

# The Right Size for Learning:

## Class Sizes in Massachusetts

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### Introduction

All young people deserve to learn in supportive classrooms that enhance their full academic, social, and personal development. Smaller class sizes are one way to help teachers provide supports tailored to each student's individual needs. In fact, many effective educational programs – high quality preschool, effective summer learning programs, and the Commonwealth's hands-on vocational schools – rely on using smaller classes.<sup>1</sup>

It is important to note, however, that class size reduction efforts have not always been well implemented. There have been both prominent successes and costly initiatives that did not achieve positive results as intended.

The aims of class size reductions are straightforward. First, reducing class sizes can allow more individualized support and attention to students. Second, smaller class sizes can make classrooms more manageable for teachers leading to more time on task and fewer disruptions.

This report explores the connection between class size and student learning, distills key principles to inform policy debates, compares current class sizes in Massachusetts with optimum sizes identified by leading research, and provides estimates for what it would cost to bring class sizes down to these levels in targeted districts.

### Evidence from Class Size Reduction Efforts Across the Country

Research on the relationship between class size and student success has identified several key insights.<sup>2</sup> These can be distilled to four main principles:

1. **Target the early grades.** Class size reductions have been most effective with early elementary classes, lowering class sizes for students in kindergarten through 3<sup>rd</sup> grade. In particular, children in kindergarten and 1<sup>st</sup> grade classes have benefited the most from smaller class sizes. This is in part because more individual attention from teachers can be most beneficial for students during the critical early elementary years where basic academic concepts, social skills, and school behavior are formed.<sup>3</sup>



ROADMAP TO  
Expanding Opportunity  
Evidence on What Works in Education

The promise of a high-quality education leading to opportunity and shared prosperity for all children is a deeply held value in Massachusetts. Despite a record of prominent successes, however, our Commonwealth has struggled to provide students from all backgrounds the supports necessary for long-term life success. To confront this challenge, the Massachusetts Budget and Policy Center and the Rennie Center for Education Research & Policy are undertaking this shared research project: the *Roadmap for Expanding Opportunity: Evidence on What Works in Education*.

This series of reports builds on progress initiated with the Education Reform Act of 1993, addressing critical areas in which progress has stalled. Ultimately, this project will provide a roadmap for bringing education reform into the 21<sup>st</sup> century. Reports will examine promising evidence-based strategies for supporting all children in achieving college, career, and life success. In particular, analyses will be grounded in a recognition that learning must extend beyond traditional school structures and offerings.

Reports will offer strategies for adapting a broad evidence base to local contexts, including cost analyses to assess the level of resources required to support district and statewide innovation. Ultimately, these briefs are designed to provide education leaders and practitioners with building blocks for driving future educational reforms across the Commonwealth.

2. **Target students with the greatest need.** While all students can benefit from smaller classes, there is evidence that students of color and low-income students particularly benefit from well-designed class size reductions. In some cases these students have experienced much greater positive impact.
3. **Ensure that classes are staffed with strong teachers.** Reducing class sizes often involves hiring additional teachers, and it is critical to ensure these new teachers are highly qualified. When California implemented a statewide class size reduction plan, they did not get the intended results, in part because they staffed up with under-qualified teachers. Rushed implementation in California also led districts to use inferior facilities as new classrooms.
4. **Combine class size reductions with other effective school practices.** Class size reductions are most effective when they are part of larger school reform efforts, combining them with other effective practices. These practices include appropriate teacher training and support, increased learning time that provides additional enrichment and academic opportunities, and services that address the non-academic social barriers that students face outside of the classroom.

## Case Studies on Class Size Reduction

### *1) Tennessee Project STAR – A Well-Designed Small Class Size Program*

Perhaps the best studied class size reduction program is the Student Teacher Achievement Ratio project (Project STAR) undertaken in the 1980s in Tennessee. Project STAR supported small class sizes for early elementary students (kindergarten to 3<sup>rd</sup> grade) over four years. Research on this effort has consistently found positive academic improvement for kids whose classes were reduced to roughly 15 students. Kids in these smaller classes continued to do better throughout the later grades and also did better on college entrance exams. The positive impacts were greatest for low-income students, students of color, and those in urban schools.

