# TABLE OF CONTENTS

1. Introduction  
2. Economic Impact of Investment in Education  
   2.1 Increases in Productivity and Employment  
   2.2 Reductions in Public Expenditures  
   2.3 Third-Grade Later-Life Correlations  
   2.3.1 National Studies  
   2.3.2 Methodology: Current Testing Methods  
      2.3.2.1 NAEP  
      2.3.2.2 MCAS  
   2.3.3 Third Grade MA Data Profile  
3. Interventions  
   3.1 Universal Pre-Kindergarten  
      3.1.1 Mechanics  
      3.1.1.1 States in Which Universal Pre-Kindergarten Has Been Implemented  
         3.1.1.1.1 New Mexico Case Study  
      3.1.2 Benefits  
      3.1.2.1 Prominent Studies of the Benefits of Universal Pre-Kindergarten  
         3.1.2.1.1 Chicago Child-Parents Centers  
         3.1.2.1.2 Abecedarian Program  
      3.1.3 Costs  
   3.1.4 Counterargument  
   3.1.4 Conclusion  
   3.2 Kindergarten and First Grade Reading Interventions  
      3.2.1 Mechanics  
      3.2.2 Benefits  
      3.2.3 Costs  
      3.2.4 Counterargument  
   3.3 Expanded Learning Time  
      3.3.1 Mechanics  
      3.3.2 Benefits  
      3.3.3 Costs  
      3.3.4 Counterargument  
   3.4 Curriculum  
      3.4.1 Mechanics  
      3.4.2 Benefits  
      3.4.3 Costs  
      3.4.4 Counterargument  
   3.5 Promise Zones  
      3.5.1 Mechanics  
      3.5.2 Benefits  
      3.5.3 Costs  
      3.5.4 Counterargument  
   3.6 Outside Tutoring  
      3.6.1 Mechanics  
      3.6.2 Benefits  
      3.6.3 Costs  
      3.6.4 Counterargument  
   3.7 Virtual Schools  
      3.7.1 Mechanics  
      3.7.2 Benefits  
      3.7.3 Costs  
      3.7.4 Counterargument  
4. Conclusions  
5. Compiled Works Consulted
1. Introduction

In this paper, we present the economic case for investing in our state’s public school system and then proceed to discuss and evaluate seven different popular strategies for interventions. In particular, we focus on the consequences that ensue when we fail to act in the early years of students’ schooling. In presenting this information, we have two main goals. Firstly, we attempt to provide our readers with a balanced understanding of the costs and benefits of any given intervention — as well as the cost effectiveness of intervening at all — in order to help them reach a jumping-off point for further research. Secondly, we hope that this paper can help our readers make informed decisions about the merits of different strategies for improving our state’s schools.

A first-class public education system is the backbone of an economically strong and sustainable society. Especially here in Massachusetts, where our state’s constitution has acknowledged the importance of the public school system since the eighteenth century, we have long prided ourselves on having some of the nation’s best schools. However, as we will go on to argue in this report, we cannot settle into complacency. Instead, we must look for ways to improve our schools, recognizing that a strong education system is the only way to move forward in the 21st century.

In acknowledgment of the importance of investment in English language and reading skills, this policy paper will primarily focus on interventions that affect reading test scores. We begin by discussing the economic impact of education in terms of social welfare spending and economic growth. As part of doing so, we also provide a sketch of the current state of education in Massachusetts, by presenting readers with a third grade MCAS data profile of the state. We then continue by exploring various intervention programs to improve reading skills, with a substantial section on the costs and benefits of universal pre-kindergarten followed by a discussion of six alternative methods to improve literary performance. The paper finally concludes with a list of relevant scholarly literature that we hope will help our readers investigate the interventions we discuss in further depth, should they desire to pursue any of our recommendations further.

2. Economic Impacts of Investment in Education

2.1 Increases In Productivity And Employment

Investing in education will yield positive economic benefits to society by increasing the our workers’ productivity, both by better developing our state’s human capital and by enabling the parents of school-age children to participate in the labor force at higher rates. Greater access to education allows for the development of more qualified workers, who then can contribute back to society in terms of taxes and decreased public expenditure. It is estimated that the average college graduate in Massachusetts pays $131,705 more in taxes and $66,130 less in public expenditures.1

Additionally, enabling more children to attend early education programs allows their parents to work for longer hours and remain in the labor market longer. The biggest reason many parents stop working or take absences from work is due to childcare. Providing quality, trustworthy public education for children at earlier age therefore allows parents to continue working. This not only decreases their individual costs for childcare, but also creates $31.9 billion per year in Massachusetts.2 Figure 1 below depicts the percentage of parents who change their work habits due to childcare and education needs. Interestingly, parents of middle class income are most likely to change their work habits due to childcare and education needs. Because the middle class forms a substantial segment of Massachusetts’s demographics, it is important to realize the economic benefits to parents of younger children by investing in early education.

---

2.2. Reductions In Public Expenditures

This section particularly focuses on public expenditures made by the state in terms of welfare, unemployment compensation, Medicaid and interaction with the judiciary system. By quantifying the impact of education on social support, we hope to make the case for increasing spending in education now in order to decrease public spending later.

In addition to increases in tax revenue from educated citizens, people who hold college degrees also cost less to the state in terms of public expenditure. A study from the MIT Workplace Center estimates that every dollar invested in quality early education saves the state $13 in other costs.\(^4\) The Business Roundtable and Corporate Voices of Working Families reported a return at $4-7 on every dollar invested in quality early education.\(^5\)

Figure 2 presents the lifetime state expenditures for different social programs, according to monetary value in 2007, broken down by educational attainment level. As the chart clearly demonstrates, the higher the level of a citizen’s education, the less money the state, in the long term, will have to pay in welfare and other related costs. For instance, in 2012 dollars, the total state welfare expenditure amounts to $54,301 per high school graduate. Bay Staters with bachelor’s degrees, by contrast, tend to access state programs at a much lower rate, and the state therefore spends approximately $66,000 less on them throughout the course of their lives.

---


One significant source of costs for the state comes from interactions with the corrections department. Figure 3 below depicts the difference in public cost of covering pre-kindergarten to third grade education (from the U.S. Census) and cost per inmate (from the Vera Institute) in an infographic by CNN. Although Massachusetts costs are not depicted in the graphic, the striking trend depicted in the graphic can help contextualize the difference in spending:

