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## RESEARCH-BASED OPTIONS FOR EDUCATION POLICYMAKING

### The Effectiveness of Class Size Reduction

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Ask a parent if they want their child in a class of 15 or a class of 25. The answer is predictable. Intuitively, they know that smaller classes will provide more personalized attention, a better climate, and result in more learning. Ask teachers, and they will wax eloquent on the importance of small classes in providing individual support to their students. But ask a school board or district administrator, contending with a tight budget. They ask if the average class size can be a bit bigger.

Teacher pay and benefits are the largest single school expenditure, representing 80% of the nation's school budgets.<sup>1</sup> Thus, small class size is a costly, important, contentious and perennial issue.

### The Research on Class Size

There are many studies of the impact of smaller classes and they vary widely in quality.<sup>2</sup> As a result, proponents from all perspectives can cherry-pick studies that support their point of view.

But let's look closer. There is, in fact, an independent consensus on what we know:

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One of the earliest influential meta-studies was by Glass and Smith in 1979.<sup>3</sup> They statistically analyzed 300 reports involving almost 900,000 students. Once the class size fell below about 15, learning increased progressively as class size became smaller.

The most prominent study supporting smaller class sizes was the Tennessee STAR (Student/Teacher Achievement Ratio) experiment. The STAR experiment was a four-year statewide random-assignment experiment. Students in Kindergarten in the same schools were randomly assigned to classes of 13-15; to classes of 22-25 with a teacher's aide; or to classes of 25 without a teacher's aide. In the early studies, these students were followed through grade 3. In practice, the small classes ranged in size from 13-18 and the large classes from 22-28. It is worth noting that even the larger classes were smaller than most classes in those grades in Tennessee at the time. The smaller classes performed substantially better by the end of second grade in test scores, grades, and fewer disciplinary referrals.<sup>4</sup>

The gains lasted. The students that had been assigned to smaller classes were more likely to graduate in four years, more likely to go to college, and more likely to get a degree in a STEM field. The positive effect was twice as large for poor and minority students, and thus narrowed the achievement gap. The original STAR study and follow-up reports, called the *Lasting Benefits Studies*, and subsequent *Project Challenge*<sup>5</sup> had an impact in the political arena. President Bill Clinton proposed a \$12 billion class size reduction program in his 1998 State of the Union address that was subsequently adopted by Congress.

Molnar *et al.* (1996-2001), in a well-designed series of five annual evaluations of the Wisconsin SAGE (Student Achievement Guarantee in Education) class size reduction program utilizing a quasi-experimental design, reproduced the STAR results.<sup>6</sup> With class sizes of 15, they found significant and substantial effect sizes of 0.2 standard deviations, indicating that class size was a very effective school improvement strategy. Gains were greatest for African-American students, and teachers reported better classroom climates and fewer discipline problems. The continuation of small class sizes into the higher grades increased its impact. But cost considerations resulted in class size reduction activities being concentrated in the lower grades, mostly among economically deprived and children of color.<sup>7</sup>

Over the years, Erik Hanushek of the Hoover Institute has taken a more skeptical look. He performed a "meta-analysis" of 277 studies in 1997, claiming that class size reduction was not an effective school reform strategy. He argued that class sizes have dropped over the last half of the twentieth century with no corresponding increase in achievement scores.<sup>8</sup> In summary,

Surely class size reductions are beneficial in specific circumstances —for specific groups of students, subject matters, and teachers. Second, class size reductions necessarily involve hiring more teachers, and teacher quality is much more important than class size in affecting student outcomes. Third, class size reduction is very expensive, and little or no consideration is given to alternative and more productive uses of those resources.<sup>9</sup> (p. 5)

Hanushek's analysis was criticized on methodological grounds in that he gave more weight to studies that showed no impact from lowering class size, while also treating weak studies as equivalent to those that were experimental and/or of much higher quality. He was also questioned about his claim that teacher quality was more important than class size in affecting student outcomes. Moreover, in re-analyzing the Tennessee STAR data, Alan Krueger not only concluded that class size reduction had economic benefits that outweighed the costs, and even within the large cohort of 22 to 25 students, the smaller the class, the better

the student outcomes.<sup>10</sup> Mosteller also reported sustained effects and “the effect size for minorities was about double that for majorities.”<sup>11</sup>

