). This indicates that most of the small class advantage occurred in kindergarten; it was maintained, but not increased, in subsequent years.

Unlike the scores for the students who were in the study all four years, recall that the effect sizes for the total group (Figure 1) and their year-to-year gain scores indicate that the effect was larger in Grade 1 than in kindergarten, and declined thereafter. These analyses suggest that there is little or no additional, cumulative effect after Grade 1.

We can also look at the small class effect for new students who entered the project each year (see Figure 3). The new entrants to the project allow class size effects each year to be compared with the cumulative effects for

Figure 2. Effect sizes by grade for the cohort of students in the project all 4 years (n~2000); small classes compared to regular classes

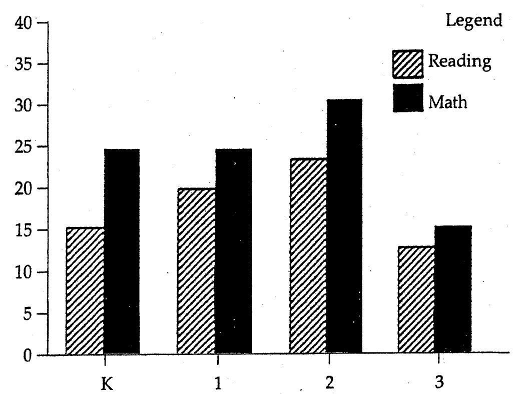
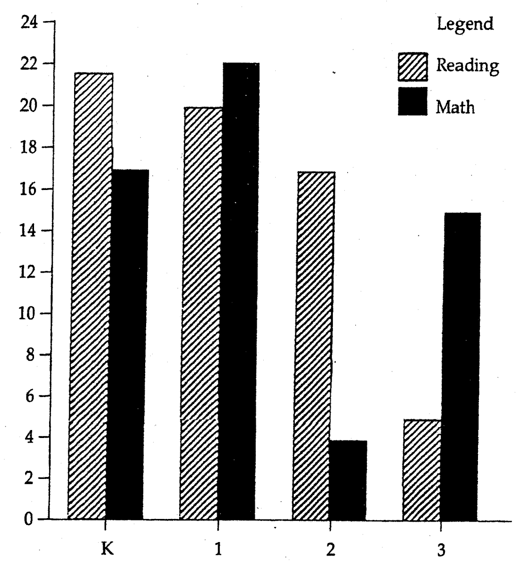


Table 2
Scale Score Gains Each Year in Reading and Math Small and Regular Classes for Students in Project All 4 Years

	Reading		*Math*	
Grade	*Small*	*Regular*	*Small*	*Regular*
One	98	94	46	47
Two	58	58	47	45
Three	24	28	34	38

students who have been in the project from the beginning. In other words, they provide an estimate of the one-year size of the effect. The effect size in reading for *new* students is about the same in kindergarten and Grade 1, declines in Grade 2, and is not significant in Grade 3. For math, the class size effect is highest in Grade 1, not significant in Grade 2, and rebounds in Grade 3 (see Figure 3).

Figure 3. Effect sizes for new students entering the project each year for reading and math



All students were new in kindergarten. The number of new students by grade is: One-2,047, Two-1,522, & Three-1,220.

New student effect sizes also indicate that the small class effect is concentrated in kindergarten and Grade 1 and is lower for students in Grades 2 and 3. Effect sizes for the continuing students are larger than the effect sizes for the new students, which is to be expected, because continuing students have had the benefit of the small class for more than one year. The "advantage" of the continuing students over the new students, expressed as the average effect size in math and reading, is approximately the same in Grades 1, 2, and 3. This also indicates that there is minimal additional class size effect after Grade 1.

These findings are similar to some others reported by Robinson (1990):

> Two recent studies also indicate that the initial effects of class size reductions may not be sustained in subsequent years. Follow-up data to the Doss and Holley (1982) study indicated that the first year's positive effects had largely disappeared by the second and later years of the study (Christner, 1987). Second, data from a cohort study in one school district of the Indiana Prime Time Program . . . found that the gains in reading and mathematics achievement observed in Grade 1 had largely disappeared by the end of Grade 3. (p. 82)

One possible explanation of the larger effects in kindergarten and Grade 1 is that it is more difficult to manage a large group of students who are not well socialized into classroom routines. By the time children get to the second and third grades, they are better socialized, and the teacher can manage a larger group more effectively. This hypothesis is supported by class size limits for preschool children. A teacher can manage (and teach) more 5- and 6-year-olds than 3- and 4-year-olds. Most preschool programs for 3- and 4-year-olds limit maximum class size to 15 or at most 20.