---

**Figure 2**

<table>
<thead>
<tr>
<th>Categories in Massachusetts</th>
<th>High School</th>
<th>Associate's Degree</th>
<th>Bachelor's Degree</th>
</tr>
</thead>
<tbody>
<tr>
<td>Welfare</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Sum</td>
<td>$3,003</td>
<td>$781</td>
<td>$255</td>
</tr>
<tr>
<td>Present Value</td>
<td>$1,736</td>
<td>$440</td>
<td>$147</td>
</tr>
<tr>
<td>Degree Premium – Sum</td>
<td>-$2,242</td>
<td>-$2,748</td>
<td></td>
</tr>
<tr>
<td>Degree Premium – PV</td>
<td>-$1,296</td>
<td>-$1,585</td>
<td></td>
</tr>
<tr>
<td>Medicaid</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Sum</td>
<td>$22,450</td>
<td>$11,684</td>
<td>$6,833</td>
</tr>
<tr>
<td>Present Value</td>
<td>$12,973</td>
<td>$6,717</td>
<td>$3,949</td>
</tr>
<tr>
<td>Degree Premium – Sum</td>
<td>-$10,827</td>
<td>-$15,617</td>
<td></td>
</tr>
<tr>
<td>Degree Premium – PV</td>
<td>-$6,256</td>
<td>-$9,023</td>
<td></td>
</tr>
<tr>
<td>Unemployment Compensation</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Sum</td>
<td>$22,702</td>
<td>$26,891</td>
<td>$20,198</td>
</tr>
<tr>
<td>Present Value</td>
<td>$18,897</td>
<td>$15,540</td>
<td>$11,672</td>
</tr>
<tr>
<td>Degree Premium – Sum</td>
<td>-$5,810</td>
<td>-$12,504</td>
<td></td>
</tr>
<tr>
<td>Degree Premium – PV</td>
<td>-$3,358</td>
<td>-$7,225</td>
<td></td>
</tr>
<tr>
<td>Worker's Compensation</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Sum</td>
<td>$4,102</td>
<td>$2,542</td>
<td>$802</td>
</tr>
<tr>
<td>Present Value</td>
<td>$2,371</td>
<td>$1,469</td>
<td>$464</td>
</tr>
<tr>
<td>Degree Premium – Sum</td>
<td>-$1,560</td>
<td>-$3,300</td>
<td></td>
</tr>
<tr>
<td>Degree Premium – PV</td>
<td>-$802</td>
<td>-$1,907</td>
<td></td>
</tr>
<tr>
<td>Corrections</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Sum</td>
<td>$34,744</td>
<td>$9,590</td>
<td>$4,008</td>
</tr>
<tr>
<td>Present Value</td>
<td>$16,333</td>
<td>$4,838</td>
<td>$2,381</td>
</tr>
<tr>
<td>Degree Premium – Sum</td>
<td>-$25,154</td>
<td>-$32,736</td>
<td></td>
</tr>
<tr>
<td>Degree Premium – PV</td>
<td>-$11,496</td>
<td>-$18,953</td>
<td></td>
</tr>
<tr>
<td>Public Healthcare</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Sum</td>
<td>$3,198</td>
<td>$2,345</td>
<td>$1,973</td>
</tr>
<tr>
<td>Present Value</td>
<td>$1,991</td>
<td>$1,687</td>
<td>$1,384</td>
</tr>
<tr>
<td>Degree Premium – Sum</td>
<td>-$885</td>
<td>-$1,225</td>
<td></td>
</tr>
<tr>
<td>Degree Premium – PV</td>
<td>-$204</td>
<td>-$607</td>
<td></td>
</tr>
<tr>
<td>Total State and Local Expenditure</td>
<td>$100,200</td>
<td>$50,753</td>
<td>$34,070</td>
</tr>
<tr>
<td>Present Value</td>
<td>$54,901</td>
<td>$30,680</td>
<td>$19,996</td>
</tr>
<tr>
<td>Degree Premium – Sum</td>
<td>-$46,446</td>
<td>-$66,130</td>
<td></td>
</tr>
<tr>
<td>Degree Premium – PV</td>
<td>-$23,611</td>
<td>-$34,304</td>
<td></td>
</tr>
</tbody>
</table>

Present Value is calculated with a 3 percent real interest rate. Estimates for Corrections and Public Healthcare are from Topel (2007), based on national averages, and updated with the CPI-U.

---

In general, individuals who drop out of high school tend to access correctional services at a much higher rate than those who complete their schooling. One study run by the federal government found that 75% of inmates in state prisons were high school dropouts. Another study suggested that, nationally, were we to increase high school graduation rates by just 1%, we could save approximately $1.4 billion in incarceration costs, or about $2,100 for each male high school graduate. In general, these correlations suggest that the state ends up footing an even higher bill for students who slip through the crack of our state’s education system – that is, students who fail to complete their high school educations entirely, let alone attend college. Given our state’s ballooning prison costs – a corrections system that costs more than 1.2 billion a year, has a high recidivism rate and high minimum sentencing policies that cost tax payers more and more every year, and has a high recidivism rate with few programs designed to reintegrate individuals back into their communities – an increase in education spending designed to keep these children from slipping away could help curb these high costs later.

---

2.3 Third Grade-Later Life Correlations

2.3.1 National Studies

Being able to read proficiently by third grade is crucial for future academic success because, starting in fourth grade, the focus changes from “learning to read” to “reading to learn.” In other words, after third grade, students are assumed to be competent readers, so the assignments change from teaching students to read to having them use written materials to learn information. If students cannot read well by the end of third grade, they will not be able to learn from written materials as effectively in later grades.¹¹

A study by Lesnick et al. investigated the possible relationship between third grade reading level and four separate outcomes: eighth grade reading level, ninth grade academic performance, high school graduation, and college attendance. Reading levels were assessed according to their scores on the Iowa Tests of Basic Skills (ITBS): students in the 0-25th percentiles nationally were considered below grade level, those in the 25th-75th percentiles were at grade level, and those in the 75th-100th percentiles were above grade level.¹² Males, African Americans, and foster children were disproportionately represented in the below grade level group.

Lesnick et al. found a positive correlation between third and eighth grade reading levels. In addition, it concluded that third grade reading level is indirectly related to ninth grade academic achievement, as the latter is determined mostly by eighth grade reading level and the academic quality of the school attended in ninth grade. Third grade reading level was similarly related to high school graduation and college attendance rates: 45% of students who were below grade level, 60% who were at grade level, and 80% who were above grade level in third grade graduated high school within five years.¹³

These results suggest that early interventions aimed at targeting the ‘learning to read’ years may reap substantial benefits in the ‘reading to learn’ years. However, one limitation to acknowledge in extrapolating these results is that the study notes that ITBS and NAEP cannot be exactly aligned; the tests have some content in common, but have different response formats and definitions for what proficient or grade level performance is. Additionally, none of the studies in this section use randomized control methodology, and therefore cannot make causal claims. The correlations that Lesnick et al. report may simply be the result of a general pattern where good students in elementary school also tend to be good students in middle and high school, making the choice of third grade in particular relatively arbitrary. Or, as the following studies investigate, third grade may well be important because of the transition to “reading to learn,” but factors outside the classroom may actually be more determinative.

Hernandez (2011) also supports literacy interventions in the “learning to read” years, based on his own longitudinal survey-based research with 3,975 students.¹⁴ Hernandez sorted students into reading groups — proficient, basic, and below basic — based on their scores on the PIAT Reading Recognition subtest, with proficiency standards corresponding roughly to the NAEP exam. He found that students who are not proficient readers by the end of third grade are four times less likely to graduate high school than their proficient peers. If they lack even basic reading skills, they are six times less likely to graduate than their proficient peers.¹⁵

However, there is an important effect of poverty. Students were also sorted into three poverty groups — never lived in poverty, lived in poverty for less than half of their life, and lived in poverty for more than half of their life — and, while 9% of not proficient (basic or below basic) students who never lived in poverty dropped out of high school, 11% of proficient but sometimes impoverished students dropped out. Looking at poverty alone, 6%, 22%, and 32% of students at each of the poverty levels, respectively, dropped out. Hernandez (2011) concludes that poverty and lack of reading proficiency put students in “double jeopardy” of dropping out.

Therefore, educational interventions need to address some of the problems of poverty that can also create academic problems, such as lack of access to quality schools, frequent absences, and summer learning loss. One school-based educational intervention that has been shown to be successful is the “integrated Pre-kindergarten-3rd approach.” This universal Pre-kindergarten initiative aligns the curriculum and academic goals of the Pre-kindergarten and grade school programs, which makes it more likely that the benefits of attending

¹² Lesnick et al., 13.
¹³ Lesnick et al., 2-3.
¹⁵ Hernandez, 3.
Pre-kindergarten will last throughout grade school. One study of this initiative showed that it generated a return on investment of 8.24/1 for every dollar spent on a child’s first six years of education.\(^{16}\)

\[
\text{2.3.2 Methodology: Current Testing Methods}
\]

The following section will describe the structures of the two tests that this report will primarily rely upon for data, the NAEP (the National Assessment of Educational Progress) and the MCAS (Massachusetts Comprehensive Assessment System) tests. In particular, given that many of the studies cited throughout this report are national in character and therefore tended to rely on the NAEP for data, this section of the report will attempt to place the NAEP and MCAS in a comparative perspective.

\[
\text{2.3.2.1 NAEP}
\]

The NAEP reading assessment measures the reading and comprehension skills of students in grades 4, 8, and 12 by asking them to read selected grade-appropriate passages and answer questions based on what they have read. The main assessments include reading and interpreting literary and informational texts, and memorizing vocabulary.

