



# The False Promise of Class-Size Reduction

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Matthew M. Chingos April 2011



Center for American Progress



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# Contents

- 1 Introduction and summary**
- 4 The evidence on class-size reduction**
- 8 CSR: The most expensive school reform**
- 10 Looking ahead**
- 12 References**
- 13 Endnotes**
- 15 About the author and acknowledgements**



# Introduction and summary

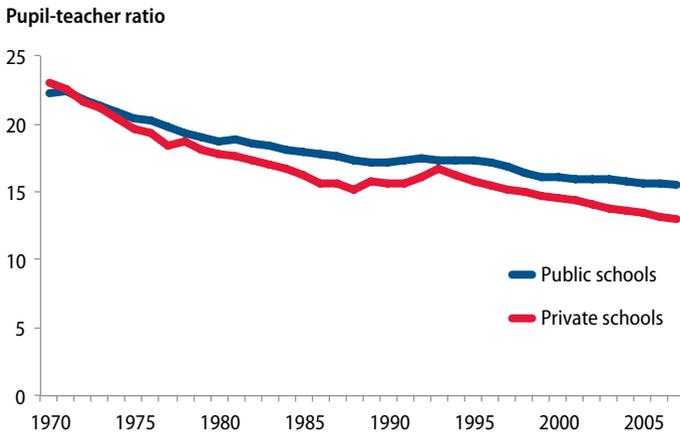
Class-size reduction, or CSR, is enormously popular with parents, teachers, and the public in general. The latest poll results indicate that 77 percent of Americans think that additional educational dollars should be spent on smaller classes rather than higher teacher salaries.<sup>1</sup> Many parents believe that their children will benefit from more individualized attention in a smaller class and many teachers find smaller classes easier to manage. The pupil-teacher ratio is an easy statistic for the public to monitor as a measure of educational quality, especially before test-score data became widely available in the last decade.

Policymakers across the nation, including those in at least 24 states, have taken these ideas to heart and enacted CSR initiatives at costs upward of billions of dollars.<sup>2</sup> California allocated \$1.5 billion per year in the late 1990s to reduce class size in the early grades. Florida has spent about \$20 billion since 2002 reducing class size in every grade from kindergarten through high school.<sup>3</sup> The federal government also has its own program, which provided \$1.2 billion to \$1.6 billion per year from 1999 to 2001 for CSR in grades K–3. This program was absorbed into Title II of the No Child Left Behind Act in 2001.<sup>4</sup>

These policies, coupled with trends in local school districts, have produced a widespread reduction in the number of students per teacher over the past four decades.<sup>5</sup> Figure 1 shows that the pupil-teacher ratio in public schools has fallen by about 30 percent since 1970. This trend partly reflects an increase in educational services to students with disabilities, as required by federal law beginning in 1975.<sup>6</sup> But falling pupil-teacher ratios affected all students, as evidenced by the even steeper drop at private schools (which serve fewer disabled students).<sup>7</sup> The trend at private schools also likely reflects the strong preference of parents for small classes and the greater incentive for private schools to respond to those preferences.

Parents, teachers, and policymakers have all embraced CSR as a strategy to improve the quality of public education. There is surprisingly little high-quality

**FIGURE 1**  
**Pupil-teacher ratio in U.S. public and private schools, 1970-2007**



Source: National Center for Education Statistics, Digest of Education Statistics 2009, Table 64.

research, however, on the effects of class size on student achievement in the United States.<sup>8</sup> The credible evidence that does exist is not consistent, and there are many low-quality studies with results all over the map. The most encouraging results for CSR come from a single experiment conducted in the 1980s, which found that a large reduction in class size in the early grades increased test scores, particularly among low-income and African American students. But evaluations of large-scale CSR policies in California and Florida have yielded much less positive results, perhaps because of the need to hire so many (inexperienced and potentially less effective) new teachers.

The evidence on class size indicates that smaller classes can, in some circumstances, improve student achievement if implemented in a focused way. But CSR policies generally take exactly the opposite approach by pursuing across-the-board reductions in class size at the state or federal level. These large-scale, untargeted policies are also extremely expensive and represent wasted opportunities to make smarter educational investments.

