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# *Class Size and Student Achievement: Lessons from California and Tennessee*

Over the past several years, states have come under increased pressure to improve the academic achievement of all students in their schools. As states have looked for ways to accomplish this task, more and more have turned to class size reduction, particularly in the early elementary grades. In this paper, we summarize evidence from two well-known, state-sponsored class size reduction initiatives. Results from Tennessee's Student/Teacher Achievement Ratio project provide the most convincing evidence we have to date about the relationship between class size and student achievement. It is on the results of this one initiative that much of the current support for smaller classes is based. More recent evidence from California's Class Size Reduction project, however, has been less conclusive. The approaches to class size reduction taken by these two states, coupled with other evidence, provide the following lessons for other states that might be considering such programs.

#1: **Size matters.** Results from the class size experiment in Tennessee suggest that small classes of about 15 students in the early elementary grades in schools or districts with relatively large populations of at-risk students would help to close the achievement gap. Even though California reduced average class sizes in its early grades from 29 students to about 20, the reduction may not have been large enough to produce the effects found in programs with still smaller classes.

#2: **Bigger (in scope) is not necessarily better.** States looking to reduce class sizes need to consider resource availability and the unintended effects of potential resource scarcities on the quality of the class size initiative and other existing educational programs.

#3: **Class size reduction is costly.** State funds in California did not cover the costs of class size reduction, which forced the most needy schools and districts that wanted to participate in the program to use funds originally allocated for other purposes. Class size reduction is not a panacea. Diverting money from other educational programs to support class size reduction requires careful consideration of the relative benefits of the competing programs.

#4: **Policy choices influence costs.** Policy decisions, such as the number of students per class, the scope of the program within the state, the number of grade levels included and the flexibility of the program, have an enormous impact on costs. In general, the more targeted and flexible the program, the lower the costs of class size reduction will be.

#5: **Small classes are enormously popular with parents and teachers.** Once implemented, class size reduction programs are difficult to dismantle. Long-term considerations of the costs and benefits associated with class size reduction are necessary prior to the implementation of such programs.

#6: **Teacher quality matters more than class size.** Schools in California reduced class size at the expense of hiring qualified teachers. Yet, evidence shows that teacher quality is even more critical than class size for students' learning.

## Introduction

Over the past several years, states have come under increased pressure to improve the academic achievement of all students in their schools. As states have looked for ways to accomplish this task, more and more have turned to class size reduction, particularly in the early elementary grades. During the 1980s, for example, seven states funded class size reduction initiatives. In the 1990s, fourteen states adopted such policies (ERIC, 2000). And in 1998, federal legislation provided an initial $1.2 billion for class size reduction programs (Witte, 2000). Yet, the impact of class size reduction on student achievement has been and continues to be a topic of debate among educational researchers. In this paper, we summarize evidence from two well-known, state-sponsored class size reduction initiatives and consider why these initiatives produced such different results.[1] The approaches to class size reduction taken by these states provide lessons for other states that might be considering such programs.[2]

## An Examination of Two Class Size Reduction Efforts

In 1978, Glass and Smith synthesized the findings from 77 seemingly conflicting studies on the relationship between class size and student achievement and found a "clear and strong" relationship between the two variables, particularly when class size is reduced below 20 students. This landmark meta-analysis generated increased interest in class size reduction as a policy tool for improving education, as well as heightened scrutiny of the effects of school resources in general on student achievement. While educational researchers argued about whether money and the things that money can buy, such as smaller classes, matter for student outcomes (see, e.g., Hanushek, 1986; Hedges et al., 1994), a number of states and districts moved ahead with their own class size reduction projects. For the most part, these projects were small-scale, targeted to particular student populations, and/or non-experimental in design, making generalizations of their results difficult. Tennessee's Student/Teacher Achievement Ratio project (Project STAR), in contrast, was relatively large-scale, longitudinal and experimentally designed. Results from Project STAR provide the most convincing evidence we have to date about the relationship between class size and student achievement. It is on these results that much of the current support for smaller classes is based. More recent evidence from California's Class Size Reduction (CSR) project, however, has been less conclusive. Here we examine the results from these two state-sponsored initiatives.

