

2. CLASS-SIZE REDUCTION IN GRADES K-3

EXECUTIVE SUMMARY

SUMMARY OF RESEARCH FINDINGS

Reducing class size in Grades K-3 has been found to have academic benefits in all subject areas, especially for children living in poverty. Studies published since the mid-1980s show that classroom behavior and test scores improve while students are in small classes. Further, the improvement persists through the middle school and high school years, even though students return to full-size classes. To reap the full range of benefits, it is important that pupils enter small classes in the early years (Grades K or 1) and continue in small classes for three or more years. Students who attend small classes are also more likely to take college-entrance examinations; this is especially true for minority students.

RECOMMENDATIONS

- Resources should be provided to schools and districts serving low-income pupils to restrict class sizes in the primary grades to no more than 18 pupils.
- To ensure that the research-documented benefits of small classes are realized, policies for implementing small classes should include the following provisions:
- Begin class-size reduction in K-1 and add additional grades in each subsequent year.
- Use the reduced-class model supported by the research: one teacher in a classroom with 18 or fewer pupils. Pupils assigned to small classes should represent a cross-section of students in the school, *not* just difficult-to-manage students.
- Plan for class-size reduction in advance, hiring fully qualified teachers. Additionally, some programs of professional support and development are likely to be helpful.
- Systems should be established to monitor class-size reduction initiatives continually and closely, providing feedback to administrators, policy makers, and parents about the successes of the program. Teachers should be afforded opportunities to discuss problems as they arise, and to have them addressed by the school administration.

2: CLASS-SIZE REDUCTION IN GRADES K-3

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The advantages of small classes have been touted by parents and educators throughout modern history. Only in recent years, however, has there been a significant impetus for reducing class sizes in American public schools. This is partially due to the fact that teachers, parents, policy makers, and the courts understand the importance of small classes for teaching and learning, that education has risen to the top of state and national agendas, and that high-quality research has demonstrated the academic and behavioral benefits of small classes, especially for children at risk. This report summarizes the current state of research on class-size reduction and its implications for educational policy – especially as it pertains to the academic performance of students at risk.

CLASS-SIZE REDUCTION RESEARCH

The impact of class size on educational outcomes is among the most researched areas in education. By the 1980s, more than 200 studies had appeared on the topic. Some early studies did not establish a connection between smaller class sizes and student achievement, but mainly attempted to weigh the value of small classes against larger classes. Others suffered from problems of methodology and data collection. Most acceptable studies, however, supported the importance of smaller classes in promoting student success. In a review of early studies, Educational Research Service¹ and Robinson² concluded that reducing class sizes in the primary grades to 22 or fewer students appeared to have a beneficial effect on reading and math scores,

¹ Research assistance was provided by Anke Halbach, University of Wisconsin-Milwaukee

especially for economically disadvantaged pupils. Since that time, more sophisticated experiments have confirmed and extended this conclusion.

The first refined analysis to connect reduced class size to academic achievement was a 1978 meta-analysis by Glass and Smith of 77 earlier research studies.³ This analysis found that not only did small classes improve the chances for academic achievement, but that small classes could also be used as a predictor of student success. Glass and Smith showed that “as class size increases, achievement decreases.” Repeated studies have provided evidence of important relationships between the number of students in the classroom and the success of teaching and learning in the same classrooms. This research demonstrated that an appropriate class size was fewer than 20 students, and that the greatest benefits of small classes are obtained in the early grades.

LARGE SCALE STUDIES

Based on this early work – particularly the findings of benefits to poor students and to young students – beginning in the mid-1980s some large-scale projects and an actual experiment in class size and student outcomes were started. Among them were Indiana’s Prime Time; HB 72, which limited class sizes in Grades K-4 to 22 students in Texas; STAR and its related studies in Tennessee; Wisconsin’s SAGE Project; and California’s massive Class-Size Reduction (CSR) effort. Prime Time and STAR were particularly important because they provided the motivation for many districts, states, and the federal government to reduce class sizes on a large scale. Several overviews of the more recent class size research are available including a book by Achilles⁴ and monographs by Finn⁵ and by Ehrenberg, Brewer, Gamoran, and Willms.⁶

Prime Time in Indiana

Between 1981 and 1983, Indiana launched Project Prime Time as a statewide initiative. Prime Time began this reduction with first grade, but was not entirely a CSR initiative. In particular, it added teacher aides to classrooms to reduce the adult-to-child ratio – not truly resulting in small classes. Prime Time reported mixed results with some gains in student achievement on reading and math scores. Gains in reading were larger than those in math.⁷ An important outcome of Prime Time was the demonstrated feasibility of large-scale efforts to change classroom organization in the pursuit of improved student learning.