Comparison of Project STAR Results with Other Studies

In a meta-analysis of well controlled studies, Glass (1984) estimated the *average* effect size for reading was .11, and for math, .22. These estimates are based on an average reduction in size of 43%, from 35 to 20. Glass speculates that reading effects are smaller because reading instruction is done in small groups, where the overall size of the class makes less difference. Math instruction, on the other hand, is done whole group, and class size makes more of a difference.

Project STAR teachers taught as Glass suggested; nearly all teachers used small groups for reading instruction and whole class for math instruction. But Glass's effect size for reading is less than half that of

Project STAR. The Project STAR effect size (averaged over 4 years) is .26 for reading, and .23 for math. Project STAR found that class size reduction had similar effects for all of the subtests in the Stanford Achievement battery.

The Project STAR findings for reading effect size differ from the other recent large scale randomized study (Sharpson, Wright, Eason, & Fitzgerald, 1980) done in the fourth and fifth grades in Toronto. When comparing class sizes of 16 with 23, they had effect size of .22 for math, and −.05 for reading. Because they covered different grade levels, the two studies aren't directly comparable, but it is interesting that there were similar effect sizes for math, but very different effect sizes for reading.

One possible explanation for finding a larger effect of a small class on reading in Project STAR is the great influence of first grade results on reading achievement. On the Stanford Achievement Test, children have much larger average gains in reading in the first grade than in the second grade, and their average reading gains in third grade are only one-fourth of the gains they made in first grade (see Table 2). Children learn more about reading in the first grade (as measured by the test scores) than in the second and third grades combined.

The first grade and kindergarten are also the grades where small classes make the most difference. It may be that if the other studies of class size reading effects had included just the early elementary grades, instead of being done at a variety of elementary grade levels, they would have found larger class size effects on reading.

The effect sizes in Project STAR are somewhat larger than those found in other well-controlled studies. Slavin (1989) estimated an average effect size for smaller classes of .13, about half the Project STAR effect size averaged across 4 years. In the early grades (K-3), a majority of studies show positive effects for small classes (Robinson & Wittebols, 1986). At higher grade levels, fewer studies find positive effects. Project STAR's larger effect sizes may be because it was conducted in Grades K through 3, while Slavin's effect sizes averages are drawn from studies of a broader range of elementary grades.

Another explanation for the larger effect sizes for Project STAR is that it was a longitudinal study. Substantial differences that occurred in Grades K and 1 were mostly retained by the students in Grades 2 and 3. When the effect size for new students who entered Project STAR in Grades 2 and 3 are compared to those reported by Slavin, they are quite similar. Since most of the studies in his comparisons are based on data for only one year, with no cumulative effects possible, the appropriate comparison is with Project STAR's new student effect sizes. Project STAR's new student effect sizes are quite similar to Slavin's average effect size above the first grade.

Small Classes Help Low Socioeconomic Students' Achievement, But They Help High SES Students' Achievement About As Much

In reading at each grade level, effect sizes for low SES students exceed those for high SES students. At Grade 2 the difference is substantial (see Table 3). In math, by contrast, effect sizes for high SES students exceed those for low SES students except in Grades 2 and 3, where they are about the same.

Low socioeconomic students score lower than high SES students on the average, but there are many exceptions. To look at the effect of small classes on low academic achievers, we looked at how the bottom quartile students on the test did at the end of the next year. In the next year, did a small class help these low achievers more than it helped the average student?

The small class effect sizes for students in the lower quartile in achievement were below the overall small class effect sizes for reading at each grade, and for math at Grade 1. At Grades 2 and 3, math effect sizes were about the same for lower quartile and all students (see Table 3).

Table 3
Effect Sizes for Small Classes by Grade, SES, and Achievement Level Reading and Math

Test and Group	*Small-Regular Effect Size*			
Reading	K	1	2	3
All	.21	.34	.26	.24
High SES	.19	.32	.20	.21
Low SES	.23	.35	.33	.25
Bottom quartile, previous year	—	.26	.12	.12
Math				
All	.17	.33	.23	.21
High SES	.20	.34	.21	.20
Low SES	.14	.30	.22	.18
Bottom quartile, previous year	—	.09	.25	.23

These results indicate that there is no differential effect of a small class that substantially favors low achieving or low socioeconomic students over average students or high SES students. Small classes help all students "across the board." If low achieving students are going to be helped, a program targeted to their needs—such as the Success for All program in Baltimore (Madden, Slavin, Karweit, & Livermon, 1989)—will be more effective. The Success for All effect sizes for the low achieving students were three to five times as large as those found in Project STAR for low achieving students.