Literary texts include three types at each grade: fiction, literary nonfiction, and poetry. Informational texts include three broad categories: exposition; argumentation and persuasive text; and procedural text and documents. The inclusion of distinct text types recognizes that students read different texts for different purposes. First, students may identify explicitly stated main ideas or may focus on specific elements of a story. Furthermore, students may make comparisons, explain character motivation, or examine relations of ideas across the text. Lastly, students view the text critically by examining it from numerous perspectives or may evaluate overall text quality or the effectiveness of particular aspects of the text. Vocabulary questions measure students' knowledge of specific words as used in the passages they are asked to read for the assessment. To answer these questions, students integrate their understanding of the word with their passage comprehension. Vocabulary questions appear in two types of sections: comprehension sections and vocabulary-only sections.

The results of student performance on the NAEP reading assessment are presented in two ways: the average scale scores represent how students performed on the assessment. The achievement levels represent how that performance measured up against set expectations for achievement. Thus, the average scale scores represent what students know and can do, while the achievement-level results indicate the degree to which student performance meets expectations of what they should know and be able to do. Average reading scale score results are based on the NAEP reading scale, which ranges from 0 to 500.

The average score for students in Massachusetts in 2013 (232) was lower than their average score in 2011 (237) and was higher than their average score in 1992 (226).\(^{17}\)

\[
\text{2.3.2.2 MCAS}
\]

The Massachusetts Comprehensive Assessment System, MCAS is the statewide standards-based assessment program developed in 1993, in response to the Massachusetts Education Reform Act. State and federal law requires all students who are enrolled in grades 3-8 and 10, who are educated with Massachusetts public funds to participate in MCAS testing.\(^{18}\)

MCAS has three primary purposes. The first purpose is to inform and improve curriculum and instruction. The second purpose is to evaluate student, school, and district performance according to Massachusetts curriculum framework content standards and performance standards. The third purpose is to determine student eligibility for the Competency Determination requirement in order to award high school diplomas. (MCAS, 2014)

MCAS tests the English Language Art, Mathematics, and the Science and Technology/Engineering, in the form of Multiple-choice questions, short-answer question, short-response questions, short-response questions, open-response questions, and writing prompts.

For a comparison of MCAS and state NAEP please look at Figure 4 below:

\(^{16}\) Hernandez, 10-11.


\(^{18}\) MCAS 2014.
<table>
<thead>
<tr>
<th><strong>Primary purpose</strong></th>
<th>MCAS</th>
<th>State NAEP</th>
</tr>
</thead>
<tbody>
<tr>
<td>To inform/improve curriculum and instruction;</td>
<td>To compare student achievement in states and other jurisdictions;</td>
<td></td>
</tr>
<tr>
<td>To evaluate student, school, and district performance according to Curriculum Framework content standards and MCAS performance standards;</td>
<td>To track changes in achievement of fourth-, eighth-, and twelfth-grade students in mathematics, reading, writing, and other content domains;</td>
<td></td>
</tr>
<tr>
<td>To determine eligibility for high school competency determination.</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th><strong>Who oversees the assessment program?</strong></th>
<th>Massachusetts Department of Elementary and Secondary Education</th>
<th>U.S. Department of Education - National Center for Education Statistics (NCES)</th>
</tr>
</thead>
</table>

<table>
<thead>
<tr>
<th><strong>First year of testing</strong></th>
<th>The standard MCAS tests began in 1998. The MCAS Alternate Assessment began in 2001.</th>
<th>While NAEP has conducted national assessments since 1969, state assessments began in 1990.</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>In each participating state, NAEP assesses a representative sample of students in the grades tested. In each state, NAEP selects roughly 2,500 to 5,000 students in each grade for each subject tested. To accomplish this, NAEP typically samples between 100 and 200 schools at both grades 4 and 8.</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th><strong>Student participation</strong></th>
<th>All students in the grades tested must participate in MCAS.</th>
<th></th>
</tr>
</thead>
</table>

<table>
<thead>
<tr>
<th><strong>Are students with disabilities and LEP students tested?</strong></th>
<th>Yes. Students with disabilities may receive accommodations that are specified in their IEP plan and routinely used during testing. Students with significant disabilities who are unable to take the standard MCAS tests, even with accommodations, must take the MCAS Alternate Assessment (MCAS-Alt).</th>
<th>Yes. Students with disabilities may receive accommodations that are specified in their IEP plan and routinely used during testing.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Limited English proficient (LEP) students are assessed, with the sole exception of LEP students in their first year of enrollment in U.S. schools. Schools have the option of administering the reading and English language arts tests and history and social science question tryouts to first-year IEP students.</td>
<td>Limited English proficient (LEP) students are assessed unless the student has received instruction primarily in English for less than 1 school year and the student cannot demonstrate his or her knowledge of the subject to be assessed in English even with an accommodation permitted by NAEP.</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th><strong>Subjects tested</strong></th>
<th>Reading, English language arts, science, technology/engineering and mathematics, history and social sciences</th>
<th>Reading, mathematics, science, writing</th>
</tr>
</thead>
</table>

<table>
<thead>
<tr>
<th><strong>Grades tested</strong></th>
<th>3–8, 10</th>
<th>4, 8, 12</th>
</tr>
</thead>
</table>

<table>
<thead>
<tr>
<th><strong>Administration Dates</strong></th>
<th>March/April: Reading, English language arts</th>
<th>Late January through early March</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>May/June: Science, Technology Engineering and Math, and history and social sciences</td>
<td>Multiple-choice, short and extended constructed-response, writing prompts (writing).</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th><strong>Item Types</strong></th>
<th>Multiple-choice, open-response, short answer (math), writing prompts (ELA, grades 4, 7, and 10).</th>
<th>Multiple-choice, short and extended constructed-response, writing prompts (writing).</th>
</tr>
</thead>
</table>

<table>
<thead>
<tr>
<th><strong>Level of results reported</strong></th>
<th>State, districts, school, student</th>
<th>State; district for Boston only</th>
</tr>
</thead>
</table>

<table>
<thead>
<tr>
<th><strong>Types of scores reported</strong></th>
<th>Raw scores, scaled scores, performance levels</th>
<th>Scaled scores, achievement levels</th>
</tr>
</thead>
</table>

<table>
<thead>
<tr>
<th><strong>Generic performance level definitions</strong></th>
<th>Advanced: Students at this level demonstrate a comprehensive and in-depth understanding of rigorous subject matter, and provide sophisticated solutions to complex problems. Proficient: Students at this level demonstrate a solid understanding of challenging subject matter and solve a wide variety of problems. Needs Improvement: Students at this level demonstrate a partial understanding of subject matter and solve simple problems. Warning/Failing: Students at this level demonstrate a minimal understanding of subject matter and do not solve simple problems.</th>
<th>Advanced: Superior performance. Proficient: Solid academic performance for each grade assessed. Students reaching this level have demonstrated competency over challenging subject matter, including subject-specific knowledge, application of such knowledge to real-world situations, and analytical skills appropriate to the subject matter. Basic: Partial mastery of prerequisite knowledge and skills that are fundamental for proficient work at each grade.</th>
</tr>
</thead>
</table>

<table>
<thead>
<tr>
<th><strong>Comparative performance data</strong></th>
<th><strong>2011 MCAS Tests:</strong> Percent of Massachusetts students performing at or above Proficient GRADE 4: English Language Arts: 53% Mathematics: 47% GRADE 8: English Language Arts: 77% Mathematics: 58% Science: 59%</th>
<th><strong>2011 NAEP Tests:</strong> Percent of Massachusetts students performing at or above Proficient GRADE 4: Reading: 50% Mathematics: 58% GRADE 8: Reading: 46% Mathematics: 53% Science: 44%</th>
</tr>
</thead>
</table>

One of the criticisms of state assessments is that the academic accomplishment and growth they report from year to year is inflated because schools narrowly teach to the portion of the curricula they expect to be on the assessments, and students are prepared to maximize their scores by using test-taking skills. Some critics feel that students would not do nearly as well on assessments such as those offered by NAEP where the content domains being assessed may be more challenging and testing-taking skills would be less influential in the results. (Hampton, 2004) However, NAEP and MCAS seem to be similar measures that soundly provide similar results of reading scores in students. For instance, MCAS shows that 50% of Massachusetts students perform at or above Proficient on the grade 4 reading test, and NAEP shows 53%.