Project STAR in Tennessee

From 1985-1989, the STAR (Student/Teacher Achievement Ratio) experiment was conducted in Tennessee. This large-scale (n=11,600) longitudinal study of class sizes provided the legislature and administrators with convincing data to support class-size reduction for students statewide. At each grade level K-3, a strictly controlled study was set up to examine whether small (13-17) classes made a difference in student accomplishments in the early years, when compared to regular (22-25) classes, or regular classes with a full-time teacher aide.⁸

Because of its magnitude and scientific rigor, the results of STAR carried more weight than the earlier studies. The most important findings are:

- In every grade level (K-3) students in small classes outperformed students in larger classes on every achievement test administered – in all subject areas and on both norm-referenced and criterion-referenced achievement tests.
- The benefits of small classes were greater for minority students and students attending inner-city schools than for white students or those in non-urban areas. In

many cases, the advantages were *two to three times as great* for African-American students as for white students.

- New analyses of the STAR data have shown that both *starting early* (K or 1) and *continuous participation* (3 to 4 years) in small classes lead to the greatest benefits.⁹

Students who had participated in Project STAR in K-3 were followed after they returned to full-size classes in Grade 4. The most important long-term findings are:

- Pupils who attended small classes in K-3 performed significantly better in all academic subjects in all subsequent Grades, 4, 6, and 8.¹⁰
- The more years pupils spent in small classes in K-3, the longer the benefits lasted into later grades. For example, at the end of Grade 6, pupils who had attended small classes for one year had a 1.2-month advantage in reading over pupils who attended full-size classes. Pupils who had attended small classes for two years had a 2.8-month advantage. Three years in a small classes produced a 4.4-month advantage, and four years produced a 6-month advantage in reading.
- Pupils who attended small classes in K-3 were more likely to graduate from high school and more likely to take SAT/ACT college admissions tests. The impact on minority students was particularly strong, thus reducing by 60% the gap in SAT/ACT rates between black students and white students.¹¹

Additional strength was added to the STAR results by secondary analysts at the University of London, The University of Chicago, and Princeton University who examined the STAR data using different statistical approaches.¹² All approaches yielded the same conclusions.

Other large-scale CSR efforts, described below, have confirmed the basic findings of STAR in other locations. Research using the STAR data continues today; researchers are

examining the long-term effects of small classes on teen births¹³ and on employment and schooling after high school.¹⁴

Besides the impact on academic achievement, Project STAR revealed that:

- Teacher morale is increased in small classes, a finding consistent with all prior research.
- Teachers of small classes spend more time on active teaching and less on classroom management, a finding substantiated in other research in addition to STAR.
- There are fewer disruptions in small classes and fewer discipline problems, a finding replicated in other studies.
- Students' engagement in learning activities is increased.¹⁵
- In-grade retentions are reduced.¹⁶ Because retained students are disproportionately minority, male, and from low-income homes, the reduction in retentions also reduces the achievement gap in schooling.¹⁷

Project STAR found no achievement advantages associated with full-time teacher aides.