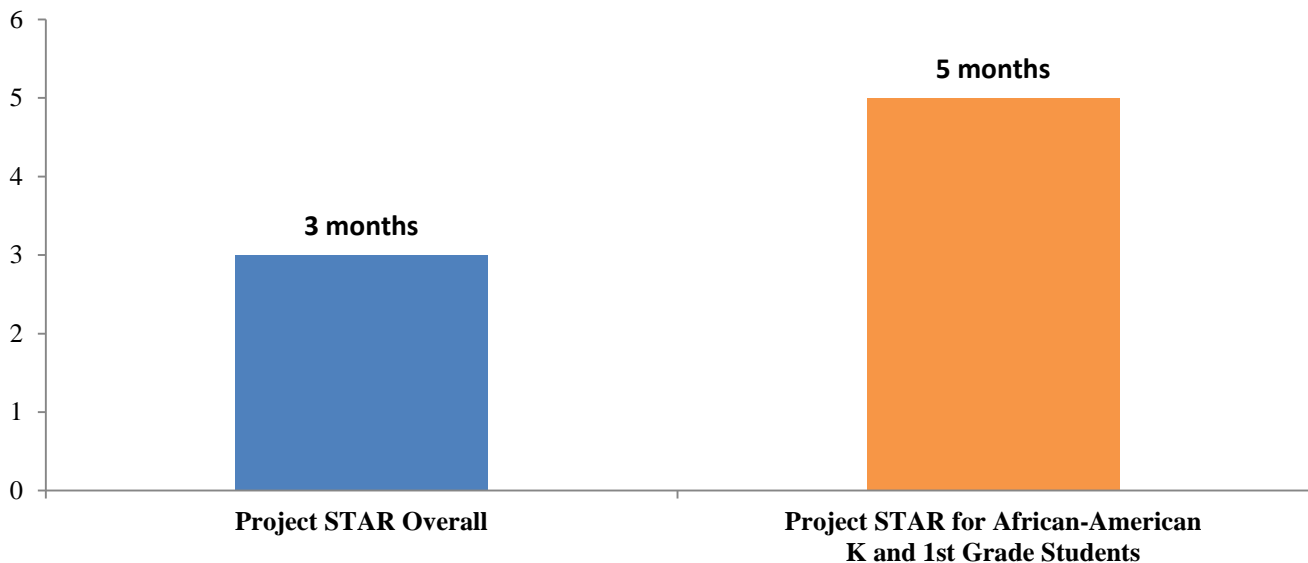
Project STAR was designed and implemented in a way that allowed researchers to clearly identify the impact of smaller class sizes. Project STAR had a fairly representative mix of students across Tennessee including roughly 12,000 kids in more than 40 school districts in inner-city, suburban, and rural areas.<sup>4</sup> Since it was a demonstration study, it received significant state investment, \$12 million (\$27 million in current dollars) but did not go in effect across all of Tennessee.<sup>5</sup> The STAR program allowed the most rigorous evaluation because it randomly assigned teachers and students to either large classes with 22 to 26 students or small classes with 13-17 students.<sup>6</sup> This ensured that any differences in academic performance could be attributed to smaller classes.

STAR students randomly assigned to small classrooms gained the equivalent of roughly 2-3 months of learning in reading and math.<sup>7</sup> The gains from small classes in Project STAR for students of color was twice the overall average in kindergarten and 1<sup>st</sup> grade, roughly equal to five months of additional academic growth.<sup>8</sup> However, the additional gains for African-American kids were similar to others by 2<sup>nd</sup> and 3<sup>rd</sup> grade. The benefits of small classes in STAR were greater for low-income, African-American, and inner-city students, and these additional benefits were present for each of these groups independently when controlling for the other variables.<sup>9</sup>

Additionally, this immediate boost from small classes lasted over time. A five year follow-up study found that having been in Project STAR small classes had a similar effect five years later as it did when students were directly participating in smaller classes.<sup>10</sup> Gains in reading, math, and science persisted through 8th grade.<sup>11</sup> Benefits were also greatest for students who had been in small classes for more years during kindergarten through 3<sup>rd</sup> grade.

## Small Class Sizes in Project STAR Benefited Youth – Particularly Students of Color

Math & Reading Test Score Gains Compared to Control Group, in Months of Learning



Sources: Mostellar 1995, Hill et. al 2007

The positive long-term impact of Project STAR also improved college preparation. The share of high school seniors taking college entrance exams was 10 percent greater for those who were in smaller classes a decade earlier. ACT scores were also higher for these students, particularly African-Americans.<sup>12</sup>

### 2) California's Class Size Reductions – A Cautionary Tale

Attempting to build on the success of Project STAR in Tennessee, the state of California in the 1990s implemented a large-scale statewide class size reduction plan to boost achievement for early elementary students. Instead of replicating the effective program features in Tennessee, however, the California initiative was staffed by lower quality teachers, was poorly targeted, and didn't significantly reduce class sizes. It ultimately failed to deliver the same results.

California's class size reduction program was at significantly greater scale than Project STAR. The state allocated up to \$1.5 billion annually from 1996 to 2002 to reduce class sizes.<sup>13</sup> The level of funding, which made it one of the largest education reforms in the state's history, reflected the goal of making small classes the norm across California. This was in contrast to starting with a small to medium scale demonstration study as happened with the \$26 million dollar program in Tennessee.