### *Tennessee's Project STAR*

Begun in 1985, this four-year project was designed as a large-scale, scientific experiment in which students entering kindergarten in the state were randomly assigned within each school to one of three class types: a small class (target of 13-17 students), a regular class (target of 22-26 students), or a regular class with a full-time teacher's aide. Students were to stay within the same class type for all four years of the experiment (through grade 3), although some shuffling occurred after kindergarten among students in the regular class types. Teachers also were randomly assigned to classrooms in accordance with the experimental design. In the first year of implementation, 6,000 students in 329 classrooms within 79 schools and 46 districts participated. Over the course of the intervention,

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[1] The terms pupil-teacher ratio and class size are sometimes used synonymously despite the fact that they measure quite different things. A pupil-teacher ratio is calculated by dividing the number of students in a school by the number of certified personnel in the school. But, because certified personnel include specialty teachers, such as art, music and physical education teachers, as well as regular classroom teachers, the pupil-teacher ratio often underestimates the average number of students a typical regular classroom teacher faces each day (i.e., average class size). In her study of the Boston Public Schools, for example, Miles (1995) found a pupil-teacher ratio for the district of 13 to 1, but an average class size of 23. The evidence presented in this brief is based on class size.

[2] For a more detailed analysis of the class size issue, see Laine & Ward, 2000.

nearly 12,000 students participated (Finn & Achilles, 1999). All of the funding required to hire additional teachers and aides was provided by the state.[3]

Results from Project STAR show multiple and long-lasting benefits for students who attend small classes in the early elementary grades compared to those who attend large classes, both with and without teacher aides. Specifically, Project STAR students from small classes outperformed their peers from large classes on standardized exams in both math and reading by an average of 0.15 to 0.28 standard deviations during grades K-3 (Finn & Achilles, 1999; Krueger, 1999). And although slightly diminished in terms of effect size, the achievement advantage of students from small classes was found to endure for at least five years after the students had returned to regular-size classes (i.e., through eighth grade) (Finn et al., 2001; Krueger & Whitmore, 2001; Nye et al., 1999). Significantly larger differential achievement effects of small classes for minority and low-income students also have been reported (Finn & Achilles, 1999; Krueger, 1999; Mosteller, 1995). Within individual classrooms, however, the benefits for low-achieving students appear no greater than those of their higher-achieving peers (Nye et al., 2002). Given the remarkable consistency of small class benefits across participating schools in Tennessee, researchers concluded that small classes appear to benefit students of all types in all kinds of schools (Nye et al., 2000).

In addition to these achievement benefits, small classes in the Tennessee experiment were found to impact students' long-term behaviors in class, including their levels of effort and initiative (Finn & Achilles, 1999), as well as their likelihood of taking college-entrance exams in high school. Again, this latter benefit was found to have a greater impact on minority and low-income students; according to one estimate, small classes in Project STAR narrowed the college-entrance-exam-taking gap between African American and White students by 54 percent (Krueger & Whitmore, 2001).[4] [5]

*California's CSR*

The most comprehensive class size reduction initiative to date was started in California in 1996. California's Class Size Reduction (CSR) effort, which was phased in over a three year period beginning with grade 1, provided funding ($650/student in the first year,

[3] Schools had to have sufficient enrollments and physical space to participate. Thus, small or overcrowded schools were excluded from the program. Moreover, participating schools had to be willing to implement the experiment for the full four years. These restrictions interfered with the experimental design of the initiative, although there is no evidence to suggest that they had a significant impact on the results.

[4] Although taking a college-entrance exam does not mean that a student will attend college, it does raise the prospect of attendance for that student.