Krueger noted, as have many others, that class size reduction most benefits minority and disadvantaged students, and would be expected to narrow the racial achievement gap by about one-third. He also estimated that the economic gains of smaller classes in the early grades outweighed the costs two to one.<sup>12</sup> While experimental studies have not been done for the middle and upper grades, there are many controlled studies, including longitudinal studies, showing gains in student outcomes for smaller classes at these grade levels.<sup>13</sup> Many of these studies also show improvements in student engagement, lower drop-out rates and better non-cognitive skills. One longitudinal study revealed that smaller classes in eighth grade led to improvements in persistence and self-esteem, and that for urban schools, the economic benefits from investing in smaller classes would likely save nearly twice the cost. A study done for the US Department of Education analyzed the achievement levels of students in 2,561 schools, as measured by performance on the NAEP (national) exams. After controlling for student background, the only objective factor found to be positively correlated with student performance was class size. Student achievement was even more strongly linked to smaller classes in the upper grades.<sup>14</sup>

In recent work (2015), Jackson, Johnson and Persico investigated the effects of school finance reform in 28 states. They followed the infusion of new money between 1970 and 2010, and found, “...a 10% increase in per-pupil spending each year for all 12 years of public school leads to 0.27 more completed years of education, 7.25 percent higher wages, and a 3.67 percentage-point reduction in the annual incidence of adult poverty .” They concluded that the gains were achieved primarily by lower student-to-teacher ratios, increases in teacher salaries, and longer school years. Gains were strongest for economically disadvantaged children and were sufficient to eliminate from two-thirds to one hundred percent of the adult outcome gaps (i.e. - wages, education level, percent in poverty) between those raised in poor and non-poor families.<sup>15</sup>

Overall, the literature on class size reduction is clear and positive. The “overwhelming majority” of peer-reviewed papers find it an effective strategy.<sup>16</sup>

## Further Policy Considerations

### Supply of Teachers

An oft-heard reservation about class-size reduction is that there are not enough well-qualified teachers to make the system work. However, in California’s billion dollar Class Size Reduction initiative, achievement increased for all groups, but there was little or no evidence that the need to hire more teachers led to lower quality teachers in the long run. When the Los Angeles Unified School District needed to triple its hiring of elementary teachers following the state’s class-size reduction initiative, there was no reduction in mean teacher effectiveness.<sup>17</sup> In addition, some studies point to lower teacher attrition rates when class sizes are reduced, which would likely lead to a more experienced and effective teaching force overall.<sup>18</sup>

## Wash-Out Effects

Most of the research has been conducted in the early grades (K-3). This led some to questioning whether the effects are lasting or are cost-effective.<sup>19</sup> Though Harris contended the effects wash out by seventh grade,<sup>20</sup> Krueger and Schanzenbach found gains in college entrance exams and especially among minority students. In fact, they concluded that small classes through eighth grade cut the achievement gap by 54%.<sup>21</sup> Dynarski, *et al.* found gains in college attendance, graduation rate, and a higher likelihood of graduating with a STEM degree.<sup>22</sup> Jackson, Johnson and Persico found sustained long-term social and economic effects in their 28-state work. Chetty, *et al* found that students from smaller classes in kindergarten had a greater likelihood of attending college, owning a home and holding a 401K more than 20 years later.<sup>23</sup>

## Non-Cognitive Effects

In addition to the gains listed above, college attendance, graduation rate, student engagement, persistence and self-esteem is reported as higher.<sup>24</sup> The gains in test scores are attributed to the greater individualization of instruction, better classroom control and, thus, better climate. Teachers have more time for individual interactions with children, consulting with parents, and giving greater attention to grading papers.<sup>25</sup>

## As Compared to Other Reforms

There is little evidence indicating that other reforms would be more effective at a lower cost.<sup>26</sup> While teacher quality is undoubtedly important, those who argue that improving teacher quality would be more cost-effective present no comparative data from experimental or controlled studies.