Large-scale CSR policies clearly fail any cost-benefit test because they entail steep costs and produce benefits that are modest at best. But what about reductions in class size at the district or school level? When school finances are limited (as they always are), the cost-benefit test any educational policy must pass is not “Does this policy have any positive effect?” but rather “Is this policy the most productive use of these educational dollars?” Assuming even the largest class-size effects in the research literature, such as the STAR results that indicate that a 32 percent reduction in class size increased achievement by about 15 percent of a year of learning after one year, CSR will still fail this test because it is so expensive. Reducing class size by one-third, from 24 to 16 students, requires hiring 50 percent more teachers. Depending on how much extra space schools have, new facilities may need to be built to accommodate the additional classes.

There are certainly many policies that might be proposed as cost-effective alternatives to CSR, but one set of policies that stand out are those aimed at improving teacher quality. Researchers agree that teacher quality is the single most important in-school determinant of how much students learn.<sup>9</sup> Stanford economist Eric

Hanushek has estimated that replacing the worst 5 percent to 8 percent of teachers with average teachers would dramatically boost achievement in the United States.<sup>10</sup> Investing less in CSR would free up resources that could be used to recruit and retain highly effective teachers. For example, schools might “treat different teachers differently,” or pay teachers differently based on their effectiveness in the classroom or the subject area they teach, as Robin Chait and Raegen Miller have suggested.<sup>11</sup>

The fact that across-the-board CSR policies at the state or district level are not cost-effective does not mean that smaller classes should never be used, but rather that they should be reserved for use in special cases by individual schools. A principal may decide, for example, that a smaller class makes sense for an inexperienced teacher who needs support in developing skills to provide accommodations for students with disabilities. At the same time, the principal may want to assign a larger class to a highly effective veteran teacher, perhaps with some extra compensation for the additional work required. School districts should encourage this kind of creative management and enable it by collecting and providing to principals detailed data on their teachers and the classes they teach.

# The evidence on class-size reduction

The vast majority of class-size studies are not rigorous, so their results are not very useful as a guide to policy. The primary difficulty in studying class size is that schools with different class sizes likely differ in many other, difficult-to-observe ways. More affluent schools are more likely to have the resources needed to provide smaller classes, which would create the illusion that smaller classes are better when in fact family characteristics were the real reason. Alternatively, a school that serves many students with behavior problems may find it easier to manage these students in smaller classes. A comparison of such schools to other schools might give the appearance that small classes produce less learning when in fact the behavior problems were the main factor.

Studies that do not carefully isolate the causal effect of class size (and only class size) produce widely varying results. Stanford's Eric Hanushek compiled 276 estimates of class-size effects from 59 studies, and found that only 11 percent of these estimates indicated positive effects of smaller classes.<sup>12</sup> A similar number (9 percent) were negative, with the remaining 80 percent not statistically distinguishable from zero. Princeton economist Alan Krueger argued for an alternative method of counting the estimates, but this change only increased the proportion of studies showing positive effects to 26 percent, with the majority showing either negative or insignificant effects.<sup>13</sup> One way to interpret these tallies is that class size matters in some circumstances but not others. Another plausible explanation is that unreliable studies produce unreliable results.

The only way to credibly measure the causal effect of class size is to compare students who are in larger or smaller classes for reasons unrelated to their achievement. One way to do this is a controlled experiment, where researchers randomly assign students to smaller and larger classes. The only large-scale class-size experiment carried out in the United States is the Student Teacher Achievement Ratio, or STAR, study, which was conducted in Tennessee during the late 1980s.<sup>14</sup> Beginning with the entering kindergarteners in 1985, students and teachers were randomly assigned to a "small" class, with an average of 15

students, or a “regular” class, with an average of 22 students.<sup>15</sup> Thus the reduction in class size (seven students, or 32 percent) was quite large.

The results of the STAR experiment after one year were encouraging: Students in the small kindergarten classes outperformed students in the regular-size classes on standardized tests by about 15 percent of a year of learning.<sup>16</sup> But this effect did not increase after one year, and decreased by the end of the third grade when the experiment ended.<sup>17</sup> In other words, the calculation of the class-size effect depends enormously on the time frame used. The bump in test scores after one year would be impressive if it didn’t erode over time despite the continued use of small classes.<sup>18</sup>

Students who entered the STAR experiment in later years also saw gains from being in the smaller class that were generally concentrated in the first year of participation. Additionally, the positive effects of class size in Project STAR were largest for black students, economically disadvantaged students, and boys.<sup>19</sup>

The other prominent high-quality study of class size in the United States is Stanford economist Caroline Hoxby’s examination of Connecticut schools using data from the 1980s and 1990s.<sup>20</sup> Hoxby takes advantage of differences in class size that result from random changes in the school-age population. For example, a small school that has 15 first-grade students in one year and 18 the next year would have a larger class during the second year. Additionally, a school that has set a class-size limit of 25 would have one second-grade class of 25 if there were 25 second-grade students but two classes of 13 if there were 26 students. Hoxby finds no relationship between class size and achievement in fourth and sixth grade (which should reflect class size in all previous grades). Hoxby does not even find class-size effects at schools that serve disproportionately large shares of disadvantaged or minority students.