[5] A second, albeit smaller-scale, class size initiative that was started in Wisconsin in 1996 provides additional evidence of the beneficial effects for students of small classes in the early elementary grades. The Student Achievement Guarantee in Education (SAGE) project was designed as a five-year targeted pilot in which schools with 30 percent or more low-income students could qualify to participate. The project included four intervention strategies, one of which was the reduction of pupil-teacher ratios in each classroom to 15:1 beginning with kindergarten and first grade in 1996-97 (Molnar et al., 1999). Second grade and then third grade classes were added in the ensuing two years. Thirty schools in 21 districts, including seven schools in Milwaukee, were chosen to participate in the first year. In contrast to Project STAR, SAGE schools with space limitations could achieve "small classes" by combining 30 students with two teachers into one classroom. Between 14 and 17 schools with similar student populations and other characteristics served as comparison schools.

Results from the first two years of the SAGE program for first grade show benefits for students in small classes that are similar to those found in Project STAR. Students in small classes outperformed their comparison-school peers in large classes by about 0.2 standard deviations in reading and math in the first year, with diminished effects in the second year. Moreover, the small class benefits were greater for African American students than for White students. But in contrast to the Project

$800/student thereafter) to K-3 classes in the state with no more than 20 students per class in the affected grades. Because CSR funds were not targeted to particular schools, such as those with large populations of low-income or minority students, wealthy schools and districts with already small class sizes experienced a funding boom under this program. One-time facilities grants of $25,000 per newly created classroom in the first year and $40,000 in the second year were also available from the state. Unlike the STAR experiment, implementation of the CSR initiative was widespread and occurred very rapidly at a cost to California of $1 billion in its first year, rising to $1.6 billion in its most recent year (2002) (Bohrnstedt & Stecher, 2002).[6] In addition to these state funds, an unknown amount of supplemental local funds was needed to meet the program's requirements (Brewer et al., 1999).

The sheer scope of CSR created resource scarcities, the burden of which fell most heavily on the most disadvantaged schools (i.e., schools with 30 percent or more low-income students). For example, between 1995-96 and 1998-99 (the year before CSR implementation and the third year of the program, respectively), the number of K-3 teachers in California increased from 62,226 to 91,112, a 46 percent increase. Given this large increase in the number of teachers needed to staff the smaller classes, the proportion of teachers without full credentials in California rose from 1.8 percent in the year before the initiative to 12.5 percent by the second year of the program. By 2000-01, more than 20 percent of the teachers in the most disadvantaged schools were not fully credentialed compared to less than five percent in the least disadvantaged schools (Bohrnstedt & Stecher, 2002).[7] In addition, schools that were overcrowded or space constrained before CSR's implementation were either slower to incorporate the program or forced to use space allocated to other programs, such as libraries, labs, or stages, as classrooms. And as a result of inadequate state funding, poorer schools and districts had to reallocate funds from other areas, such as professional development and computer programs, to meet the CSR requirements. Again, the most disadvantaged schools were disproportionately affected (Bohrnstedt & Stecher, 2002).

In contrast to Project STAR, the benefits of CSR on student achievement have been less conclusive. While the achievement levels of students in California rose during the first years of the program, researchers have found it difficult to attribute the gains to CSR rather than to other programs that were initiated or in place around the same time. At best, slight positive associations between third graders' scores on the SAT-9 standardized math and language tests and reduced class sizes have been noted. Specifically, CSR has been associated with an additional three percent of students from small classes testing above the national median (i.e., 50$^{th}$ percentile) on the SAT-9 tests in math and language arts. No differential impact, however, was found for minority or low-income students (Bohrnstedt & Stecher, 2002).

**Why the Difference? Lessons from California and Tennessee**

While it is difficult to say definitively why the results from Tennessee's Project STAR and California's CSR draw such different conclusions about the relationship between class size and student achievement, the approaches to class size reduction taken by these two states, coupled with other evidence, provide lessons for other states considering such initiatives.

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STAR findings which showed no beneficial effects of having a teacher's aide in a large class, SAGE students in large classes with two teachers (30:2 ratio) fared as well as their peers in the small classes (15:1 ratio) (Molnar et al., 1999).

[6] By the end of CSR's first year, 88 percent of the state's first graders and 57 percent of its second graders were attending small classes (Bohrnstedt & Stecher, 2002).

[7] The impact of CSR on teacher migration from urban to suburban schools was small. About 11 percent of first grade teachers changed schools in the first year of CSR, compared to seven percent in the year before CSR was implemented (Bohrnstedt & Stecher, 2002).