In the most complete examination of this issue, researchers concluded that there were no differences in academic achievement “between ... students in teacher aide classes and students in regular classes on any test in any grade (K-3).”¹⁸ The authors continue:

In several instances, students in aide classes performed more poorly than students in non-aide classes... In terms of learning behavior, again no significant differences were found ... In several instances, behavior was marginally *poorer* among students in classes with aides.¹⁹

Also, the problems teachers encounter in teaching and in managing classes “are not reduced when a teaching assistant is present.”²⁰

STAR and the Black-White Achievement Gap

The disproportionate impact of small classes on minority students and students attending inner-city schools reduced the achievement gap between black and white students. For example, the black-white gap in pass rates on the first grade reading mastery test was 14.3% in full-size classes – that is, 14.3% more whites mastered the reading tests. In small classes, the gap was reduced to 4.1%. Both black students and white students gained significantly by being in small classes, but black students gained more.²¹ Other research has examined the achievement gap in more detail and reached the same conclusions.²² Bingham performed a comparative analysis examining white vs. minority differences and also concluded that smaller class sizes are an effective strategy in reducing the gap. According to Bingham, the smallest white-minority gap was associated with small classes beginning no later than in Grade 1 and lasting for a minimum of two years. The finding of a reduced black-white gap in college aspirations, indicated by students taking SAT/ACT tests, shows a positive impact on behavior in later grades as well.²³ The effect of small classes on the achievement gap has been confirmed in other class-size initiatives, particularly Wisconsin’s Project SAGE, discussed below.

Critique of Project STAR

Despite the exceptional research design used in STAR, some factors were beyond the control of the research team. In particular, students moved from one neighborhood to another and changed schools in the process. This led to some attrition from STAR schools over the four-year period and, in a small number of cases, students changing from one class type to another when they changed schools. Economist Eric Hanushek has suggested that these factors may have compromised STAR’s findings, a criticism echoed by Witte²⁴ as well as by Ehrenberg et al.²⁵ These issues have been addressed by several data analysts. Krueger²⁶ undertook a thorough analysis of attrition in STAR. His work showed that neither of these factors produce “bias” in the

study's main findings, that is, average differences in performance among the class types. Hedges and his colleagues²⁷ compared the Grade 3 performance of STAR participants who were still in the sample in Grades 4, 6, and 8 with that of participants who left the sample. Again, the difference between small-class and large-class students was the same for “stayers” and “leavers.” Although attrition did result in a somewhat selective long-term sample, the basic findings of the experiment still hold.

OTHER LARGE-SCALE CLASS-SIZE INITIATIVES

Project STAR provided the scientific support for the long-held belief of educators and parents that small classes in the early grades had many advantages. Because the impact was particularly strong for students at risk, STAR helped motivate many districts, states, and even the U.S. Department of Education to undertake further reduced class initiatives. By the year 2000, approximately 35 states had class-size legislation.

Wisconsin's Project SAGE, the Burke County project in North Carolina, the massive CSR program in California, and the federal initiative begun during the Clinton administration are among the CSR initiatives that were accompanied by formal evaluations. These programs were not intended to be controlled experiments: their foremost purpose was to provide an intervention – small classes – whose efficacy had already been demonstrated. Occasionally, critics lose sight of that purpose and comment on these programs' lack of tightly controlled research designs.²⁸ Despite this criticism, each of the programs was accompanied by an extensive evaluation and each produced results consistent with those of STAR.

The SAGE Program in Wisconsin

The Student Achievement Guarantee in Education (SAGE) program is a statewide effort to increase the academic achievement of children living in poverty by reducing the student-

teacher ratio in kindergarten through Grade 3 to 15:1. The program began in 1996 and was targeted toward schools with a high proportion of students living in poverty. School districts in Wisconsin that had a least one school with 50% of children or more living below the poverty level were eligible to apply for participation in SAGE. Within these districts, any school with 30% of students or more below the poverty level was eligible to become a SAGE school. Funding was set at a maximum of \$2,000 per low-income student enrolled in SAGE classrooms (K-3). During the 1996-7 school year, 30 schools in 21 school districts, including seven in Milwaukee, began the program in K-1. Grade 2 was added in these schools in 1997-98 and Grade 3 in 1998-99.