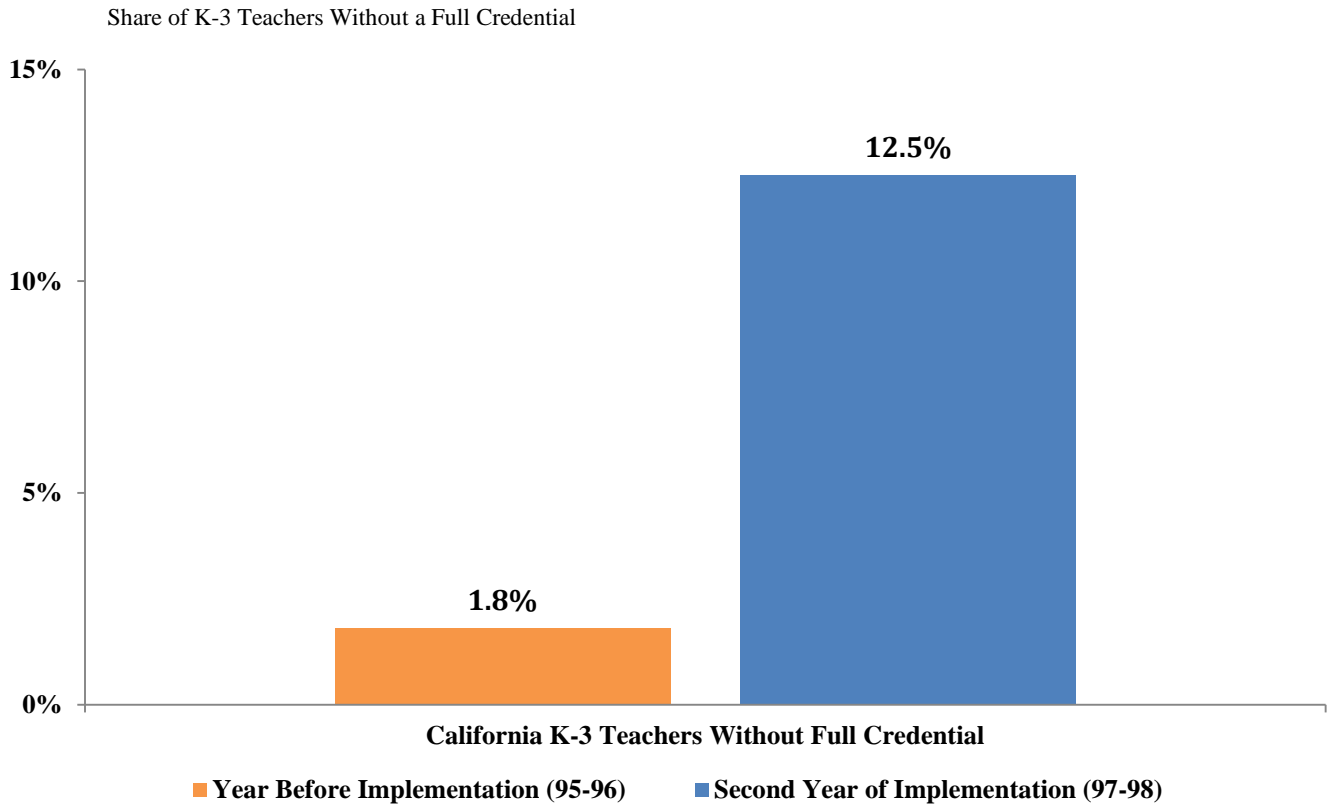
The California class size reduction program failed to deliver results for a few key reasons, including:

- The class size reductions resulted in lower quality teachers and facilities.** The class size program created a need to hire 29,000 teachers in four years.<sup>14</sup> This led to a large increase in under-qualified teachers. The share of kindergarten to 3<sup>rd</sup> grade teachers who were not fully credentialed increased by a factor of seven (from 1.8% to 12.5%).<sup>15</sup> When the initiative was fully implemented, one in five teachers in schools with large populations of low-income students was under-qualified.<sup>16</sup> The plan also created a need for 18,000 new classrooms. This led to use of inadequate makeshift facilities, such as libraries and

auditorium stages, and the repurposing of space away from other services such as special education, arts, and after-school.<sup>17</sup>

- **Class sizes were not reduced enough to make a difference for participating schools.** California gave flat grants of slightly over \$1,000 per-student (2015 dollars) once districts reached the goal of class sizes of 20 or fewer.<sup>18</sup> This approach failed to provide the support to achieve the significantly smaller class sizes attained by students in Tennessee. California’s definition of small classes as 20 or fewer students was only 2 students below the range for large classes in the Tennessee study, which featured reduced class sizes 33 percent smaller.<sup>19</sup>
- **The initiative was not targeted to support the students most in need.** Given that districts received funding only after reaching the smaller class size benchmark, the program more rapidly benefited relatively affluent cities and towns that could already afford lower class sizes.<sup>20</sup> Lower income districts, the most in need of additional funding and support lagged behind on implementing smaller classes.<sup>21</sup> Districts serving more low-income and immigrant youth faced the most overcrowded classrooms, lacked adequate facilities to reduce classes, and struggled to find additional teachers who were certified to serve English learners.<sup>22</sup> On average, districts with more students of color received less class size reduction grant funding.<sup>23</sup>