**Lesson #1: Size matters.** Glass and Smith's meta-analysis (1978) showed that large benefits of class size reduction occur in classes with less than 20 students. The small classes in Project STAR had an average of 15-16 students. Similarly, classes in Wisconsin's SAGE project averaged 15 students per teacher (see footnote 5). By comparison, small classes in California averaged 20 students, closer to the large class average of about 23 students in Tennessee (Krueger, 1999). Thus, even though California reduced average class sizes in its early grades from 29 students to about 20, the reduction may not have been large enough to produce the effects found in programs with still smaller classes.

**Lesson #2: Bigger (in scope) is not necessarily better.** California's fast and widespread implementation of small classes in the early elementary grades created an imbalance between its demand for and the supply of qualified teachers in the state, thus negatively affecting the quality of teachers hired to work in the small classes. The proportion of teachers without full credentials in California increased nearly sevenfold within the first two years of the initiative and disproportionately impacted the most needy schools and districts. In addition, not all schools in California had enough space to accommodate more classes, which forced them to take over space originally designated for other educational purposes. Project STAR, in contrast, was designed so that participating schools would have no disadvantage in terms of facility space or the quality of its teachers. All of the teachers hired to staff the additional classrooms in Tennessee were certified for the grade level they were teaching (Achilles, 1999). And only schools with ample space were allowed to participate. States looking to reduce class sizes need to consider resource availability and the unintended effects of potential resource scarcities on the quality of the class size initiative and other existing educational programs.

**Lesson #3: Class size reduction is costly.** California has spent between $1 billion and $1.6 billion per year on CSR, and these state expenditures have not covered the full cost of the program. Poorer schools and districts in the state that wanted to reduce their class sizes were forced to reallocate funds from other programs or increase class sizes in upper grades to meet the requirements of CSR (Bohrnstedt & Stecher, 2002; Sack & Richard, 2003). While evidence from Project STAR indicates that small classes in the early grades have beneficial effects on student achievement, it does not suggest that small classes are the panacea for education. Diverting money from other educational programs to support class size reduction requires careful consideration of the relative benefits of the competing programs.

**Lesson #4: Policy choices influence costs.** The costs of class size reduction vary considerably depending on how the program is constructed. Policy decisions, such as the number of students per class, the scope of the program within the state (i.e., targeted to specific districts, schools or student populations versus statewide), the number of grade levels included, and the flexibility of the program (i.e., average class sizes in entire grade levels or schools versus every classroom), affect costs (Brewer et al., 1999). Recent budget woes in California, for example, have forced the state to consider allowing districts to have more flexibility in meeting CSR targets by enabling them to use district wide rather than classroom averages of 20 students per class in the targeted grades (Sack & Richard, 2003). The more targeted and flexible the program, the lower the costs of class size reduction will be. Based on our most compelling evidence about class size reduction from Project STAR, small classes of about 15 students in the early elementary grades in schools or districts with relatively large populations of at-risk students would help to close the achievement gap. States might consider this or some similar cost-conscious approach before embarking on a comprehensive class size reduction project.

**Lesson #5: Small classes are enormously popular with parents and teachers.** Once implemented, class size reduction programs are difficult to

dismantle. Even in the midst of budget shortfalls, districts in California view cuts in their CSR programs as a "last resort" option given the popularity of small classes with parents and teachers (Bohrnstedt & Stecher, 2002). Thus, long-term considerations of the costs and benefits associated with class size reduction are necessary prior to the implementation of such programs.

**Lesson #6: Teacher quality matters more than class size.** Schools in California reduced class size at the expense of staffing their classrooms with qualified teachers. Poor and minority students, moreover, were the most negatively affected. Yet, ample evidence shows that teacher quality is critical to students' learning (see, e.g., Sanders & Horn, 1998), even more so than class size (Hanushek, Kain, & Rivkin, 1998). Given the existing inequitable distribution of teacher quality across schools and districts (The Education Trust, 1998), states looking to close the achievement gap should consider policies aimed at improving the quality of teachers of minority and low-income students.

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