There is no consensus as to how to reconcile these two conflicting studies, but there are several possibilities. First, there are many differences between Connecticut and Tennessee that might make class size a more important factor in the latter state. For example, in 1994–95 Connecticut had the highest-paid teachers in the nation, whereas Tennessee ranked 34th.<sup>21</sup> Perhaps higher salaries attract better teachers and better teachers can teach well regardless of the size of the class.<sup>22</sup> In Project STAR, the class-size effect varied widely by school—the small-class effect was positive in two-thirds of the schools, but negative in the other third.<sup>23</sup> Eric Hanushek has interpreted this finding as evidence that differences in teacher quality are extremely important.<sup>24</sup>

Another potentially important difference between the two studies is that the teachers in Project STAR knew they were part of an experiment, whereas in Connecticut there was no experiment, just data collected and analyzed after the fact. One way this knowledge could affect the results is if STAR teachers assigned to regular-size classes were disappointed and reduced their effort as a result. A final difference worth noting is that STAR did not include smaller schools because they did not have enough students to randomly assign between class types in a single grade, whereas the Connecticut study focuses on small schools because their class sizes are most affected by modest population changes. Thus it could be the case that class size matters more in larger schools than in smaller schools.

Even though these studies cannot be reconciled, the important point is that we just don't know a whole lot about the impact of CSR on student achievement. The two studies of the early grades have conflicting results, and we know little about the later grades. The only high-quality study of class size in middle or high school is Thomas Dee and Martin West's analysis of eighth-graders in a nationally representative data set.<sup>25</sup> Dee and West compare the outcomes of the same students who attended different-size classes in different subjects. They find no impact of class size on test scores (except for a small effect in urban schools), but do find modest effects on noncognitive skills such as student attentiveness and attitudes about learning.

Research on large-scale CSR initiatives suggests that such policies are unlikely to produce the kind of results seen in the STAR experiment. California's late-1990s policy that reduced K–3 class sizes by about 10 students (from 30 to 20, on average) is difficult to evaluate because statewide tests were not administered until after the program began. The most careful study of this multibillion-dollar policy found that it had modest effects on student achievement of 6 percent to 11 percent of a year of learning, some of which were offset by the hiring of inexperienced teachers to lead newly created classes, particularly in the first few years of the policy.<sup>26</sup> Other unintended negative consequences of the California policy included an increase in class size in grades 4 and 5 and the use of multigrade classrooms.<sup>27</sup>

Florida enacted an even broader CSR policy that imposed specific caps on class size in every core-subject classroom in every grade.<sup>28</sup> This policy cost about \$20 billion to implement during its first eight years, with continuing costs of \$4 billion to \$5 billion each subsequent year. In a recent study, I found no evidence that the Florida policy had any impact on test scores in grades 4 through 8, perhaps because class size does not make much of a difference in these grades.<sup>29</sup> I also found no impacts on third-grade scores, which would be affected by class sizes

in grades 1 to 3. The reductions in class size of about two to three students that I examined were smaller than in previous studies, but I didn't find relatively small effects—I found no effects even in the grades that experienced the biggest reductions in class size.

There is clearly a need for more rigorous studies of class size, but two important conclusions emerge from the existing research. First, across-the-board reductions in class size at the state level are likely to yield disappointing results, as was the case in California and Florida. Second, CSR policies pursued at the school or district level may produce larger effects in some circumstances. The Tennessee STAR reduction of class size in the very early grades produced the largest class-size effects. But even if reducing class sizes produces benefits this large, is it worth the cost?