The program requires that participating schools implement four interventions: (a) reduce the pupil-teacher ratio within a classroom to 15 students per teacher, (b) establish “lighted schoolhouses” open from early in the morning until late in the evening, (c) develop “rigorous” curricula, and (d) create a system of staff development and professional accountability. While most class-size reductions were accomplished by assigning 15 or fewer students to a teacher within one classroom, some alternate configurations were also adopted. They included classrooms of approximately 30 students with two-teacher teams, shared space classrooms with two separate teaching spaces each with one teacher and about 15 students, and floating teacher classrooms where an additional teacher supports classes of about 30 students during reading and math instruction. The class-size reduction was an immediate intervention in the schools whereas the other SAGE provisions were implemented by schools with considerable variation and, at times, with considerable delays.²⁹

To determine the impact of SAGE pupil-teacher reductions on student achievement, the SAGE evaluation uses a quasi-experimental, comparative change design. The quasi-experimental

design was used because it was not possible to randomly assign students and teachers to classrooms and to keep classroom cohorts intact from year to year. The evaluation uses a control or comparison group of classrooms from districts participating in the SAGE program for the purpose of assessing the impact of SAGE class-size reductions. These comparison schools have normal class sizes, and, as group, resemble SAGE schools in family income, achievement in reading, K-3 enrollment, and racial composition.

The longitudinal evaluation of the SAGE program has produced substantial scientific data on the effects of small classes in Grades K-3. The positive impact of small classes on student achievement in SAGE classrooms, especially for minority students, has been a consistent finding for four years and has confirmed earlier findings from STAR. The greatest achievement gains were made in first grade with second- and third-grade students maintaining the gains. Perhaps of greater significance, SAGE has provided guidance for policy makers and administrators about how best to implement small classes at the district and local level through extensive non-experimental data collection such as principal and teacher questionnaires and classroom observations and teacher interviews.³⁰

Like STAR, Project SAGE has not been without its critics. Some criticisms concern weaknesses in the project's experimental design and methods of analysis, for example, the lack of random assignment, student attrition, a ceiling effect on some of the tests.³¹ These comments may not be germane because SAGE, although it included a formal evaluation component, was not intended to be a controlled experiment. More pertinent are the comments that the expansion of SAGE has met with a shortage of qualified teachers and classroom space, especially in the Milwaukee Public Schools. To deal with these problems at some schools, teachers have "doubled up," putting two teachers in one classroom with 30 students.³² Team teaching presents both

benefits and problems. Among the latter, teachers have to work well together and collaborate well in order for instruction to be optimal. Extensive advance planning is needed in order for this to occur, a principle also learned in California (below).

The Burke County Project in North Carolina

Studies of the effects of small classes in Burke County, North Carolina, reinforce SAGE and STAR findings, while addressing questions about financial and educational policy implications of CSR.³³ With the goal of improving education in relatively poor Burke County, a pilot program in 1991-1992 reduced class size to 18 in Grade 1 in four schools, and in Grades 2 and 3 in subsequent years. Pilot program results were highly positive. On the strength of these findings, the program was extended in 1995-1996 to all elementary schools, Grades 1-3, providing the same positive findings. By 2000, classes of about 17:1 were in all 17 schools with Grades 1-3. By comparing the CSR classes with the control classes, researchers reported higher rates of time on task for students and more emphasis on student interaction. The smaller classes significantly outperformed regular classes in math and reading at the end of Grades 1, 2, and 3, and later these same students continued to outperform the others after returning to regular classes in Grades 4 and 7. An important feature of the Burke County initiative was the ability of administrators to implement small class sizes with no increase of per-pupil expenditures for the district. This was accomplished through the careful reallocation of existing resources, especially the reassignment of qualified staff members who had not been teaching their own classes all day, to reduced size classes.

The California CSR Program

Class-size reduction began in California in 1996. Within a period of several months, new teachers were hired and placed in Grade K-3 classrooms across the state, reducing class sizes to

20 pupils or fewer. In three years of operation, this largest CSR initiative has resulted in 28,000 new teachers being deployed and virtually every classroom in Grades 1-2 being reduced in size. Since the program was implemented so quickly, very few large classes were available to serve as a comparison group for evaluators. The evaluation has focused on Grade 3, in which small but statistically significant achievement gains were reported in reading, language, and mathematics.³⁴ The benefits of small classes were in the range 0.05 to 0.10 standard deviations. Although these would be considered small effects, they replicate the results from project STAR for pupils who entered small classes in Grade 3; in STAR, the largest effects were obtained for students who entered small classes in earlier years (K or 1).