## Recommendations<sup>27</sup>

- Class size is an important determinant of student outcomes, and one that can be directly determined by policy. All else being equal, lowering class sizes will improve student outcomes.
- The payoff from class-size reduction is greater for low-income and minority children. Conversely, increases in class size are likely to be especially harmful to these populations -- who are already more likely to be subjected to large classes.
- While lowering class size has a demonstrable cost, it may prove the more cost-effective policy overall particularly for disadvantaged students. Money saved today by increasing class sizes will likely result in additional substantial social and educational costs in the future.<sup>28</sup>
- Generally, class sizes of between 15 and 18 are recommended but variations are indicated. For example, band and physical education may require large classes while special education and some laboratory classes may require less.

## Notes and References

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- 1 *Public School Expenditures* (2016, May). Washington, DC: National Center for Education Statistics. Retrieved May 26, 2016, from [http://nces.ed.gov/programs/coe/indicator\\_cmb.asp](http://nces.ed.gov/programs/coe/indicator_cmb.asp)
- 2 Glass, G.V., & Smith, M.L. (1979). Meta-analysis of research on class size and achievement. *Educational Evaluation and Policy Analysis*, 1(1), 2-16.  
  
Chingos, M. & Whitehurst, G. (2011). *Class Size: What research says and what it means for state policy*. Washington, DC: Brown Center on Education Policy at the Brookings Institution. Retrieved May 28, 2016, from <http://www.brookings.edu/research/papers/2011/05/11-class-size-whitehurst-chingos>
- 3 Glass, G.V., & Smith, M.L. (1979). Meta-analysis of research on class size and achievement. *Educational Evaluation and Policy Analysis*, 1(1), 2-16.
- 4 Finn, J.D. & Achilles, C.M. (1999). Tennessee's class size study: Findings, implications, and misconceptions. *Educational Evaluation and Policy Analysis*, 21(2), 97-110.
- 5 Mostellar, F.(May 2008). The Tennessee Study of Class Size in the Early School Grades. *The Future of Children*. pp 113-126. Retrieved June 8, 2016, from [https://www.princeton.edu/futureofchildren/publications/docs/05\\_02\\_08.pdf](https://www.princeton.edu/futureofchildren/publications/docs/05_02_08.pdf)
- 6 Molnar, A., Smith, P., Zahorik, J., Palmer, A., Halbach, A., & Ehrle, K. (1999). Evaluating the SAGE program: A pilot program in targeted pupil-teacher reduction in Wisconsin. *Educational Evaluation and Policy Analysis*, 21(2), 165-77. Retrieved May 28, 2016, from <http://eps1.asu.edu/sage/documents/evalsage.pdf>  
  
Maier, P., Molnar, A., Percy, S., Smith, P., & Zahorik, J. (1997, December). *First Year Results of the Student Achievement Guarantee in Education Program*. Milwaukee, WI: Center for Education Research, Analysis, and Innovation. Retrieved June 7, 2016, from <http://nepc.colorado.edu/publication/first-year-results-student-achievement-guarantee-education-program>  
  
Molnar, A., Smith, P., & Zahorik, J. (1998, December). *1997-98 Evaluation Results of the Student Achievement Guarantee in Education (SAGE) Program*. Milwaukee, WI: Center for Education Research, Analysis, and Innovation. Retrieved June 7, 2016, from <http://nepc.colorado.edu/publication/1997-98-evaluation-results-student-achievement-guarantee-education-sage-program>  
  
Molnar, A., Smith, P., & Zahorik, J. (1999, December). *Evaluation Results of the Student Achievement Guarantee in Education (SAGE) Program, 1998-99*. Milwaukee, WI: Center for Education Research, Analysis, and Innovation. Retrieved June 7, 2016, from <http://nepc.colorado.edu/publication/1998-99-evaluation-results-of-student-achievement-guarantee-education-sage-program>  
  
Zahorik, J., Smith, P., & Molnar, A. (2000, December). *1999-2000 Evaluation Results of the Student Achievement Guarantee in Education (SAGE) Program*. Milwaukee, WI: Center for Education Research, Analysis, and Innovation. Retrieved June 7, 2016, from <http://nepc.colorado.edu/publication/1999-2000-evaluation-results-student-achievement-guarantee-education-sage-program>  
  
Molnar, A., Smith, P., & Zahorik, J. (2001, December). *2000-2001 Evaluation Results of the Student Achievement Guarantee in Education (SAGE) Program*. Milwaukee, WI: Center for Education Research, Analysis, and Innovation. Retrieved June 7, 2016, from <http://nepc.colorado.edu/publication/2000-2001-evaluation-results-student-achievement-guarantee-education-sage-program>
- 7 Betts, J.R. & Shkolnik, J.L. (1999). The behavioral effects of variations in class size: The case of math teachers. *Educational Evaluation and Policy Analysis*, 21(2), 193-213.  
  