### California’s Class Size Program Lowered Teacher Quality



Source: Bohrnstedt and Stecher, 2002

In the first two years of implementation, California students in these smaller classes realized little measurable achievement gains.<sup>24</sup> There were no better results from smaller classes for students who were academically behind, English language learners, or low-income students. However, there was a slight benefit of smaller class sizes for African-American students.<sup>25</sup>

These disappointing results provide a cautionary tale. Class size reductions should be implemented with well prepared and supported teachers. Policymakers should implement these efforts at reasonable scale and over several years, in a way that prioritizes the students most in need of additional support. Smaller class sizes also should be made available along with adequate facilities.

### ***3) Wisconsin Project SAGE – Combining Small Class Sizes with Other Effective Practices***

Other small class size initiatives have been more successful. For instance, Wisconsin's Project SAGE (Student Achievement Guarantee in Education), initiated in 1996, effectively used smaller class sizes to improve the achievement of low-income students. The Wisconsin effort did more than just reduce class sizes. It combined smaller class sizes with effective teacher development and other supportive school practices. Project SAGE much more effectively targeted these services to benefit low-income youth.

A diverse range of districts participated in Project SAGE, including urban areas (such as Green Bay, Madison, and Milwaukee), and 18 smaller districts.<sup>26</sup> Eligible school districts had to have at least one school with over half low-income students and eligible schools had to have at least 30 percent low-income students.<sup>27</sup> These districts received up to \$2,800 per student to implement smaller classes and total program funding reached \$23 million annually (\$33 million in current dollars) when it was fully implemented in 1999.<sup>28</sup> The program was rolled out gradually, starting with kindergarten and 1<sup>st</sup> graders, then expanding as students progressed to serve 2<sup>nd</sup> and 3<sup>rd</sup> graders. Project SAGE reached an average of 3,700 students per-year over the initial five years.<sup>29</sup>

Project SAGE combined smaller early elementary class sizes in low-income schools with several other elements including teacher professional development, rigorous curriculum, and increased learning time and other social supports.<sup>30</sup> SAGE classrooms had 15 students per teacher, lowering averages by close to ten students, consistent with Tennessee's Project STAR.<sup>31</sup> SAGE schools also used curriculum identified by teacher and administrator associations as setting ambitiously high academic standards.<sup>32</sup>

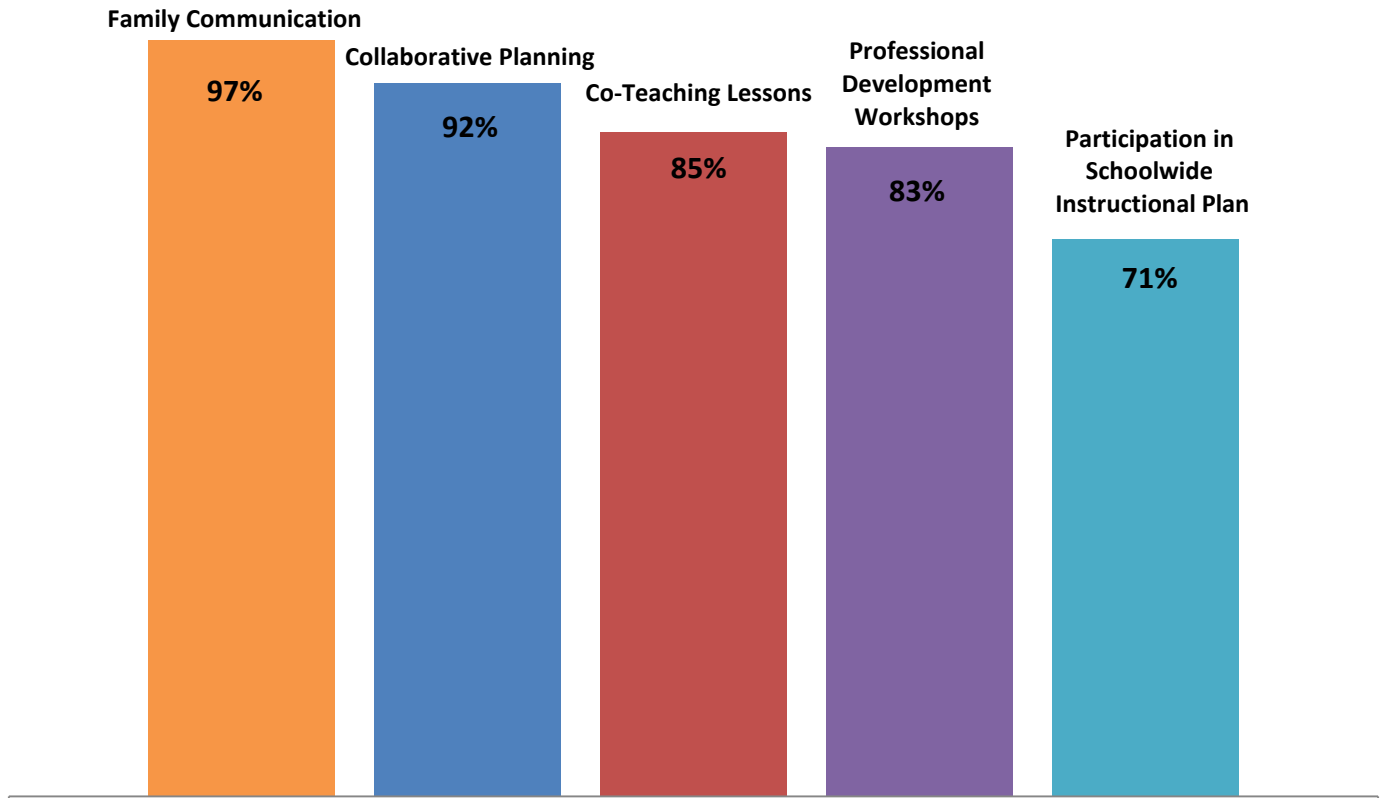
SAGE schools had strong professional development and collaborative teaching practices. The overwhelming majority of SAGE principals and teachers, 80-90 percent, reported that their schools had implemented collaborative planning between multiple teachers, participated in team teaching, and engaged in formal professional development workshops and conferences.<sup>33</sup> However, there were also areas of professional development that could have been strengthened, including the fact that only 54 percent of teachers had a formal written development plan, and only 17 percent received specific training on how to take advantage of smaller-class sizes.<sup>34</sup>