California's experience provided important insight into the types of planning needed before implementing a large-scale CSR initiative: The speed with which teachers were hired resulted in many teachers being placed in classrooms who had not even completed their formal teacher credentialing programs. As a result, in the first year of California's CSR program, the percentage of K-3 teachers who were not fully credentialed rose from 1.8% to 4%; this figure increased to 12.5% and 13.4% in subsequent years.³⁵ Had the program been implemented in phases, the drop in the preparation and experience levels of California's teachers could have been remedied.

Federal Initiatives

Begun in 1999-2000, the federal class-size reduction program provided funds to schools serving high-poverty populations. By the second year of operation the program supported CSR initiatives in 36 major urban school systems and increased its funding to \$1.3 billion from \$1.2 billion. School districts targeted their funds toward low-achieving schools and those identified as highest-need schools. Local school districts used 87% of the federal funds to hire new teachers.

In its first-year report, *The Class-Size Reduction Program: Boosting Student Achievement in Schools Across the Nation*, the U. S. Department of Education highlighted the expected benefits of class-size reduction. Federal class-size reduction funds were aimed at helping to make classrooms more manageable so that teachers could focus on teaching and learning. Further, teachers were expected to report more enthusiasm for teaching and opportunities to address students' individual needs, accompanied by a boost in students' reading scores and overall achievement scores.³⁶

The federal class-size reduction program permitted schools to implement several models of small classes, including some that were not small classes at all. The latter included large classes (e.g., 32-40 pupils) that were team-taught by two full-time teachers, and pairs or triplets of larger classes (e.g. 30 pupils) that shared a "rotating" teacher who would spend part of the day in each classroom. Both of these models reduce the *pupil-teacher ratio* (PTR) in classrooms but do not reduce the actual class size, that is, the actual number of pupils in the room who interact with the teacher full-time each day. STAR researchers have pointed out that the strong findings of reduced-class benefits do not apply to these settings.³⁷

In its first year of operation, approximately 29,000 new teachers were hired under the federal CSR initiative. An evaluation contract was awarded to Abt Associates, a Boston firm. However, the ensuing calendar year saw a change in administrations in Washington. President Bush's education plan, "No Child Left Behind," targets federal class-size reduction money for elimination, apparently disregarding the research base that supports class-size reduction. Nevertheless, with or without support from the federal government, small classes have become standard practice in many states and districts across the country and are producing noticeable benefits to teachers and pupils.

RESEARCH, POLICY, AND PRACTICE

The research on class size supports a number of practices that can be implemented to enhance students' academic performance. The benefits of small classes, especially for minority students and students from low-income homes, have been confirmed time and again. STAR and the studies to follow STAR have also drawn these conclusions:

Timing and Continuity of Class-Size Reduction

The most recent analyses of STAR data show that the greatest initial impact on student achievement is obtained when students enter reduced-size classes in kindergarten or Grade 1.³⁸ Pupils who attended small classes for at least three years had significant sustained benefits through Grade 8; the carry-over effects of fewer than three years were mixed. Several large CSR initiatives have started in Kindergarten or Grade 1 and expanded to Grades 2 and 3 in subsequent years. This is good policy, especially if the same students attend small classes for several years in a row.

What Does 'Small Class' Mean?

Research on class size has been conducted according to high scientific standards; this cannot be said of any other educational intervention to improve pupil achievement. Project STAR has received praise from scientists and policy makers;³⁹ it has provided the starting point for several national conferences of researchers concerned with the need to base educational decisions (like medical decisions) on strong empirical evidence.⁴⁰

The evidence provided by STAR, and by other CSR efforts that confirm STAR findings, are not relevant to other classroom arrangements. The results tell us little or nothing about programs that reduce pupil-teacher ratios without decreasing the number of students in the room. They tell us little or nothing about team-taught classrooms, about "push-in" or "pull-out"

classrooms with a common teacher, or about part-time class-size reduction, for example, just for reading. The STAR results do tell us about one alternative reduced-ratio arrangement: a full-size class with a full-time teacher aide does not work.

Alternative class configurations such as team-taught classes or classes with support teachers for reading and math instruction need their own research to evaluate whether or not they offer viable options to increase student achievement. This research is important, especially given the shortage of space faced by many schools and districts. However, for schools to benefit from the strong findings about small classes, the accumulated body of research indicates that actual class sizes must be small: that is, fewer than 20 pupils for the entire school day.