# CSR: The most expensive school reform

The costs of class-size reduction are as certain as the benefits are uncertain. Reducing class size means hiring more teachers and building more classrooms—the public school system’s two primary costs. Reducing class size by one-third, from 24 students to 16 students, requires hiring 50 percent more teachers. Depending on how much extra space schools have, new facilities may need to be built to accommodate the additional classes. And if small classrooms are built to accommodate small classes, schools may be stuck with small classes in the future even if they decide they are not cost-effective.

Consider this example: A school that pays teachers \$50,000 per year (roughly the national average) would save \$833 per student in teacher salary costs alone by increasing class size from 15 to 20.<sup>30</sup> The true savings, including facilities costs and teacher benefits, would be significantly larger. These resources could be used for other purposes. If all of the savings were used to raise teacher salaries, for example, the average teacher salary in this example would increase by \$17,000 to \$67,000.

School finances are—and always will be—finite, so the right way to think about every dollar spent is not “will it have any positive effect?” but “is this the best possible way to spend this dollar?”<sup>31</sup> A hugely expensive policy has to produce very impressive results in order for it to be preferable to all of the other potential uses for those resources. Class-size reduction almost always fails this test because it is too expensive to justify even benefits as large as those suggested by the Tennessee STAR study.

Some advocates of class-size reduction argue that a policy that produces any benefit is worth the cost, but that is only true if there are no alternative policies. There are many educational policies that deserve to be carefully considered in terms of their benefits and costs. The emerging consensus that teacher effectiveness is the single most important in-school determinant of student achievement suggests that teacher recruitment, retention, and compensation policies ought to rank high on the list.

Economists Eric Hanushek and Steven Rivkin reported the results of 10 studies that use student test scores to measure teacher effectiveness.<sup>32</sup> These studies indicate that, on average, a student taught by an above-average teacher—one at the 75th percentile—will learn more than the student of an average teacher by 27 percent to 29 percent of a year’s worth of learning.<sup>33</sup> Hanushek has also estimated that replacing the worst 5 percent to 8 percent of teachers with average teachers would dramatically boost achievement in the United States.<sup>34</sup> In addition to removing chronically ineffective teachers, schools might also change their personnel policies to better reflect market realities. Robin Chait and Raegen Miller have argued that schools should “treat different teachers differently,” for example, and pay teachers differently based on their effectiveness in the classroom or the subject area they teach.<sup>35</sup>

Changing the nature of the teaching profession to make it more responsive to quality would come at a cost. Teachers would need to be paid more to compensate them for the loss of job security. Providing bonuses to teachers in high-need subjects and schools would also consume resources. If these policies are more cost-effective than reducing class size, then increasing class size in order to pursue them would increase student achievement. Rigid across-the-board CSR policies make it impossible for schools to pursue such policies by tying up valuable educational resources.

## Looking ahead

The popularity of class-size reduction may make it difficult for policymakers to pursue more cost-effective policies.<sup>36</sup> State policymakers who are determined to implement CSR policies should target the reductions at students who have been shown to benefit the most: disadvantaged students in the early grades.<sup>37</sup>

But an even better approach would be to let individual schools use small classes as a response to very specific circumstances. An individual principal may decide, for example, that a smaller class makes sense for an inexperienced teacher who needs support in developing skills managing a classroom with several students with behavior problems. At the same time, the principal may want to assign a larger class to a highly effective veteran teacher, perhaps with some extra pay to compensate the teacher for the extra work required. Of course, principals would need to be given the flexibility to make such carefully considered arrangements.

These sorts of efficiency-enhancing decisions should not be limited to innovative principals acting on their own, but should be enabled and encouraged at the district level. Frederick Hess and Jon Fullerton have argued that school districts should collect detailed data not just on expenditures and test-score outcomes (as most now do) but also on other areas such as human capital and finance.<sup>38</sup> Data on the size of every class and the effectiveness of the teacher leading it (as measured using value-added methods or observations) ought to be available to the principal, with the understanding that district administrators also have access to these data and expect the principal to use them. The costs of building such complex data systems are not negligible, but are a small fraction of the cost of CSR.

Looking ahead, education researchers, policymakers, and practitioners might also consider whether there are ways to leverage the intuitive benefits of smaller classes—such as more individualized instruction—without the steep costs and unintended consequences. An important frontier in this regard may be expanding the instructional model to include high-quality computer-enhanced education. A sophisticated piece of software that gives targeted feedback and allows each

student to learn at her own pace would be highly individualized yet could be provided to large numbers of students at a fraction of the cost of a small class.