Project SAGE also infused schools with a host of additional enrichment activities, with substantial variation in the specific services offered. The most common were school breakfast, after-school learning such as Girl Scouts and tutoring, and summer reading programs.<sup>35</sup> There were also several parent focused services including adult literacy programs, family resource centers, and social events that connected families with the school community.<sup>36</sup>

Wisconsin's SAGE program achieved similar positive results as Project STAR had in Tennessee. In the 3<sup>rd</sup> year of the program, early elementary students in Project SAGE achieved two to three months of additional academic progress in math, reading, and English versus comparison schools.<sup>37</sup> African-American students had greater gains, meaning that race-based achievement gaps for African-American students were reduced.<sup>38</sup> Gains were consistent and did not fade out over time.<sup>39</sup>

## Many SAGE Educators Undertook Positive School Practices

Share of SAGE Educators Who Engaged in Positive Practices, 2000-2001 School Year



Source: Molnar et. al, 2001

Implementation of Project SAGE was paired with extensive teacher surveys in order to help researchers identify how small classes helped improve instruction. Project SAGE allowed for more individualized attention for students, improved classroom management, and provided more hands-on learning opportunities that resulted from more orderly and well-managed classrooms.<sup>40</sup> Project SAGE educators reported they were better able to learn about the individual strengths and weaknesses of students and pair this knowledge with strategies to meet these needs.<sup>41</sup> Project SAGE classes had fewer discipline problems and more time to promote positive relationships, which was further enhanced by maintaining small classrooms over several years.<sup>42</sup> This allowed familiarity with team teaching, collaborative planning, and integration of professional development into practice.<sup>43</sup>

With other positive conditions in place, SAGE teachers implemented more hands on activities and student-centered learning practices that allowed students and teachers to get more in depth with academic content.<sup>44</sup> Although variation in the increased learning time opportunities and social supports makes overall conclusions difficult, these additional programs, along with the lower class sizes, expanded what was available to kids, while helping to increase family engagement through social events, services, and increased communication.<sup>45</sup>



## Costs and Other Considerations for Class Size Reductions

The Commonwealth can adapt the lessons learned from class size efforts around the country. The effective examples of Project STAR in Tennessee and SAGE in Wisconsin suggest that we could boost achievement by reducing class sizes to 15 students in kindergarten through 3<sup>rd</sup> grade, particularly in low-income schools. Class size reductions should make sure all classes have well-prepared teachers and other supportive services. However, because previous Roadmap to Expanding Opportunity reports have detailed policy options and costs for [teacher training](#), [increased learning time](#), and comprehensive child and family service programs ([wraparound services](#)), the following discussion will be limited to targeted class size reductions.

Smaller class size efforts could start by targeting schools that serve high proportions of low-income students most in need of additional support. One way to identify target schools is to select those eligible for school-wide services through federal Title I grants. To reach this threshold, schools must have 40 percent or more low-income students.<sup>46</sup> In 2013-2014, there were 461 elementary schools that serve 40 percent or more low-income students across Massachusetts.<sup>47</sup> Among these schools, 414 (90 percent) have class sizes larger than 15, with an average class size just under 20 students.<sup>48</sup> Details on the target schools and a sample of districts with these focus schools are listed in the tables below.