Professional Support and Development for Teachers of Small Classes

Due to the short lead time in hiring teachers for California's CSR program, the quality of the entire state's teaching force declined. In other locations, difficulties in locating and placing qualified teachers in newly created classrooms has created a level of disorganization that required weeks or months to settle.⁴¹ These dynamics can easily offset the benefits that small classes provide.

The experiences of districts across the country show that CSR initiatives benefit from careful advance planning. The most effective settings were those in which school administrators, parents, and community leaders were informed about the program and what it was expected to accomplish.⁴² Several initiatives were hindered by the lack of lead time to find space for CSR classes or to identify teachers before the school year began.

Professional support and development activities for teachers have been useful as well. Research has demonstrated clearly that the academic benefits of small classes are obtained

without programs of professional development. Project STAR demonstrated advantages with no intervention other than reduced classes (and teacher aides). Nonetheless:

- Many teachers being placed in elementary classrooms are new to teaching, new to the classroom, and new to their school setting. They have a critical need for help “getting started” and for targeted on-the-job training.
- Many veteran teachers are transferring from other kinds of settings to small classes. The instructional practices that may be ingrained from years of experience in these settings are often not current best practice.
- It may be possible to *enhance* the benefits of small classes by taking advantage of the opportunities the class size provides; good professional development can help make this happen.

The recent report, “The Professional Development and Support Needs of Beginning Teachers,” discusses this issue in depth.⁴³ Particular classroom strategies and particular domains of professional support are identified in the report that are especially useful when implementing CSR programs.

The Need to Monitor CSR Programs Closely

In recent years, many districts have undertaken CSR programs, both with and without an accompanying evaluation. The absence of a systematic evaluation can create problems subsequently. It may not be necessary to document that academic achievement is improved by CSR in every site; the benefits have already been demonstrated scientifically. Follow-up evaluation is necessary, however, to make sure that smaller classes are implemented correctly and that problems are addressed quickly. Several evaluations, including one in Buffalo, New York, were able to identify implementation problems during the school year and to provide mid-

course corrections. It is also important that basic information is available to administrators, parents, and legislators to demonstrate that the investment in small classes has been spent properly.

There is also a great deal yet to be learned about small classes and the opportunities they provide, as the SAGE, California, Burke County, and US Department of Education programs have demonstrated. A regular system for monitoring reduced-class programs, addressing problems that arise, and reporting progress to administrators and the public has been demonstrated to be an important ingredient of CSR initiatives. Several models have been forwarded to help districts monitor or conduct a formative evaluation of their CSR program.⁴⁴

QUESTIONS THAT REMAIN

Many questions about small classes remain to be answered. For example:

- How small does a class have to be in order to reap the benefits demonstrated by STAR and other studies? Most CSR interventions are using “fewer than 20 pupils” as their guideline, but research has not established a specific threshold that must be met.
- What are the effects of small classes in later grades, for example, the middle school years or high school years? The early overviews of research on class size⁴⁵ reported mixed results based on a relatively small number of studies. Recent years have not seen an increased number of studies of class size in the upper grades. Several studies have been performed using a federal data set, the National Longitudinal Study of 1988. These have produced non-significant results⁴⁶ and mixed results,⁴⁷ respectively, for Grade 8. The complexity of the situation, with students moving from class to class for different subjects, has undoubtedly discouraged research in this arena.

- What are the effects of combining small classes with other interventions, especially those targeted to students at risk, such as full-day kindergarten, preschool programs, and remedial reading programs?
- What are the long-term effects of small classes on high school and post-secondary outcomes, for example, college attendance and employment? Researchers are currently studying these questions.