The idea is not that virtual education could replace traditional education, but that better outcomes might be achieved without an increase in costs through a combination of software-driven and traditional instructional methods. Each method (or a combination of the two) might be used in contexts where it is most advantageous. For example, perhaps some math content could be taught to 30 students in a computer lab with a teacher providing help as needed, which would free up resources to teach reading skills in the traditional way in a smaller class.

Technology-enhanced education is still in its infancy, so its full potential is far from clear, but the important point is that districts (and states) need to think creatively about ways to reallocate resources so that they get the most out of every dollar. In the wake of the economic recession that began in 2008, it has become clear that our nation's public schools must learn to do more with less. CSR policies use up valuable resources that make it difficult for schools to target resources on the students who need them the most, and to pursue cost-effective policies that benefit all students.

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# Endnotes

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- 5 The pupil-teacher ratio is not equivalent to average class size, but the two are related and only pupil-teacher ratio has been recorded for the entire country over a reasonably long period of time.
- 6 The federal law is the Education for All Handicapped Children Act of 1975, which was revised and renamed the Individuals with Disabilities Education Act in 1990.
- 7 For additional evidence that changes in special education do not explain more than a modest share of the fall in the pupil-teacher ratio, see Eric A. Hanushek, "The Evidence on Class Size," in Susan E. Mayer and Paul E. Peterson, ed., *Earning & Learning: How Schools Matter* (Washington: Brookings Institution Press, 1999).
- 8 For examples of high-quality international evidence, see Joshua D. Angrist and Victor Lavy, "Using Maimonides' Rule to Estimate the Effect of Class Size on Scholastic Achievement," *Quarterly Journal of Economics*, 114(2) (1999): 533–575; and Ludger Wößmann and Martin West, "Class-Size Effects in School Systems Around the World: Evidence from Between-Grade Variation in TIMSS," *European Economic Review*, 50(3) (2006): 695–736.
- 9 For a summary of several of these studies, see Eric A. Hanushek and Steven G. Rivkin, "Generalizations about Using Value-Added Measures of Teacher Quality," *American Economic Review*, 100(2) (2010): 267–71.
- 10 Eric A. Hanushek, "The Economic Value of Higher Teacher Quality," National Bureau of Economic Research Working Paper No. 16606 (2010).
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- 14 The seminal analysis of Project STAR is Alan B. Krueger, "Experimental Estimates of Education Production Functions," *Quarterly Journal of Economics*, 115(2) (1999): 497–532.
- 15 A third group was assigned to a regular-size class with a teacher's aide. Having an aide in the classroom had no impact on student achievement.
- 16 The effect size after one year was about 0.2 standard deviations, which is converted to years of learning using the average annual gain in effect size from kindergarten to first grade (averaged for math and reading). Reported in Carolyn J. Hill and others, "Empirical Benchmarks for Interpreting Effect Sizes in Research," *Child Development Perspectives*, 2(3) (2008): 172–177.
- 17 Author's calculations from the Project STAR data. The effect size after three years for students who entered in kindergarten was 0.14 standard deviations. Dividing this effect size by the first four average annual gains in effect size reported by Hill and others (2008) indicates that it corresponds to about 16 percent of a year of learning (i.e., the effect size fell in terms of standard deviations of student test scores, but not in terms of years of learning). Test scores are the average of standardized (mean zero, standard deviation one) reading and math scores. Estimated effects, which are based on the students who entered the experiment in kindergarten, control for school fixed effects and student race, gender, and free lunch receipt.
- 18 For a detailed discussion of this issue, see Eric A. Hanushek, "The Evidence on Class Size," in Susan E. Mayer and Paul E. Peterson, ed., *Earning & Learning: How Schools Matter* (Washington: Brookings Institution Press, 1999).
- 19 The four-year effect sizes (in standard deviations) for the students that entered the study in kindergarten are 0.23 for black students, 0.13 for white students, 0.17 for students eligible for the federal free or reduced-price lunch program, 0.14 for students not eligible for this program, 0.03 for girls, and 0.25 for boys (author's calculations from the Project STAR data using third-grade reading and math test scores). The effects (in standard deviations) on third-grade scores for all students in the STAR experiment who took the third-grade test, including later entrants, were 0.15 for all students, 0.24 for blacks, 0.13 for whites, 0.21 for disadvantaged students, 0.10 for nondisadvantaged students, 0.11 for girls, and 0.18 for boys. These results also control for school-by-entry-wave fixed effects (the level at which randomization occurred).
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- 26 Christopher Jepsen and Steven Rivkin, "Class Size Reduction and Student Achievement: The Potential Tradeoff between Teacher Quality and Class Size," *Journal of Human Resources*, 44(1) (2009): 223–250.