Rice, J.K. (1999). The impact of class size on instructional strategies and the use of time in high school mathematics and science courses. *Educational Evaluation and Policy Analysis*, 21(2), 215-229.
- 8 Hanushek, E. (1997). Assessing the Effects of School Resources on Student Performance: An Update. *Educational Evaluation and Policy Analysis*, 19(2), 141-164.
- 9 Hanushek, E. (February 1998). *The evidence on class size*. Occasional Paper Number 98-1. Wallis Institute of Political Economy. University of Rochester. Retrieved May 28, 2016, from <http://hanushek.stanford.edu/>

sites/default/files/publications/Hanushek%201998%20HouseTestimony%20Class%20Size.pdf

Hanushek, E. (2002). Evidence, Politics and the Class Size Debate. In L. Mishel & R. Rothstein (Eds.), *The Class Size Debate*. Washington, DC: Economic Policy Institute. Retrieved June 5, 2016, from <http://hanushek.stanford.edu/sites/default/files/publications/Hanushek%202002%20ClassSizeDebate.pdf>

- 10 Krueger, A. (2002) *Economic Considerations and Class Size*. NBER Working Paper No. 8875. Retrieved June 5, 2016, from <http://www.nber.org/papers/w8875>
- 11 Mostellar, F. (2008, May). The Tennessee Study of Class Size in the Early School Grades. *The Future of Children*, 5(2), 117. Retrieved June 8, 2016, from [https://www.princeton.edu/futureofchildren/publications/docs/05\\_02\\_08.pdf](https://www.princeton.edu/futureofchildren/publications/docs/05_02_08.pdf)
- 12 Krueger, A. (2002). A Response to Eric Hanushek's "Evidence Politics, and the Class Size debate." In L. Mishel & R. Rothstein (Eds.), *The Class Size Debate*. Washington, DC: Economic Policy Institute. Retrieved June 5, 2016, from <http://hanushek.stanford.edu/sites/default/files/publications/Hanushek%202002%20ClassSizeDebate.pdf>
- 13 Dustmann, C., et al. (2015). Class Size, Education and Wages. *Journal of Labor Economics* 33(3), 711-750.  
Fredriksson, P., Öckert, B., & Oosterbeek, H. (2011). *Long-Term Effects of Class Size*. IZA Discussion Paper # 5879. Retrieved June 6, 2016, from <http://ftp.iza.org/dp5879.pdf>  
Babcock, P. & Betts, J. (2009). Reduced Class Distinctions: Effort, Ability, and The Education Production Function. *Journal of Urban Economics*, 65, 314-322. Retrieved June 6, 2016, from <http://econweb.ucsd.edu/~jbetts/Pub/A60%20babcock%20and%20betts%20JUE%202009.pdf>  
Blatchford, P., Bassett, P., & Brown, P. (2008). *Do low attaining and younger students benefit most from small classes? Results from a systematic observation study of class size effects on pupil classroom engagement and teacher pupil interaction*. Paper delivered to the American Educational Research Association Annual Meeting, New York. Retrieved June 6, 2016, from [http://www.classsizematters.org/wp-content/uploads/2011/04/Blatchford\\_2008.pdf](http://www.classsizematters.org/wp-content/uploads/2011/04/Blatchford_2008.pdf)
- 14 McLaughlin, D. & Drori, G. (2000). *School-Level Correlates of Academic Achievement: Student Assessment Scores in SASS Public Schools*. U.S. Department of Education. National Center for Education Statistics NCES 303. Retrieved June 6, 2016, from <http://nces.ed.gov/pubs2000/2000303.pdf>
- 15 Jackson, C.K., Johnson, R.C., & Persico, C. (2015). *The effects of school spending on educational and economic outcomes: Evidence from school finance reforms* (No. w20847). Cambridge, MA: National Bureau of Economic Research. Retrieved June 1, 2016, from <http://www.nber.org/papers/w20847>
- 16 Zyngier, D. (2014). Class size and academic results, with a focus on children from culturally, linguistically and economically disenfranchised communities. *Evidence Base 2014(1)*. Retrieved June 5, 2016, from <http://www.classsizematters.org/wp-content/uploads/2014/05/EvidenceBase2014Issue1.pdf>
- 17 Jepsen, C. & Rivken, S.(2009). Class Reduction and Student Achievement: The Potential Tradeoff between Teacher Quality and Class Size. *Journal of Human Resources*, 44(1), 223-250.  
Gordon, R., Kane, T. and Staiger, D. (April 2006). *Identifying Effective Teachers Using Performance on the Job*. Hamilton Project, Retrieved June 6, 2016 from [http://www.brookings.edu/views/papers/200604hamilton\\_1.pdf](http://www.brookings.edu/views/papers/200604hamilton_1.pdf)
- 18 Isenberg, E. (2010, February), *The Effect Of Class Size On Teacher Attrition: Evidence From Class Size Reduction Policies In New York State*, US Census Bureau Center for Economic Studies, Paper No. CES-WP-10-05.  
Bohrnstedt, G. & Stecher, B. (2002, September). *What We Have Learned About Class Size Reduction in California, Technical Appendix, APPENDIX C: Class Size Reduction and Teacher Migration*. Retrieved June 6, 2016, from [http://www.classiz.org/techreport/CSRYear4\\_final.pdf](http://www.classiz.org/techreport/CSRYear4_final.pdf)
- 19 Clinton Demands \$1.4 Billion to Reduce Class Size. (1999, April). *Education Reporter*, 159. Retrieved May 30, 2016, from [http://www.eagleforum.org/educate/1999/apr99/class\\_size.html](http://www.eagleforum.org/educate/1999/apr99/class_size.html)
- 20 Harris, D. (2007). Class Size and School Size: Taking the Trade-Offs Seriously, In Frederick Hess and Tom Loveless (Eds.), *Brookings Papers on Education Policy 2006-2007* (137-61). Washington, DC: Brookings