Small Classes Reduce Grade Retention

A smaller percentage of students in small classes are retained each year than students in regular classes. Since grade retention has been shown by previous research (CPRE, 1990; Shepard & Smith, 1989) to reduce pupils' chances of graduating, compared to equal ability pupils who are not retained, this is an advantage of small classes. Over the 4 years of Project STAR, 19.8% of the small class students were retained, as compared with 27.4% of students in regular classes. This 7½% difference in favor of small classes means fewer small class students had to repeat a grade. A lower grade retention rate of 2% a year would mean about a 2% a year lower cost per grade. Reducing retention would also save costs later on because promoted students have a greater chance of completing school, and avoiding problems such as delinquency and unemployment.

Teacher In-Service Training Did Not Improve Student Achievement

One of the reasons offered in the literature for class size *not* making a difference is that teachers do not change the way they teach when they have a smaller class (Robinson & Wittebols, 1986). Project STAR specified that there should be training for teachers, so they could adjust their teaching to the smaller class or the full-time aide. A subgroup of 57 teachers in 13 randomly selected schools in Grade 2, and another 57 teachers in the same schools in Grade 3, were given 3 days of in-service training before school started. The training was designed to help them to teach more effectively in whatever class type they had been randomly assigned to teach (Evertson, Folger, Breda, & Randolph, 1990).

Training emphasized classroom management, individualization of instruction, teaching higher order thinking skills, and how to work with an aide. (Aides attended that part of the training.) Training was provided (to groups of 10-12 teachers) by five experienced teacher trainers using the same curriculum. Teachers uniformly rated the training very good. A major emphasis of the training was to get the teachers to make a commitment to try something in the classroom they had learned in the training program. Trainers conducted follow-up sessions with the teachers to help them implement ideas and techniques they had agreed to try.

Teachers who were trained were observed teaching a math and reading lesson *before* they were trained, and were observed once in the fall and once in the winter after training. A sample of untrained teachers was also observed in the fall.

Observation data showed some differences in favor of trained teachers in classroom management and teaching practices as compared to untrained teachers in Grade 2, but these differences were not found in Grade 3 teachers where differences in observer ratings tended to favor the untrained teachers but were generally not significant. More importantly, there were not significant differences in student achievement in reading or math in either the second or third grade between classes with trained and untrained teachers (see Table 4).

Table 4
Stanford Achievement Test Scale Score Gains in Reading and Math for Students in Classes Where Teachers were Trained or Untrained—Grades 2 and 3

	Reading		*Math*	
Grade	*Trained*	*Untrained*	*Trained*	*Untrained*
Two	58.6	58.2	46.5	45.3
Three	25.7	27.4	31.9	34.1

Most of the teachers (about 80%) who did not participate in the STAR in-service training project had completed in-service training in the previous 2 years that dealt with similar topics as the STAR training—improving classroom management, and reading or math workshops. In actuality, the comparison was between experienced teachers (average years teaching 13) with relevant in-service training, and experienced teachers with in-service training plus 3 days of Project STAR in-service training. In exit interviews at the end of the year, about half the STAR-trained second grade teachers said they had not modified their teaching as a result of the training. It is not surprising that the training program did not lead to improved student performance under these conditions.

Summary: What are the Lessons from Project STAR?

The following are some of the lessons learned from Project STAR:

1. There is a positive effect on student learning in a small class in the early elementary grades. The "advantage" of a small class occurs in all types of schools—inner city, suburban, urban, and rural. The small class advantage is similar in both reading and math, which differs from the average results of other studies which indicated that a small class did more for math achievement than for reading achievement.

2. There is a more consistent effect across schools and subjects, and overall a larger effect when Project STAR results are compared with other studies of class size and achievement in elementary schools. Project STAR's average effect size across all schools, grades, and subjects was .25. This compares with the median effect size of .13 reported by Slavin in his summary of other well-designed studies.

3. A small class helps students from high socioeconomic status about as much as students from low SES backgrounds. A small class helped black students more than white. However, blacks in the project were concentrated in inner-city schools, and a small class was more helpful to all inner-city students than to students in other types of schools.