- The effect sizes in school-level standard deviations in their preferred model (columns 4 and 9 of Table 3) ranged from 0.037 to 0.072 in grades 2 and 3. These effect sizes are converted to years of learning using the grade- and subject-specific average annual gains in effect size reported in Hill and others (2008). However, the converted figures probably overstate the amount of student learning because school-level standard deviations tend to be substantially smaller than student-level standard deviations.
- 27 David Sims, "A Strategic Response to Class Size Reduction: Combination Classes and Student Achievement in California," *Journal of Policy Analysis and Management*, 27(3) (2008): 457–478, and David Sims, "Crowding Peter to Educate Paul: Lessons from a Class Size Reduction Externality," *Economics of Education Review*, 28 (2009): 465–473.
  - 28 The maximum class sizes in Florida are 18 in grades PK–3, 22 in grades 4–8, and 25 in grades 9–12.
  - 29 Matthew M. Chingos, "The Impact of a Universal Class-Size Reduction Policy: Evidence from Florida's Statewide Mandate," Program on Education Policy and Governance Working Paper 10-03 (2010).
  - 30 The average teacher salary in the United States is \$51,049 (American Federation of Teachers, "Survey and Analysis of Teacher Salary Trends 2007" (2009)).
  - 31 Some studies calculate cost-effectiveness by comparing the estimated cost of a policy to an estimate of the policy's effects on students' future earnings (over their lifetimes, discounted to the present). A policy that produces more in benefits than it costs is said to be cost-effective, but this type of cost-benefit analysis misses the important point that those costs may have produced even larger benefits had they been spent on a different policy.
  - 32 Eric A. Hanushek and Steven G. Rivkin, "Generalizations about Using Value-Added Measures of Teacher Quality," *American Economic Review*, 100(2) (2010): 267–71.
  - 33 Specifically, they found that having a teacher who is one standard deviation above average (as compared to the average teacher) increases test scores by 0.11 and 0.15 standard deviations in reading and math, respectively. I convert these estimates to years of learning (after adjusting for the fact that the 75<sup>th</sup> percentile is about 0.7 standard deviations above the mean) by dividing by the average of the average annual gains in effect size from grades 4 to 8 (the grades often covered by value-added studies) reported in Hill and others (2008).
  - 34 Eric A. Hanushek, "The Economic Value of Higher Teacher Quality," National Bureau of Economic Research Working Paper No. 16606 (2010).
  - 35 Robin Chait and Raegen Miller, "Treating Different Teachers Differently" (Washington: Center for American Progress, 2010).
  - 36 But perhaps citizens would feel differently if they understood the costs of smaller classes and the tradeoffs with other policies that they favor—tradeoffs that are particularly salient in the current economic climate. This past November, 55 percent of voters in Florida voted to modestly scale back their CSR policy (but were unable to because the threshold to amend the state constitution is 60 percent).
  - 37 State governments may also wish to impose maximum class sizes that are based on safety considerations, such as the maximum number of children that can safely fit into a classroom. Children, who are required by law to attend school, should not be placed with 40 other students in a classroom designed for 25 or 30, but such horror stories also should not be used as justification for reducing class size from 25 to 23 across an entire state at a cost of billions of dollars.
  - 38 Frederick M. Hess and Jon Fullerton, "Balanced Scorecards and Management Data," working paper, Center for Education Policy Research (2009).

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## About the author

Matthew M. Chingos is a Fellow in the Brown Center on Education Policy at the Brookings Institution and a Postdoctoral Fellow at the Program on Education Policy and Governance at Harvard University. He studies education politics, economics, and policy at both the K–12 and postsecondary levels. Chingos’s first book, *Crossing the Finish Line: Completing College at America’s Public Universities*, coauthored with William G. Bowen and Michael S. McPherson, was published by Princeton University Press in 2009. His current research examines teacher labor markets, class-size reduction policies, citizen perceptions of school quality, technology-enhanced learning, and the college choices of low-income students. Chingos received a B.A. in Government and Economics and a Ph.D. in Government, both from Harvard University.

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