The fundamental differences in NAEP and MCAS assessments are the subjects and the ages that each tests. NAEP tests reading, mathematics, science and writing where as MCAS tests on additional topics such as English language arts an history and social sciences. NAEP tests grades a broader range of grades 4,8,12 where as MCAS tests more frequently, from 3 to 8 then grade 10. Furthermore, the primary purpose of NAEP is to observe and compare student achievement between states, whereas MCAS additionally aims to apply the test results to improve curriculum and instruction.

2.3.3 Third Grade MA Data Profile

Turning to Massachusetts in particular, it is instructive to understand how students are performing currently in order to evaluate potential interventions. On the English-Language Arts MCAS, more than 3 out of 5 Massachusetts students scored Proficient or Advanced in 2012: 46% scored Proficient and 15% scored Advanced. In addition, the state score on the Composite Performance Index (CPI) was 84.1. On the CPI, students are scored 100, 75, 50, 25, or 0 based on how close to proficient they are, with proficient and advanced students receiving a score of 100, and their scores are averaged to create a statewide score. Thus, a state CPI score of 100 would indicate that all students were at least proficient. Massachusetts currently spends an average of $13,636 per pupil, but a school’s per pupil expenditure is not correlated with the percentage of students at that school scoring Advanced ($R^2 = 0.00895$) or at least Proficient ($R^2 = 0.00016$). PPE by school is also unrelated to CPI by school ($R^2 = 0.00153$). Figures 5-7 below demonstrate these findings. These results demonstrate the need for the state of Massachusetts to allocate funding more efficiently, such that spending on interventions does strongly influence student achievement.

---

Figure 6

Comparing Massachusetts Schools' PPE and Percentage of Students Scoring Proficient or Advanced on the MCAS

\[ y = -6 \times 10^{-5} x + 68.266 \]
\[ R^2 = 0.00016 \]

Figure 7

Comparing Massachusetts Schools' Per Pupil Expenditure and Composite Performance Index Score

\[ y = -9 \times 10^{-5} x + 88.652 \]
\[ R^2 = 0.00153 \]
3. Interventions

This section of the report presents cost/benefit analyses of various interventions that can be used to help increase students’ reading test scores. It begins with a detailed description of universal pre-kindergarten, the main intervention on which the report will focus. It then goes on to describe kindergarten and first grade reading interventions, expanded learning time, specific curriculum changes, teacher quality, promise zones (and community involvement), outside tutoring, and virtual schools. For each intervention, the report will discuss the mechanics of implementation, the benefits (especially economic benefits) associated with the intervention, and its costs, and then provide a brief counterargument section to discuss any studies that do not support the intervention.

Given the high correlation between low performance on MCAS reading exams at a young age and negative later life outcomes, many researchers and policy makers have concluded that early intervention methods may be the most effective method of targeting at-risk students.

3.1 Universal Pre-Kindergarten

3.1.1 Mechanics

For the purposes of this report, universal pre-kindergarten describes pre-kindergarten programs that are available to all children in a given state, regardless of family income. State governments fund these programs and several states are currently considering funding universal pre-kindergarten. Currently 38 of the 50 states and the District of Columbia offer some form of pre-kindergarten program.

Universal pre-kindergarten encompasses programs serving 3-4 year olds focusing on school readiness. While hours can vary, Massachusetts emphasizes universal pre-kindergarten programs offering full-day, full year programming. All universal pre-kindergarten programs share a focus on ensuring readiness for kindergarten. States implement and deliver pre-kindergarten programs in many different ways. States with pre-kindergarten programs that are not universal, for example, have targeted audiences, either children from families with low incomes or children from families with various risk factors that could affect their learning. In Arkansas, for example, eligibility to a pre-kindergarten program is based not only on family income, but also on children having one or more of the following risk factors: a teen parent, developmental delay, low birth weight, limited English proficiency, placement in foster care, a parent on active military duty, or family violence. By 2008, state pre-K programs were operating in 38 states, and served more than 1.1 million children nationwide using $4.6 billion in state dollars. At age 4, one in four American children now attends a program that can be classified as state pre-kindergarten. Some states have committed to making state pre-kindergarten available to all 5-year olds whose parents would like them to attend. Oklahoma has come closest to meeting this goal, with 71% of its 4-year-olds enrolled.

Universal pre-kindergarten would eliminate these prerequisites by offering all students whose family pays state property tax, to be eligible to attend a local pre-kindergarten program.

In Massachusetts, the Universal Pre-Kindergarten (UPK) pilot initiative called was launched in 2007. All types of providers, such as child care centers, Head Start centers, public school district programs and family child care, are included under the ‘umbrella’ of the state’s universal pre-kindergarten program. Based around a grant program that initially funded 31 preschools, MA’s pilot initiative has since remained more or less constant in scope, despite education advocates’ calls for expansion. Currently, there are 6400 children in UPK classrooms, and 185 out of the 277 UPK programs are fully funded and free to attendees.

3.1.1 States in Which Universal Pre-Kindergarten Has Been Implemented

In this section we will discuss the mechanics of several specific pre-kindergarten programs in states around the United States. Pre-kindergarten children from all five states achieved significant gains in basic language and math skills compared with non-participating peers. All five states shared a commitment to credentialed teachers and each had a student to staff ratio of no more than 10:1 and a maximum class size of no


more than twenty.

In addition, many states have identified other program characteristics as essential for their pre-kindergarten programs. In 2005, for example:

- Twenty-seven state pre-kindergarten programs screen children on vision, hearing and health issues.
- Twenty-three state programs provide at least one meal per day.
- Thirty states use regular site visits to monitor local programs.

For more common indicators of what makes a quality Pre-kindergarten education program, The National Institute for Early Education Research (NIEER) has developed a 10-point quality standard checklist for evaluating pre-kindergarten programs.25

<table>
<thead>
<tr>
<th>Characteristics of State Pre-kindergarten Programs</th>
<th>Percent of 4-year-olds Enrolled</th>
<th>Length of School Day</th>
<th>Child/Staff ratio</th>
<th>Maximum Class Size</th>
</tr>
</thead>
<tbody>
<tr>
<td>State</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Michigan</td>
<td>19%</td>
<td>half-day</td>
<td>8:1</td>
<td>18</td>
</tr>
<tr>
<td>New Jersey (Abbott)</td>
<td>79% (in Abbott districts)</td>
<td>full-day</td>
<td>15:2</td>
<td>15</td>
</tr>
<tr>
<td>Oklahoma</td>
<td>65%</td>
<td>varies</td>
<td>10:1</td>
<td>20</td>
</tr>
<tr>
<td>South Carolina</td>
<td>32%</td>
<td>half-day</td>
<td>10:1</td>
<td>20</td>
</tr>
<tr>
<td>West Virginia</td>
<td>33%</td>
<td>varies</td>
<td>10:1</td>
<td>20</td>
</tr>
</tbody>
</table>

3.1.1.1.1 New Mexico Case Study27

New Mexico Pre-kindergarten classrooms feature maximum class sizes of 20 with staff-child ratios of 1:10 and offer a variety of comprehensive and family support services in addition to the classroom experience. One economic impact analysis finds a return on investment of $5 per pupil in New Mexico and $6.17 per pupil in the United States for every dollar invested in New Mexico Pre-kindergarten. The delineation between state and federal returns exists because different factors influence state and federal returns and expenses. For instance, there are some differences between federal and state crime and taxes. In addition, children coming from such programs will be less likely to engage in criminal behavior, be victims of abuse and neglect, and use welfare services. The real rate of return to New Mexico's state funded prekindergarten program is an estimated 18.1 percent to New Mexico. Statistically significant gains were found across the four-year New Mexico study for participating students. Across the first three years of the Pre-kindergarten initiative, children who participated in New Mexico Pre-kindergarten scored an average of 5.44 points higher on the vocabulary measure and average of 1.63 points higher on the mathematics measure and an average of 24 percent higher on the early literacy measure than children who did not participate.

25 NAEYC: “PreK- What Exactly Is It?”
3.1.2 Benefits

A variety of studies have shown that access to pre-kindergarten may lead to decreases in arrest rates and increases in IQ, educational achievement, health, and even adult income levels for students. Despite criticisms that preschool is primarily effective in lower income households, it has also proven beneficial for non-disadvantaged children.