4. A training program that provided 3 days of pre-school training to a sample of teachers in 13 schools had no effect on student achievement in either the second or third grade when compared with other classes in the project where the teachers didn't get special training.

5. The effect of a small class increases from kindergarten to first grade, but beyond first grade there is no cumulative effect. Students in small classes did not increase their achievement advantage over regular class students in Grades 2 and 3. There was actually a decrease in the size of the advantage as reflected by the decrease in the effect size from .34 in first grade to .23 in third grade.

6. In the follow-up year (Grade 4), when all students were in regular-sized classes, there was still a significant achievement advantage of the students who had been in a small class over a regular class, but the effect size had decreased to .13 for reading and .12 for math (see Table 3 in Finn article, this issue, page 80).

The longitudinal data on class size effects provided by Project STAR are an important contribution to policymakers. The class size effect reaches its maximum very early, in Grade 1 and 2. The study shows that even when class size is kept small in Grades 2 and 3, the effect decreases a little. If we extrapolate the trend from Grade 1 to Grade 3 to higher grades (which may not be justified), the effect would get very small (.10 or less) by the end of the sixth grade. Dr. Barbara Nye of Tennessee State

University is following up a sample of the Project STAR students, so there will be actual data on the effects after 2 or 3 years. A smaller effect in the upper elementary grades would be consistent with the results of other well-designed studies which generally found smaller results than Project STAR. The Grade 4 follow-up also suggests that the effect will disappear in 2 or 3 years after the students leave the small class.

Cost Effectiveness of Class Size Reduction

Since the cost of providing small classes is additive, reducing class size in Grades K-3 will be twice as expensive as reducing class size in only Kindergarten and Grade 1. Since the small class achievement advantage is larger in Grade 1 than at the end of grade 3, it is obviously much more cost effective to reduce class size only in kindergarten and Grade 1.

Given the high cost of a substantial reduction in class size, can we say that the larger achievement effects of a small class found in Project STAR are worthwhile? To answer this kind of question we need to compare the cost of achievement gains realized from class reduction with some standard. Alternatively, we can compare class size reduction effects with those of some other intervention, such as a new curriculum, or different training for teachers (Levin, 1988).

One standard for comparison is the cost of producing a similar amount of gain in achievement in a small class and the cost of that amount of achievement gain in a regular class. Elementary students in regular classes in Tennessee made about average achievement gains in a year (measured by the Stanford test), about a month's gain each month. Students in small classes were about a month ahead of students in regular classes at the end of kindergarten, and about two months ahead at the end of Grade 1. We can compare the average cost of a month of education in a regular class (the standard) with the cost of reducing class size for a year to produce a month's additional gain. The cost per student of one month's instruction in a regular class can be estimated as one-ninth of the cost per student for a year. That cost can be compared with the one-third increase in the cost per student for reducing class size by a third (see Word et al., 1990, pp. 177-180). The one month gain in kindergarten and the additional month gain in first grade from class size reduction would cost about three times as much to produce as it costs for 2 months of instruction in a regular class. By this standard, reducing class size is an expensive way to improve achievement.

By making the school year a month longer, an additional month's achievement gain could be obtained at about one-third the cost of achieving the gain by lowering class size. Research would be necessary to

determine whether students actually made an additional month's gain when the school year was lengthened by a month.

Since there was no increased achievement gain from a small class in Grades 2 and 3, the cost of achieving the gain by a small class at the end of the third grade would be about six times the normal cost of producing a month's gain in achievement. Estimates like these lead directly to the question: Are there ways to produce the class size effect by lowering class size just for the periods of instruction in math and reading (Mitchell et al., 1989)? In Tennessee schools, on the average, about 2 hours a day are spent in direct instruction in reading and math—about one-third of the school day. There is substantial variation about this average in different classes, even in the same school. If class size could be reduced just for reading and math lessons, by a combination of redeployment of existing staff to teach reading and math, and addition of special reading and math teachers, it would be theoretically possible to have small classes (average of 15 pupils) with a much smaller additional cost. Differentiated staffing to reduce reading and math class size could make the cost of producing the small class effect about one-ninth greater rather than one-third greater.