The 20 students per-class average from recent state data understates typical class sizes. This is because of the way the Department of Elementary and Secondary Education collects this data from schools. The state’s class size averages include mainstream classrooms as well as smaller self-contained classes for special education students and English Language Learners. Combining these separate types of classrooms lowers the average class size compared to what is happening in practice. To illustrate this, consider an elementary school with seven classrooms, one of which is a separate special education class of eight students, the other six of which are mainstream classes with 22 students. The average class size including both types of classes is 20 students, however 94 percent of kids are in a class of 22 students. This data issue suggests that the cost estimates below somewhat understate the actual cost of reducing non-special education and ELL classes down to 15 students.

<b>Over 400 Low-Income Elementary Schools Have Large Class Sizes</b>	
<b>Number of Schools</b>	<b>414 schools</b> (391 district, 23 charter)
<b>Average Class Sizes in 2013-14</b>	<b>20 students</b>
<b>Districts</b>	<b>103 districts</b>
<b>Low Income Students</b>	<b>73%</b>
<b>Special Education Students</b>	<b>18%</b>
<b>English Language Learning Students</b>	<b>20%</b>
<b>Kindergarten-3<sup>rd</sup> Grade Population</b>	<b>115,806 students</b>

**Sample of Districts Across the State Serving Low-Income Students in Large Classes**

**Adams-Cheshire (1 school) – Amherst (3) – Barnstable (2) – Boston (67) – Brockton (12)  
 Cambridge (2) – Chelsea (5) – Dennis-Yarmouth (4) – Easthampton (1) – Everett (6) – Fall River (9)  
 Gloucester (2) – Haverhill (6) – Lawrence (11) – Lynn (17) – Marlborough (3) – New Salem-Wendell (1)  
 Orange (2) – Pittsfield (6) – Quabbin Regional (1) – Randolph (4) – Revere (6) - Salem (6) –  
 Springfield (30) – Taunton (6) – Triton Regional (1) – Waltham (2) –Westfield (5) – Worcester (29)**

Each target school has a specific number of additional teachers necessary to reach class sizes of 15. We find that figure by dividing the total number of students at that particular school by 15 and determining how many additional teachers would be needed to reach the optimal class size. Since not all students at these schools are in kindergarten through third grade, the number of teachers necessary is scaled down to match the proportion of students in these selected grades. This calculation leads to an average of between four and five new teachers being added to the 414 target schools, and a statewide total of approximately 1,840 new educators to implement these class size reductions.

To estimate costs of hiring additional educators, we use the most recent teacher salary data from 2012-2013, adjusted to reflect current costs. This uses average salaries from around the state matched to the 414 schools.<sup>49</sup> Since additional costs for new teachers include both salary and benefits, we add a percentage of salary costs, 18 percent, on top using recent state data on benefits, primarily health insurance.<sup>50</sup> This may somewhat overstate the salaries and benefits of new teachers, if they are earlier in their careers and start low on district salary scales. However, this accounts for hiring teachers of comparable experience to our current teaching force. Overall, this method suggests that hiring 1,840 K-3 teachers in the affected districts would cost \$161 million annually.

**Targeted Class Size Reductions Would Cost \$161 Million Statewide**

<b>Cost of Additional K-3 Teachers (salary &amp; benefits)</b>	<b>Teachers Added to Target Districts and Schools (2013-2014)</b>	<b>Total Statewide Cost</b>
<b>\$87,700</b>	<b>1,840</b>	<b>\$161 million</b>

Providing more individualized support through smaller class sizes in the early elementary grades is a strategy that has promise for supporting young people in Massachusetts. However, there are numerous factors to account for in making smaller classes a reality. Each community and school district has unique strengths and challenges in bringing this program to their local community. Efforts should incorporate funding for new teacher training and facilities upgrades to create additional classroom space where necessary. Any support from the Commonwealth in funding smaller class sizes should be balanced with the need for participating districts and schools to take ownership of the process. Districts should include smaller class sizes in overall plans including new teacher training, ongoing professional development, student support initiatives, and operational concerns such as school building and facilities plans. If it is done right, creating a foundation of individualized support and attention for children in early elementary school can be part of promoting the academic, social, and personal growth for more kids across Massachusetts.