Institution.

- 21 Krueger, A. & Whitmore, D. (2000, April). *The Effect of Attending a Small Class in the Early Grades on College-Test Taking and Middle School Test Results: Evidence from Project STAR*. Working Paper 7656. Retrieved May 30, 2016, from <http://www.nber.org/papers/w7656>
- 22 Dynarski, S., Hyman, J. & Schanzenbach, D. (2011, October 16). *Experimental Evidence on the Effect of Childhood Investments on Postsecondary Attainment and Degree Completion*. Retrieved June 5, 2016, from <http://www.classsizematters.org/wp-content/uploads/2012/10/dynarski-120426.pdf>
- 23 Chetty, R., et al. (2010, September). How Does Your Kindergarten Classroom Affect Your Earnings? Evidence from Project Star. *The Quarterly Journal of Economics*, 126(4), 1593-1660. Retrieved June 6, 2016, from <http://qje.oxfordjournals.org/content/126/4/1593.full>
- 24 Dee, T. & West, M. (2011). The Non-Cognitive Returns to Class Size. *Educational Evaluation and Policy Analysis*, 33(1), 23-46.
- 25 Maier, P., Molnar, A., Percy, S., Smith, P., & Zahorik, J. (1997). *First Year Results of the Student Achievement Guarantee in Education Program*. Retrieved May 30, 2016, from [http://nepc.colorado.edu/files/yearend97\\_o.pdf](http://nepc.colorado.edu/files/yearend97_o.pdf)
- 26 Chingos, M. & Whitehurst, G. (2011, May 11). *Class Size: What Research Says and What it Means for State Policy*. Washington, DC: Brookings Institute. Retrieved June 5, 2016, from <http://www.brookings.edu/research/papers/2011/05/11-class-size-whitehurst-chingos>
- 27 Schanzenbach, D.W. (2014). *Does Class Size Matter?* Boulder, CO: National Education Policy Center. Retrieved May 30, 2016, from <http://nepc.colorado.edu/publication/does-class-size-matter>
- 28 Schanzenbach, D.W. (2014). *Does Class Size Matter?* Boulder, CO: National Education Policy Center. Retrieved May 30, 2016, from <http://nepc.colorado.edu/publication/does-class-size-matter>

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