Because substantial reductions in class size are so costly, even the greater class size effects gained in Project STAR do not make across-the-board class size reduction an attractive or cost-effective strategy for improving student achievement. Both Slavin (1989) and Odden (1990) have suggested that targeted class size reduction combined with other proven methods of improving student achievement would be a more cost-effective means of increasing student achievement. An example of this strategy is the Success for All program being implemented in a number of inner-city schools in different states (Madden et al., 1989).

The cost-effectiveness of class size reduction can also be compared with the cost-effectiveness of other programs designed to improve student achievement. To do this, the effect size for the program is divided by the per-student cost of the program, which is then multiplied by 100 to get a cost-effective ratio. This approach was used by Levin, Glass, and Meister (1984) to compare the cost-effectiveness of four treatments: (a) tutoring, (b) computer-assisted instruction, (c) increasing instructional time each day, and (d) reducing class size. They found that although tutoring was more effective than reducing class size, it was also more costly. Lengthening the instructional time by 30 minutes per subject per day was less effective than reducing class size, but it was also cheaper. When the cost effectiveness ratios are compared, peer and adult tutoring had a C-E ratio of .29; computer assisted instruction, C-E ratio .10; class size reduced from 35-20, C-E ratio .11; and increasing instructional time, C-E ratio .05 (Levin, Glass, & Meister, 1984). In these comparisons, tutoring with adults and peers gives the most improvement per dollar spent, while increasing instructional time has the lowest C-E ratio.

Improving student achievement as measured by a test may not be the only objective, and there may be other benefits which should be considered (such as future reductions in the dropout rate, teacher morale, and the ease of recruiting good teachers) in estimating the effectiveness of reducing class size. These other benefits from class size reduction should be included in the estimate of benefits if the policymaker believes they are important.

The basic conclusion is that across-the-board class size reduction is an expensive way to make a modest improvement in student achievement. Limiting class size reduction to kindergarten and the first grade would be the most cost-effective approach to across-the-board class size reduction. Reducing the size of particular classes, such as reading, to allow the teacher to employ teaching strategies that involve direct interaction with a manageable group of students may be cost effective. This approach makes class size reduction part of a comprehensive strategy designed to raise achievement levels. This targeted approach could make class size reduction more effective and more affordable than across-the-board reductions.

References

Center for Policy Research in Education. (1990). Repeating grades in school. *Policy Briefs.* Rutgers University.

Evertson, C., Folger, J., Breda, C., & Randolph, C. (1990). *How does inservice training affect teachers' instruction in small, regular, and regular/aide classes?* Paper presented at American Education Research Association, Boston, MA.

Glass, G. (1984). *The effectiveness of four educational interventions.* Center for Education Research at Stanford, Project Report 84-A19.

Levin, H., Glass, G., & Meister, G. (1984). *Cost effectiveness of four educational interventions.* Center for Education Research at Stanford, Project Report 84-A11.

Madden, N., Slavin, R., Karweit, N., & Livermon, B. (1989). Restructuring the urban elementary school. *Educational Leadership, 46,* 14-20.

Mitchell, D., Carson, C., Badarak, G. (1989). *How changing class size affects classrooms and students.* Riverside, CA: University of California, Riverside, California Educational Research Cooperative.

Odden, A. (1990). Class size and student achievement: Research based policy alternatives. *Educational Evaluation and Policy Analysis, 12*(2), 213-227.

Robinson, G. (1990, April). Synthesis of research on the effects of class size. *Educational Leadership.*

Robinson, G., & Wittebols, J. (1986). *Class size research.* Arlington, VA: Educational Research Service.

Sharpson, S. M., Wright, E. N., Eason, G., & Fitzgerald, J. (1980). An experimental study of the effects of class size. *American Education Research Journal, 17,* 144-152.

Shepard, L., & Smith, M. L. (Eds.). (1989). *Flunking grades: Research and policies in retention.* London: Falmer.

Slavin, R. (1989). Achievement effects of substantial reductions in class size. In R. Slavin (Ed.), *School and Classroom Organization* (pp. 247-257). Hillsdale, NJ: Erlbaum.

Slavin, R. (1990). Class size and student achievement: Is smaller better? *Contemporary Education, 62*(1), 6-12.

Word, E., Johnston, J., Pate-Bain, H., Fulton, B. D., Zaharias, J., Achilles, C., Lintz, M., Folger, J., & Breda, C. (1990). *The State of Tennessee's Student/Teacher Achievement Ratio (STAR) Project, Technical Report 1985-90.* Nashville, TN: Tennessee State Department of Education.