The broadest question not fully answered to date is, “*Why is it that small classes work as well as they do?*” Many studies of teachers’ instructional strategies have compared teachers in small classes with teachers in full-size classes, but few if any systematic differences have been found.⁴⁸ It is clear that small classes make additional time available to teachers – time that would be spent on record keeping or classroom management in larger classes.⁴⁹ The time saved may be used to provide more active teaching to the class and, in theory, more individualized instruction. However, research has not shown consistently that students in small classes receive more individual attention or instruction directed to their specific needs.⁵⁰

The strongest hypothesis about why small classes work concerns *students’ classroom behavior*. Evidence is mounting that students in small classes are more engaged in learning activities and exhibit less disruptive behavior.⁵¹ Educational and psychological theory explain why this may occur. For example, in a small class, each student is constantly on the firing line; he or she may be called on at any time to answer questions or complete assignments. Students cannot escape by sitting in back corners of the room or avoiding the teacher’s attention. By the same token, teachers cannot ignore students that they might otherwise prefer not to attend to, for whatever reasons. Psychologists have forwarded the principle of “diffusion of responsibility” to explain why members of small groups tend to take more individual responsibility than do

members of large groups – a principle supported by empirical research.⁵² Further, if one's classmates are well behaved and engaged in the learning process, then this behavior will become the norm that others will follow. Research on the socializing effect of group norms is also extensive.⁵³

Further research is needed to explain fully why small classes have behavioral and academic benefits. However, the evidence to date suggests that it is the very feature of *smallness* that has the greatest impact. If this principle is correct, then it is also clear that large classes with two teachers (reduced pupil-teacher ratio but not reduced class sizes) are less likely to yield the same benefits.

CONTROVERSY OVER THE VALUE OF REDUCED CLASS SIZE

Despite the appeal of small classes and despite the strong evidence of their value, the ideas have not gone unchallenged. In particular, economist Eric Hanushek has engaged in a vigorous campaign to convince policy makers and the public that small classes are not an efficient way to improve student performance. Few researchers take this position, but Mr. Hanushek has promulgated this view widely in the professional and public media. The view is consistent with his thesis of many years that fiscal resources spent on public education are not related to academic outcomes.

The conclusions are based on two sets of analyses, summarized in a monograph published by the University of Rochester, then Professor Hanushek's institution,⁵⁴ and in a document giving both sides of the argument produced by the Economic Policy Institute.⁵⁵ The first analysis is an examination of pupil-teacher ratios and academic performance for the entire country from 1970 to 1995. According to Hanushek, although the ratios declined regularly during that period, academic performance as indicated by the National Assessment of

Educational Progress (NAEP) did not increase. The second analysis is a meta-analysis of the results of 277 econometric studies of the relationship between educational “inputs” (including class size) and academic achievement. According to Hanushek, these studies show no systematic relationship with class size.

Hanushek’s position holds sway with some policy makers, and he has advised the current administration, which has marked reduced-class-size funds for elimination. A number of education researchers and other economists, not to mention most practitioners, dispute Hanushek’s conclusions, however. Among the points that have been forwarded to rebut Hanushek’s position are these:

All of the studies cited by Hanushek are studies of pupil-teacher ratios (PTRs), mainly computed at the district, state, or national level. Pupil-teacher ratios at these levels do not reveal the actual class sizes – that is, how many students are actually in classrooms. The PTR includes regular teachers, special education and Title-I teachers, teachers who don’t have their own regular classrooms (for example, remedial teachers, language, music, or art teachers, or librarians), administrators, and other staff members as well.⁵⁶ Pupil-teacher ratios at these highly aggregated levels reveal little or nothing about the actual classroom conditions in which pupils are learning. In fact, it has been shown that large urban districts tend to have low pupil-teacher ratios because of the large numbers of Title I and remedial teachers, yet often have badly overcrowded classrooms.⁵⁷ This distinction is discussed in depth in Ehrenberg et al., who concluded “class size is not the same thing as the pupil/teacher ratio. Indeed, it is quite different.”⁵⁸

Hanushek's reviews do not include any of the studies of class size reviewed by either Glass and Smith or by Educational Research Service. He also does not include class-size studies such as Prime Time, Project STAR, or SAGE.