Preschool has been found to decrease arrest rates and risk factors for arrest. In a group of 1,400 low-income children, those who had been exposed to preschool at age 3 were 9 percent more likely to have graduated from high school and were 22 percent less likely to have been arrested by age 28. Preschool has also been shown through meta-analysis of many randomly controlled studies to enhance IQ in disadvantaged children by 4 points or more, an effect hypothesized to be a result of either the environment’s more complex cognitive stimulation or early language development. Many researchers have also linked children’s high-quality preschool experiences and success in school and later life. Recently, researchers from Georgetown University studied Oklahoma’s universal pre-kindergarten program. They found significant benefits for children from both low-income and middle-income homes. The Oklahoma children who attended pre-kindergarten programs had better reading, math, and writing skills than children who attended Head Start programs or did not go to a public preschool program, possibly because of longer hours and higher rates of attendance. Likewise, an ongoing evaluation of New Mexico Pre-kindergarten has found significant gains in children’s math and early literacy skills for students in the program relative to those not enrolled.

Health benefits found to result from universal pre-kindergarten range from greater access to health services to decreased risk of teen pregnancy. The primary caveat for the benefits of Universal pre-kindergarten is that the effects seem to be less significant for populations not categorized as “severely disadvantaged.” A study at University of Virginia found that children from lower-income families tend to gain more from good preschool education than do more advantaged children. However, the educational achievement gains for non-disadvantaged children are still substantial; these children’s standardized test score gains were about 75% as large as the gains for low-income children.

Another caveat is that the same UVA study found that the academic performance boosting effects of preschool fade over the course of elementary school. Although pre-kindergarten attendees show gradually less advantage in test score, analyses show that they don’t disappear completely, as universal pre-kindergarten’s “effects decline as students move from their immediate experience in preschool to elementary school, to adolescence, and to adulthood follow-up, but they do not disappear. In a comprehensive meta-analysis (Camilli et al., 2010) that controlled for quality of the research design, the estimated effects of preschool education on children’s cognitive development dropped substantially (from about 0.70 standard deviations, SD, to 0.35 SD) as one moved the outcome assessments from the end of the program through age 10.”

A hallmark and often-cited study about the benefits of universal pre-kindergarten is the High/Scope Perry Preschool Study, which asserts that adults who participated in a high-quality preschool program have higher income levels and educational achievement, as well as more socially responsible behavior. The study followed 123 children born into poverty and at high risk for failing out of school. Data was collected about the later life outcomes of the participants at age 40. This study calculated that early education programs provided a return to society of $17 for every tax dollar invested. A second statistical analysis of the program reported a 16% rate of return, suggesting a consistent positive treatment effect.

---

30 http://nieser.org/resources/research/Preschool6LastingEffects.pdf
33 http://www.strategiesforchildren.org/eea/EAE6_PreK.htm
However, a later paper written by Heckman et al. criticized these prior analyses failed to meet several standards of statistical rigor. Because the Perry analysts fail to report standard errors for estimates, they are unable assess neither the significance of their results nor the sensitivity of results to their assumptions. Heckman et al. return to the Perry data with a much more rigorous method, accounting for many problematic aspects of the experimental design and available data, and find that the Perry program appears to return $7-12 dollars to society for every dollar invested when considering the outcomes from childhood to 65 years of age. This estimate is lower than the prior calculations of 16-17% cited above both because of the changes in the calculation methods and because Heckman et al. choose to define traffic misdemeanors and drug crimes as having no social cost, reducing the benefit of cutting down on these crimes. Still, Heckman et al. did report a statistically significant – though reduced – return rate on investment in the Perry program.

3.1.2.1 Prominent Studies of the Benefits of Universal Pre-Kindergarten

In addition to the Perry Pre-kindergarten program previously mentioned, there exist many other prominent studies supporting the benefits of Pre-kindergarten on later life outcomes. In this section, two of these studies will be highlighted: the Chicago Child-Parent Centers and Abecedarian Program.

3.1.2.1.1 Chicago Child-Parents Centers

This program focused on targeting low-income students with early education intervention paired with parental involvement. Opened in 1967 with federal funding from Title I of the landmark Elementary and Secondary Education Act of 1965, the program provides education and family support for children age 3 to 9 in low-income areas. The program attempts to build academic abilities through classroom and parent activities, paired with field trips. It is worth mentioning that this study is different from most others because of its emphasis on parental involvement. Each Center is staffed by a head teacher and includes a parent resource room, community outreach activities, and health services. After pre-kindergarten and kindergarten, the school-age program provides reduced class sizes, teacher aides, continued parental involvement, and an enriched classroom environment for math and reading skills. Benefits were measured over five different categories in 1998 dollars: school savings from reduced grade retention and special education, reductions in criminal justice system

<http://www.highscope.org/file/Research/PerryProject/specialsummary_rev2011_02_2.pdf>

spending, reductions in child welfare, reduced tangible costs to crime victims, increases in adult income and taxes.

Relative to the comparison group, preschool participants had a 29% higher rate of high school completion, a 33% lower rate of juvenile arrest, a 42% reduction in arrest for a violent offense, a 41% reduction in special education placement, a 40% reduction in the rate of grade retention, and a 51% reduction in child maltreatment. The average cost per child measured at $6,730 for 1.5 years in the preschool program, with returns to society of $47,759 per participant. Furthermore, the pre-kindergarten aspect of this program yielded significantly higher rates of return than the extended school-age aspect of the program.36

3.1.2.1.2 Abecedarian Program

This study specifically highlighted the importance of the intensity and duration of the pre-school day on the later life outcome of the children, suggesting that longer school days and rigorous coursework leads to greater achievement. Furthermore, this study compared the benefits of the Abecedarian program and with those of the High Scope/Perry Preschool program in order to determine best practices in providing pre-kindergarten to students. For instance, the longer school day of the Abecedarian program allowed for a greater level of employment among the mothers of enrolled students, a fact that, in the long run, would have positive economic consequences for the state. Also, the Perry Pre-kindergarten program saw far more cost benefits in reducing crime than Abecedarian. This has been difficult to explain, but is likely derived from differences in curriculum. Certain curriculum is able to show cognitive gains without showing any improvement in social or behavioral development.

The Abecedarian program focused on low-income, African American families in Chapel Hill, North Carolina. Children attended the program from infancy to age 5, eight hours a day, five days a week, fifty weeks a year. Staff to student ration shifted as students aged to control for individual infancy needs. Parents served on the advisory board and received health and caregiving counseling. Across the board, children who participated in the Abecedarian program had lower rates of grade retention, less likely to need special education, had higher adjusted reading scores, higher adjusted math scores, had completed more years of schools, were more likely to attend a four-year college, and were more likely to be engaged in skilled jobs.37

![Figure 10](38)

Comparison of Abecedarian and Perry program effects

<table>
<thead>
<tr>
<th>Outcome</th>
<th>Abecedarian</th>
<th>Perry</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Treatment</td>
<td>Control</td>
</tr>
<tr>
<td>IQ Age 3</td>
<td>101</td>
<td>84</td>
</tr>
<tr>
<td>IQ Age 4.5</td>
<td>101</td>
<td>91</td>
</tr>
<tr>
<td>IQ Age 14/15</td>
<td>95</td>
<td>90</td>
</tr>
<tr>
<td>Reading achievement age 14/15</td>
<td>94</td>
<td>88</td>
</tr>
<tr>
<td>Math achievement age 14/15</td>
<td>93</td>
<td>82</td>
</tr>
<tr>
<td>Ever repeated grade (%)</td>
<td>34</td>
<td>65</td>
</tr>
<tr>
<td>Ever in special education (%)</td>
<td>31</td>
<td>49</td>
</tr>
<tr>
<td>Percent of years in special ed. (%)</td>
<td>12</td>
<td>18</td>
</tr>
<tr>
<td>High school graduation by age 19 (%)</td>
<td>67</td>
<td>51</td>
</tr>
<tr>
<td>College attendance (%)</td>
<td>36</td>
<td>13</td>
</tr>
<tr>
<td>Smoking (%)</td>
<td>39</td>
<td>55</td>
</tr>
</tbody>
</table>

Note: Sources for Perry data are Schweinhart, Barnes, and Weikart (1993) and Schweinhart et al. (2005). For Abecedarian program, all differences between groups are significant at p < .05, except IQ at age 15 and Ever in special education, High School Graduation by age 19, and Smoking. Data are from Campbell and Ramey (1995), Ramey and Campbell (1984), Clarke and Campbell (1998), Campbell, Ramey, Pungello, Sparling, and Miller-Johnson (2002), and our own analyses.