## Endnotes/References

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<sup>1</sup> A host of effective educational programs profiled in the Roadmap to Expanding Opportunity and other research feature small class sizes (of 15 students per-teacher or fewer) as part of several programs with proven effectiveness. Such programs include:

- **Summer and Extended Learning Time**, such as the Building Educated Learners for Life Summer program, which eliminated summer learning loss for participating youth and features class sizes of roughly 15 students (see Chaplin, Duncan, and Jeffrey Capizzano "Impacts of a Summer Learning Program: A Random Assignment Study of Building Educated Leaders for Life (BELL)." (2006) <http://www.urban.org/publications/411350.html>)
- **High Quality Pre-Kindergarten**, such as the High/Scope Perry Preschool program, which had ten students per teacher or fewer. This program resulted in over 7:1 return on each dollar invested in positive lifetime outcomes such as greater academic achievement, higher earning, more home ownership, and reduced interactions with the criminal justice system (See American Youth Policy Forum, "High/Scope Perry Pre-School." (1988) <http://www.aypf.org/publications/nomoreisle/PDF/108-110.pdf>)
- **Massachusetts Regional Vocational Schools**, which have dropout rates which are less than half of traditional high schools (see Alison L. Fraser and William Donovan. "Hands on Achievement: Why Massachusetts Vocational Technical Schools Have Low Dropout Rates." Pioneer Institute (2013) [http://pioneerinstitute.org/wp-content/uploads/dlm\\_uploads/Voc-Tech-WP-FINAL.pdf](http://pioneerinstitute.org/wp-content/uploads/dlm_uploads/Voc-Tech-WP-FINAL.pdf))

<sup>2</sup> Class size refers to the number of students under the direct supervision of an individual teacher in a self-contained classroom. This is different than a student-teacher ratio, which simply divides the number of students in particular school by the total number of educators. Student-teacher ratios are generally lower than class sizes because they include non-teaching staff as well as lead teachers.

<sup>3</sup> Finn, Jeremy and Charles M. Achilles. "Tennessee's Class Size Study: Findings, Implications, Misconceptions." *Educational Evaluation and Policy Analysis* 21.2 (1999): 97-109. 102

<sup>4</sup> Finn and Achilles, 98

<sup>5</sup> Nye, Barbara, Larry V. Hedges, and Spyros Konstantopoulos. "The Long Term Effects of Small Classes: A Five Year Follow Up of the Tennessee Class Size Experiment." *Educational Evaluation and Policy Analysis* 21.2 (1999) 127-142. 129-130

<sup>6</sup> Nye, Hedges, and Konstantopoulos, 130

<sup>7</sup> Research findings from Project STAR reported student academic gains in statistical units called standard deviations, a measure of the average spread of educational scores across a student population. To make these results more clear we convert the gains to months of learning. This is done by utilizing a separate study which reported benchmarks, in standard deviations, for what students at different grade levels are expected to learn over the course of a calendar year. In general, younger students are expected to have more academic growth over the course of a year than older students.

**Findings from Project STAR:** Mosteller, Frederick. "The Tennessee Study of Class Size in the Early School Grades." *The Future of Children* (1995): 113-127. 117

**Translation of these findings into months of learning:** Hill, Carolyn J., et al. "Empirical Benchmarks for Interpreting Effect Sizes in Research." *Child Development Perspectives* 2.3 (2008): 172-177. 173

<sup>8</sup> Mostellar, 119

<sup>9</sup> Krueger, Alan B. "Experimental Estimates of Education Production Functions." *National Bureau of Economic Research*. (1997). 524-525

<sup>10</sup> Nye, Hedges, and Konstantopoulos, 137

<sup>11</sup> *ibid*

<sup>12</sup> Krueger, Alan B., and Diane M. Whitmore. "The Effect of Attending a Small Class in the Early Grades on College-Test Taking and Middle School Test Results: Evidence from Project STAR." *The Economic Journal* 111.468 (2001): 1-28. 3