Project STAR, being a controlled scientific experiment, provides stronger evidence than is possible through "production function analysis," the technique used in all the studies cited by Hanushek. A randomized experiment such as STAR is the highest quality research design available; it is the method of choice used by the Food and Drug Administration, for example. This point is acknowledged by Hanushek in these two manuscripts and others. For this reason, Princeton economist Alan Krueger concluded: "The design of the STAR experiment clearly produces results that are more persuasive than [all] the rest of the literature on class size."⁵⁹

Hanushek's conclusions are selected in order to show just one view of the data. For example, in order to show that NAEP scores did not increase in the period from 1970 to 1995, Hanushek focused on the reading performance of 17-year-olds, with no attention to the NAEP Grade 4 or Grade 8 results and no attention to topics that are taught explicitly to older students.

One extensive PTR study using NAEP data has been performed at Educational Testing Service.⁶⁰ The study involved a national sample of 10,000 fourth-grade students and 10,000 eighth-grade students. This study found significant gains in mathematics of reduced PTRs, with greater impact on fourth-grade students than on eighth-grade students. Also, the gains were larger for inner-city students than for any other group. This study is not included in the Hanushek review.

Hanushek's methods of analysis have also come under attack. Researchers at the University of Chicago noted that Hanushek's analyses did not take into account that some studies were more informative than others because they were based on larger samples.⁶¹ They

reanalyzed a portion of Hanushek's data using meta-analysis methods that weight studies according to the sample sizes, and found the opposite conclusion – that resources (including class size) *do* have an impact on academic achievement.

Economist Alan Krueger performed an even more complete reanalysis of Hanushek's studies.⁶² First, Krueger noted that the 277 "studies" cited by Hanushek were in fact 59 studies from which 277 statistics ("effect sizes") were drawn. Some studies contributed far more to Hanushek's conclusions than others. (In fact, between them, two studies contributed 48 of the 277 effect sizes; as it happens, these two studies accounted for most of the negative findings reported by Hanushek.) Several other studies were misinterpreted or miscoded before being entered into Hanushek's analysis. Overlooking the latter issue, Krueger performed a complete reanalysis of Hanushek's studies, counting each of the 59 investigations just once. In additional analyses, he also took into account that some studies were of higher quality than others, and that some studies had more atypical samples than others. In all three analyses, Krueger's results were the reverse of Hanushek's. He concluded that resources in general, and pupil-teacher ratios in particular, are significantly related to academic performance in the direction consistent with Project STAR: lower ratios associated with higher performance.

SUMMARY AND RECOMMENDATIONS

Class-size reduction is sound education policy. It has been shown to be effective time and again, and no serious challenge has been made to the research findings that support those conclusions. Educators have long known this. No school improvement effort relies on larger rather than smaller classes. Indeed, programs targeted to students with academic problems (for example, special education or other remedial programs) are all based on small-class arrangements. Parents often place children in private schools at least in part because of small

classes. Many interventions, such as home schooling, Reading Recovery, or Success for All, rely on the ultimate small class, one-on-one instruction.

Research has now documented the advantages of small classes, especially in the elementary grades and especially for students who attend small classes for two, three, or four consecutive years. The effects are especially pronounced for minority students and those attending school in large urban districts. As a result, the achievement gap is reduced, both in the years while pupils attend small classes and later on when they consider applying to college. Teachers, meanwhile, benefit as well. They spend less time on classroom management and clerical tasks, and have more time available to get to know each student better. Reduced-size classes provide the *opportunity* for improved instruction and for increased learning to take place.

The weight of this evidence supports the following recommendations for policy makers:

- Resources should be provided to schools and districts serving low-income pupils to restrict class sizes in the primary grades to no more than 18 pupils.
- To ensure that the research-documented benefits of small classes are realized, policies for implementing small classes should include the following provisions:
 - 1) Begin class-size reduction in K-1 and add additional grades in each subsequent year.
 - 2) Use the reduced-class model supported by the research: one teacher in a classroom with 18 or fewer pupils. Pupils assigned to small classes should represent a cross-section of students in the school, *not* just difficult-to-manage students.

3) Plan for class-size reduction in advance, hiring fully-qualified teachers.

Additionally, some programs of professional support and development are likely to be helpful.

Systems should be established to monitor class-size reduction initiatives continually and closely, providing feedback to administrators, policy makers, and parents about the successes of the program. Teachers should be afforded opportunities to discuss problems as they arise, and to have them addressed by the school administration.

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