3.1.3 Costs

Figure 11

<table>
<thead>
<tr>
<th>Type of Program</th>
<th>Cost per Child</th>
</tr>
</thead>
<tbody>
<tr>
<td>3-Hour, School Year</td>
<td>$5,100</td>
</tr>
<tr>
<td>Full-Day, School Year</td>
<td>$8,800</td>
</tr>
<tr>
<td>Full-Day, Year Round with Integrated Child Care</td>
<td>$12,970</td>
</tr>
<tr>
<td>Equal Mix of Programs</td>
<td>$8,957</td>
</tr>
<tr>
<td>3-Hour, School Year</td>
<td>$5,100</td>
</tr>
<tr>
<td>Full-Day, School Year</td>
<td>$8,800</td>
</tr>
<tr>
<td>Full-Day, Year Round with Integrated Child Care</td>
<td>$12,970</td>
</tr>
<tr>
<td>Equal Mix of Programs</td>
<td>$8,957</td>
</tr>
</tbody>
</table>

The cost of universal pre-kindergarten depends on a variety of factors that include the quality of teachers, the length of the program, and the size of the classes. More information on how these variables affect the expenditure of preschool can be found in the chart above. This graph provides national estimates of the per-child costs – in adjusted 2007 dollars – of pre-kindergarten in diverse settings and at varying levels of teacher quality, class size, and hours per day. The estimates give a general picture of the expected costs of quality improvements, though actual costs will differ from state to state.

In Massachusetts, Universal pre-kindergarten was launched in 2007 as a pilot initiative. The state legislature appropriated $4.6 million in the fiscal year 2007 budget for the Pilot Initiative, which was expanded to $7.1 in fiscal year 2008, and further expanded in fiscal year 2009 to $12.1 million. In beginning the UPK initiative, Massachusetts sponsored 277 programs, and 183 of them completely. The sponsorship of these private pre-kindergarten programs could mark the beginning of a more widely available pre-kindergarten system.

According to grantees, the Massachusetts UPK Pilot Program was well received because of a well-organized implementation and the successful targeting of funds to appropriate areas of need. The vast majority of grantees reported quality improvements in all allowable expenditure categories, and in most cases, the grantees reported “substantial improvement in quality” of the programming they were able to provide. Respondents as

40 Graph found from http://www.pewstates.org/uploadedFiles/PCS_Assets/2008/PEW_PkN_meaningfulinvestmentsbrief_may2008.pdf
41 This data in this study is presented as cost per child based on the following variables:
  - Length of “school-day”- 3, 6, 9 hour program
  - Size of classroom- 15, 17, 20 students
  - Teacher Qualifications
    - BA-I: A bachelor’s degree-holding teacher with a credential in early childhood or a related field, paid at typical kindergarten-level wages
    - BA-II: A bachelor's degree-holding teacher with a credential in early childhood or a related field, paid at typical pre-k-level wages
    - AA: A teacher with an associate’s degree in early childhood or a related field
    - CDA: A teacher with a child development associate credential
helpful described UPK funds, but in many cases they were reported to be insufficient to address pressing quality improvement needs.

Future recommendations for the UPK grant system from the Massachusetts Department of Early Education and Care include providing more technical assistance and training to participating programs, refining spending plans, investing in a more developed family child care plan, and increasing parental awareness of programs. Such changes would necessitate an increase in funding for the program.

A recent report released by the Massachusetts Budget and Policy Center examined the a variety of different possible scopes for improving access to pre-kindergarten schooling for underserved Massachusetts students who do not currently receive any state subsidy. It proposed three options for the roughly 158,000 total 3- and 4-year-olds old living in Massachusetts in 2012: universal access through the public schools, an expansion of subsidies for private care, or a public-private hybrid system.

The first option, a public school expansion, the costliest option, would cost an estimated $1.48 billion and would offer full-day pre-kindergarten to all 105,500 kids currently not receiving any public assistance, regardless of family income. The second option, expansion of subsidies, would require the administration to more than double its commitment to subsidies for private pre-school paid out on a sliding scale to all families living at or under 400 percent of the federal poverty level. This option would cost the state $153 million with families picking up the other $288 million and would not reach the almost 54,000 children from families with incomes higher than the threshold. The final option, which did not have a specific cost estimate attached, would involve explore better integration of public and private pre-school options with increased funding going toward more seats in public programs or to support integrated programming in public and private settings.43

3.1.4 Counterargument

A cost-benefit analysis of universal pre-kindergarten performed by William Dickens of the Brookings Institution for the Pew Charitable Trusts found that even when taking the impacts of the two projects at face value, the cost-benefit ratio of a widely-institutionalized Perry Preschool-type program would yield positive returns only after about 90 years, given the greater scope of a universal program and its high initial costs. For Abecedarian, the ratio would turn positive after about 55 years. Furthermore, Dickens argued that the relative infancy of the Perry program and its small size of 100 students mean that we lack enough information to conduct any significant long-term analysis.

Another analysis performed by the Brookings Institute found that universal-preschool programs in Georgia and Oklahoma had only small effects on participants’ later academic achievement. Researchers at Vanderbilt University conducted an in-depth study44 of children who attended Tennessee’s government-administered preschools, and found that by first grade, any benefits provided by the preschools had vanished entirely. In fact, the preschools had an insignificant to slightly negative effect on both academic and social/ emotional skills.45 Counterarguments towards expanding pre-kindergarten education do exist, but are typically born out variations in measuring benefits. Also, it should be noted that while certain studies find pre-kindergarten programs in some states to be ineffective, this does not speak for pre-kindergarten programs as a whole. Variations in programs exist across regions and should be recognized when analyzing research.

Over the course of elementary school, scores for children who have and have not attended preschool typically converge. Despite this convergence in scores, there is some evidence that outcomes in early adulthood still diverge based on participation in such programs. The disappearance of the initial academic gains may be due to number of factors. For example, the low quality of primary schooling, particularly for students in disadvantaged areas, may fail to build on the gains created by early childhood education.46 Additionally, having

<http://www.pec.state.ma.us/docs1/research_planning/20101103_upk_assessment.pdf>


46 Evidence Base on Preschool Education:
students who attended and benefited from preschool may also permit elementary-school teachers to focus more on the non-attenders, and this extra attention may explain the convergence or catch-up pattern.

3.1.5 Conclusion

Despite recent concerns about some of the traditional literature that has espoused universal pre-kindergarten as the cure-all for our education problems, there remains very little question that universal pre-kindergarten leads to short-term and long-term gains in students’ health, cognitive ability, and learning. However, the question is whether the short-term cost can be justified by long-term benefits, especially since pre-kindergarten shows most effectiveness among severely disadvantaged populations.

3.2 KINDERGARTEN AND FIRST GRADE READING INTERVENTIONS

3.2.1 Mechanics

Given the high correlation between low performance on MCAS reading exams at a young age and negative later life outcomes, Governor Deval Patrick has demonstrated a particular interest in early intervention strategies, publically stating that “investing in our children at a young age pays huge dividends for them and for our community as a whole.”47 In fact, implementing a universal pre-kindergarten system for literacy instruction may be less effective than strengthening intervention programs in kindergarten and first grade.

A recent research article featured in Early Childhood Research Quarterly titled “Children learning to read later catch up to children reading earlier” revealed that early earlier introduction of reading instruction does not have advantageous long-term effects on later reading achievement and performance when compared with slightly later years. The article discusses the findings of a study conducted by Suggate et al., who examined the long term effects of reading instruction age by comparing two education models in New Zealand: state-schools, in which formal reading instruction began at the age of five, and the Steiner system, in which reading was not taught until the age of seven. The purpose of the study was to determine whether earlier reading intervention conferred any long-term advantages. Students from both systems were tested using measures such as letter naming fluency, oral reading fluency, the Peabody Picture Vocabulary Test IV, reading self-concept, word identification, word attack, and passage comprehension throughout their first six years of reading instruction.48 The study found that starting reading instruction at age seven as opposed to age five actually increased reading proficiency at age eleven. This is due to the study’s finding that decoding-related skills can be learned as much as 19 months later than the Pre-kindergarten entrance age and still reach a level of fluency which is equal or even higher than their Pre-kindergarten peers. Although those students who began literacy instruction at age five initially displayed superior initial decoding and reading fluency skills, this advantage steadily decreased over the years, and the gap in reading skill disappeared by age eleven.49 In fact, at age eleven, students who were not taught to read until age seven actually exhibited slightly higher decoding and reading fluency skills. (See Fig. 12 & 13.)