- <sup>13</sup> Bohrnstedt, George W., and Brian M. Stecher. "What We Have Learned about Class Size Reduction in California. Capstone Report." (2002). 51
- <sup>14</sup> Bohrnstedt and Stecher, 38
- <sup>15</sup> *ibid*
- <sup>16</sup> Bohrnstedt and Stecher, 39
- <sup>17</sup> Bohrnstedt and Stecher, 28, 47
- <sup>18</sup> Bohrnstedt and Stecher, 20 (\$1,002, CPI inflation adjusted from \$650 in the 1996-1997 school year to 2014-2015)
- <sup>19</sup> Mitchell, Douglas E., and Ross E. Mitchell. "Evaluating the Impact of California's Class Size Reduction Initiative on Student Achievement: Third Year Evaluation Report." (2001). 2
- <sup>20</sup> Bohrnstedt and Stecher, 32-33
- <sup>21</sup> Bohrnstedt and Stecher, 5
- <sup>22</sup> Bohrnstedt and Stecher, 33
- <sup>23</sup> James, Donna Walker, Sonia Jurich, and Steve Estes. "Raising Minority Academic Achievement: A Compendium of Education Programs and Practices." American Youth Policy Forum. (2001). 96
- <sup>24</sup> Mitchell and Mitchell, 29-32
- <sup>25</sup> Mitchell and Mitchell, 35
- <sup>26</sup> Molnar, Alex, et al. "2000-2001 Evaluation Results of the Student Achievement Guarantee in Education (SAGE) Program." University of Wisconsin *Center for Education Research, Analysis and Innovation*. (2001). 9
- <sup>27</sup> Wisconsin Legislative Reference Bureau. "Budget Brief: Student Achievement Guarantee in Education (SAGE)." (1999). 1 <http://legis.wisconsin.gov/lrb/pubs/budbriefs/99bb7.pdf>.
- <sup>28</sup> Wisconsin Legislative Reference Bureau, 1. Funding level of \$23.1 million per-year in 1999, CPI inflation adjusted to 2015, is estimated at \$32.6 million. Per-student funding level of \$2,000 in 1999 is inflation adjusted to \$2,818 in 2015.
- <sup>29</sup> Molnar et. al 2001, 9
- <sup>30</sup> James, Jurich, and Estes. 86-88
- <sup>31</sup> *ibid*
- <sup>32</sup> Molnar et. al 2001, 63
- <sup>33</sup> Molnar et. al 2001, 65
- <sup>34</sup> *ibid*
- <sup>35</sup> Molnar et. al 2001, 66
- <sup>36</sup> *ibid*
- <sup>37</sup> Molnar, Alex, Philip Smith, and John Zahorik. "Evaluation Results of the Student Achievement Guarantee in Education (SAGE) Program, 1998-99." (1999). 53
- <sup>38</sup> Molnar, Smith, and Zahorik, 45
- <sup>39</sup> Smith, Phil, Alex Molnar, and John Zahorik. "Class Size Reduction in Wisconsin: A Fresh Look at the Data. Arizona State University Education Policy Studies Laboratory. (2003). 14 [eps.l.asu.edu/epru/documents/EPsL-0309-110-EPRU.doc](http://eps.l.asu.edu/epru/documents/EPsL-0309-110-EPRU.doc)
- <sup>40</sup> Molnar, Smith, and Zahorik, 70-73, 80, 61-62
- <sup>41</sup> Molnar, Smith, and Zahorik, 56-57
- <sup>42</sup> Molnar, Smith, and Zahorik, 58-59, 74

<sup>43</sup> Molnar, Smith, and Zahorik, 94-97

<sup>44</sup> Molnar, Smith, and Zahorik, 61-62

<sup>45</sup> Molnar et. al 2001, 66

<sup>46</sup> United State Department of Education. "Title I, Part A Program." (2014).  
<http://www2.ed.gov/programs/titleiparta/index.html>

<sup>47</sup> Massachusetts Department of Elementary and Secondary Education. "2013-2014 Class Size by Gender and Selected Population." [http://profiles.doe.mass.edu/state\\_report/classsizebygenderpopulation.aspx](http://profiles.doe.mass.edu/state_report/classsizebygenderpopulation.aspx)  
"2013-2014 Enrollment By Grade Report."  
[http://profiles.doe.mass.edu/state\\_report/enrollmentbygrade.aspx?mode=school&year=2014&Continue.x=4&Continue.y=7](http://profiles.doe.mass.edu/state_report/enrollmentbygrade.aspx?mode=school&year=2014&Continue.x=4&Continue.y=7)  
"School and District Profiles" <http://profiles.doe.mass.edu/>

<sup>48</sup> For this calculation, the Commonwealth's roughly 1,860 schools reported by the Department of Elementary and Secondary Education in 2013-2014 are divided into the following school types: Schools with K-6<sup>th</sup> grade or any subset are elementary, 6<sup>th</sup>-8<sup>th</sup> or any subset are middle school, 9<sup>th</sup>-12<sup>th</sup> or any subset are high schools. Regional vocational, district vocational, and agricultural high schools are vocational high schools. Schools with only Pre-K are early learning centers.

There are numerous grade arrangements in schools across the state that are not easily categorized. In those cases, schools serving two-thirds of grades in a grade level category are grouped with that category (e.g. K-8<sup>th</sup> is counted as elementary). Several schools that combine grade levels in a way that is split between two or more school types (e.g. K-12<sup>th</sup>, 3<sup>rd</sup>-8<sup>th</sup>) are not counted because they lack a clear school type. Early learning centers, as non K-12 schools, are not counted. Schools that have been closed or consolidated are not counted because there is no practical application for any proposed policy change.

<sup>49</sup> Massachusetts Department of Elementary and Secondary Education. "2012-2013 Teacher Salaries Statewide Report."  
[http://profiles.doe.mass.edu/state\\_report/teachersalaries.aspx](http://profiles.doe.mass.edu/state_report/teachersalaries.aspx)

<sup>50</sup> Massachusetts Department of Elementary and Secondary Education. "Per-Pupil Expenditure Reports"  
<http://www.doe.mass.edu/finance/statistics/ppx.html>