---

The study also mentions that countries with higher literacy rates, such as Scandinavia, typically commence reading instruction at ages six or seven, as opposed to ages four and five like the United States. This

suggests that the implementation of later interventions in kindergarten or first grade may prove more beneficial than universal pre-kindergarten in regards to long-term success.

One particularly effective literacy intervention in kindergarten and first grade classrooms is an instructional framework known as Targeted Reading Intervention (TRI). TRI is an intensive, diagnostic literacy program in which teachers target struggling kindergarten or first grade students for several weeks through a series of brief one-on-one lessons. These lessons take place while the rest of the class works independently or receives literacy instruction from a teaching assistant. Each lesson spans about 15 to 20 minutes and involves three exercises: Re-Reading for Fluency, Word Work, and Guided Oral Reading. In the first exercise of the lesson, Re-Reading for Fluency, students reread a passage which they read the day before as a means of learning to identify words and develop fluency. After a few minutes, the lesson progresses to the second exercise, Word Work. In this exercise, teachers improve students' sight-word recognition and phonological decoding by employing a range of strategies designed to facilitate the manipulation, oration, and composition of words. During the last exercise, Guided Oral Reading, teachers support and coach the student while they read aloud in order to assist them with comprehension, word-identification, and vocabulary. This last exercise targets specific objectives, such as enhancing students' ability to summarize and enabling them to make predictions, connections, and inferences. In the TRI model, teachers depend on webcam technology to receive assistance from trained literacy coaches before, during, and after the one-on-one lessons. TRI utilizes webcam technology to enable trained professionals to monitor and guide teachers during instruction, particularly when problems arise.

3.2.2 Benefits

A study conducted by Amendum et al. found the TRI model to be an effective reading intervention. In this study, the efficacy of TRI as a strategy for improving literacy was tested in eight schools from five rural, high-risk districts in southwestern United States. Of the classrooms studied, nineteen were kindergarten classrooms and 24 were first-grade classrooms. To limit variability, all classrooms in the experimental group were provided the same materials, professional assistance, and instruction. After the teachers in the experimental group were trained and equipped with webcam technology, they each identified the five lowest-performing students in their reading classrooms. Teachers in the experimental group then employed the TRI framework on these five focal students and the effects were measured on tests conducted in the spring.

According to Amendum et al., struggling students who received TRI in both kindergarten and first-grade significantly outperformed those who did not receive TRI on spring reading tests. Students who underwent the TRI program earned higher scores in Word Attack, Letter/Word Identification, Passage Comprehension, and Spelling of Sounds. Evidence shows that TRI was responsible for increased performance in all areas of reading, particularly comprehension. Experimental focal students' scores on literacy tests in the Spring after receiving TRI were higher in all dimensions than those on tests taken in the Fall prior to TRI. Scores in Word Attack jumped from 435.65 to 467.26, Letter-Word Identification scores increased from 384.03 to 425.56, Passage Comprehension scores rose from 416.40 to 443.69, Spelling of Sounds from 468.95 to 489.74, and PPVT from 88.39 to 91.81. (See Fig. 14)

---

3.2.3 Costs

Studies of the TRI Instructional Framework lack sufficient information on the costs of this intervention. Explicit figures cannot be anticipated for implementation of this model. Refer to the counterargument section for a consideration of the financial constraints of TRI.

3.2.4 Counterargument

While it is evident that this framework is an effective reading intervention for kindergarten and first-grade students, its implementation statewide may prove unfeasible. The potential costs of large-scale adoption of the TRI model would likely be very high. This intervention is heavily reliant upon the adoption of webcam technology in all participating classrooms. Subsidizing the incorporation of webcams in kindergarten and first grade classrooms across the state is an expensive endeavor. The state contains 1,154 elementary schools. Assuming that each elementary school contains at least one kindergarten and one first grade reading classroom, there are a minimum of 2,308 classrooms requiring a webcam across Massachusetts.

In addition, the TRI model necessitates that a professional literary coach collaborate with every teacher. Given its highly individualized character, it will not serve to have only one coach generically assist all schools in the program. Establishing a network of such personalized coaches and providing compensation for their service must be taken into consideration in any cost estimation. Furthermore, all teachers at the kindergarten and first grade level would need to undergo training in TRI instruction. Extensive training programs for teachers would have to be developed and standardized. This requires hired trainers, printed materials, and teacher hours. Time and compensation would need to be allotted for these training sessions. Teacher Unions might object to mandating teacher attendance to these training programs beyond the calendar of the academic school year. Additional time outside of the classroom may not meet favorable support from Teacher Unions, and certainly not without the promise of remuneration for the hours and work contributed.

While existing research does demonstrate the efficacy of the TRI model, the research is limited and the model remains in its infancy. The TRI framework is a recent development and has not yet been broadly applied. At this time, evidence only supports limited and targeted application of the TRI framework, as it has only proved effective for schools in low-income, rural communities in which students demonstrate high need and teacher performance is substandard. It might be premature to integrate the TRI framework into statewide curriculum for kindergarten and first grade classrooms at this time. However, the model is promising and should remain on

---


---
the radar as a potential future intervention strategy.

3.3 Expanded Learning Time

3.3.1 Mechanics

Expanded learning time (ELT) can be used to describe several different types of educational restructuring. The most prominent types of ELT are a longer school year or a longer school day. A longer school year can be attained either by simply extending the school year calendar or by restructuring school breaks, which would not necessarily increase the number of days students attend. For example, such a schedule would break a larger summer vacation into several smaller breaks throughout the year. However, the most common type of ELT employed is the extended school day. Thus, most of the literature available concerning ELT addresses with this approach and, as a result, extended days will be the main focus of this section.

Extended days consist of one or more mandatory hours added onto the end of the school day. Adding extra hours allows greater time for instruction, enabling students to engage with the material on a deeper level and increasing information retention. ELT has thus far been used in a targeted manner to help improve underperforming districts. This has been particularly prevalent in Massachusetts, where ELT has been widely implemented. A leader in ELT, Massachusetts has several of the most successful ELT schools in the nation. Orchard Gardens School in Boston is one such school, having experienced marked increases in MCAS scores since implementation of its ELT program in 2010. Orchard Gardens added 1 hour for grades K-5 and 3.5 hours for grades 6-8. Partnering with Citizen Schools, an organization founded to provide educational support, Orchard Gardens was able to provide more teaching staff and a small-group oriented educational environment. The extra hours were broken down into periods of homework time, reading, choice time, and apprenticeships. Reading time was focused on vocabulary and comprehension, while choice time included different possible academic and enrichments activities. Apprenticeships allowed students to explore and learn about a specific career path with help from volunteers. This programming not only lead to academic improvements, but was constructed in such a way as to keep students engaged-preventing student burn out.\(^{57}\)

3.3.2 Benefits

Multiple studies have found that the implementation of an ELT program has led to improvements in student performance. Furthermore, there is a good deal of literature that supports the idea that extended learning time is particularly effective in underperforming districts and is therefore a valuable tool with which to help close the achievement gap.\(^{58}\) \(^{59}\) ELT is effective in preventing recidivism by specifically targeting students with risk factors that indicate they may have greater potential to rely on public support later in life.

While extended learning time has not been widely implemented, it has been used in various locations, such as California and New Mexico. For example, a program implemented in New Mexico started in 2007 targeting economically underprivileged schools, particularly their kindergarten to third grade students, improved their test scores by varying amounts when compared to prior baseline testing in those same schools. However, this study has been criticized for targeting only underprivileged schools, a factor that introduces a new variable, which may account for the degree to which student scores improved, as these students have more room for growth than those at the top.\(^{60}\)

A different study of California elementary schools conducted in 2013 reached similar conclusions concerning the effectiveness of expanded learning time. The authors found a statistically significant and positive relationship between an increase in overall time in the classroom (via an increase in day length) and an increase of 11.1 points in the Academic Performance Index, a metric used to gauge student success. Further studies of cases throughout that nation have all yielded similar results, varying mostly in how much, rather than in whether,\(^{57}\) Chan, Roy. "Transforming Schools through Expanded Learning Time: Orchard Gardens K-8 Pilot School." Www.timeandlearning.org. National Center on Time and Learning, Aug. 2013. Web. 27 Apr. 2014.  
expanded learning time would increase student performance.\textsuperscript{61}

3.3.3 Costs

The costs of implementing ELT programs derive from the cumulative costs of several factors and therefore depend on the design of the program in question. Figure 15 below provides an idea of possible structures and the cost they incur, as estimated from programs that have been implemented in schools Massachusetts. In a study of Massachusetts’s schools, costs of extended days were found to be in the range of $1500 to $5,028 per pupil (see Figure 15), depending on how comprehensive the extended day program was (i.e. how many/which members of the faculty were employed in the application of the program). The table below, based on various Massachusetts-based ELT programs, illustrates possible variation in cost and in program content. Cost is dependent on the model that the school employs. As a side note, because the increase in cost is, in terms of percentages, less than the increase in the length of the day, extended days see a decrease in cost per hour.

<table>
<thead>
<tr>
<th>Academic Instruction</th>
<th>Jacob Hiatt Elementary School</th>
<th>Frank M. Silvia Elementary School</th>
<th>Joseph A. Browne Middle School</th>
<th>Edwards Middle School</th>
<th>Matthew J. Kuss Middle School</th>
</tr>
</thead>
<tbody>
<tr>
<td>Additional time dedicated to literacy, math, science and social studies instruction.</td>
<td>- Additional time dedicated to literacy instruction</td>
<td>- Additional time dedicated to literacy, math, social studies instruction, and the unified arts</td>
<td>- No time added to existing blocks for instruction in core subject areas, or the unified arts</td>
<td>- No time added to existing blocks for instruction in core subject areas, or the unified arts</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Academic Interventions</th>
<th>Jacob Hiatt Elementary School</th>
<th>Frank M. Silvia Elementary School</th>
<th>Joseph A. Browne Middle School</th>
<th>Edwards Middle School</th>
<th>Matthew J. Kuss Middle School</th>
</tr>
</thead>
<tbody>
<tr>
<td>- 8th hour math interventions (3 days per week)</td>
<td>- Embedded interventions in lower grade level classrooms (literacy and math)</td>
<td>- Groupings for workshops</td>
<td>- Academic Leagues</td>
<td>- Differentiated scheduling for students in academic interventions and enrichment</td>
<td></td>
</tr>
<tr>
<td>- Tutoring for selective students during an optional 9th period</td>
<td>- Stand-alone intervention blocks at end of the school day in literacy and math for upper grades (two times per week)</td>
<td>- Tiered intervention workshops in ELA and Math</td>
<td>- Acceleration Academies</td>
<td>- Intersession academic camps</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Enrichment</th>
<th>Jacob Hiatt Elementary School</th>
<th>Frank M. Silvia Elementary School</th>
<th>Joseph A. Browne Middle School</th>
<th>Edwards Middle School</th>
<th>Matthew J. Kuss Middle School</th>
</tr>
</thead>
<tbody>
<tr>
<td>- Embedded academic enrichment in core subject area classes by outside partner organizations</td>
<td>- “Sacred Hour” elective block (Once per week; all grades)</td>
<td>- 7th hour “elective period”</td>
<td>- Dedicated elective block (Four days per week)</td>
<td>-ELT Block (“Ramp up” interventions and electives) (Daily)</td>
<td></td>
</tr>
<tr>
<td>- Field trips</td>
<td>- Anti-bullying program (upper grades)</td>
<td>- Field trips</td>
<td></td>
<td>-“Advisory” period (Daily)</td>
<td></td>
</tr>
<tr>
<td>- 8th hour electives (2 days per week)</td>
<td>- Mandatory chorus (upper grades)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<http://eus.sagepub.com/content/early/2013/07/17/0013124513495275.full.pdf+html>.

\textsuperscript{62} Retrieved from http://www.doe.mass.edu/research/reports/2012-10ELTcostanalysis.pdf On 3/15/14
### Teacher Professional Development
- Teacher-led PD
- Facilitated PD
- Instructional rounds
- Early release days
- Literacy training for paraprofessionals
- Early release days
- Professional learning communities
- Teacher conferences and external training/professional development
- Friday professional time
- Release days during school year
- Summer professional development

### Teacher Collaboration/Planning
- Common grade level planning time (1 day per week)
- Occasional grade-level assemblies for teacher release
- No additional individual teacher planning time
- Common planning time teachers (general and special education)
- Additional individual teacher preparation time
- Common planning time (optional)
- Additional individual planning time
- Teacher teams
- Common planning time
- Additional individual planning time
- Common planning time (cluster and content/curriculum)
- Additional individual teacher preparation periods

### Program Administration
- ELT coordinator
- Instructional Leadership Team (ILT)
- Mass 2020 TA/Coaching
- Grant reapplication & reporting
- ELT program coordination (school principal and ILT)
- Mass 2020 TA/Coaching
- Grant reapplication & reporting
- ELT coordinator
- ELT planning team
- Mass 2020 TA/Coaching
- Grant reapplication & reporting
- ELT coordinator
- Instructional Leadership Team (ILT)
- ELT program coordination (school principal and ILT)
- School redesign team
- Mass 2020 TA/Coaching
- Grant reapplication & reporting

### Adjusted Per Pupil Cost
- $2513
- $1570
- 2,006
- 4,332
- 2,412

#### 3.3.4 Counterarguments
ELT skeptics cite several main concerns. These include labor concerns, cost, and the importance of quality of education over quantity. The first two concerns are similar in practice, as an increase in the length of school days has not often met with resistance from teachers unions, but rather a demand for compensation. As for the third argument, the positive effect that ELT has on test scores demonstrates that quality does not diminish with increased quantity. One more funding related critique is that it is often difficult for schools to initially secure funding for more than one year of programming. This creates hesitation in some districts to take on the new structure.

#### 3.4 CURRICULUM

#### 3.4.1 Mechanics
A curriculum-based intervention alters the manner in which reading is taught by teachers in order to improve student’s learning. To affect change in this manner, teachers need to be trained via teacher-training inservices to understand the specific areas that need to be implemented in their curriculum. The Common Core Standards (CCS) were adopted by Massachusetts in 2010 with the intention of implementing the program fully in 2013-2014 school year. The CCS are a set of national expectations for each school district to implement through

---


a uniquely designed curriculum. However, the shift to CCS will affect how reading is taught and, therefore, the amount of students achieving grade level expectations.

Because Massachusetts is only beginning to implement the standards and schools adjusted their curricula to match the CCS for the first time for the 2013-2014 school year, there is not enough data outside of models to determine how the new standards are affecting reading test scores in Massachusetts as of yet. In fact, it will probably take an entire thirteen-year cycle of students in order to see the total effects of the CCS on the average student throughout K-12 grade levels, which is partially why opponents of the CCS in Massachusetts have encouraged the state to delay the full implementation of the new standards.

Some experts have projected that students’ reading ability will be improved as the general purpose of the CCS is to increase the impact of current English Language Arts state standards by ensuring regular close reading and discussion of complex texts, including nonfiction, literary, and informational pieces. This means that each new curriculum will include a wider variety of reading pieces in order to better prepare students for later education and careers. This is projected to raise reading comprehension levels at a later age as it is diversifying the types of works to which students are exposed earlier.

Though CCS will certainly affect students’ literacy in a curricular manner, there are other curricular interventions that teachers can implement to maximize reading abilities. Teachers must craft a curriculum that will both adhere to the nationalized standards and be amenable to the personal needs of their students. In order to do this, for each student, teachers must understand each student’s abilities in phonemic awareness, phonics, guided oral reading, vocabulary, and comprehension before they can tailor the most successful possible curricular intervention in literacy. Teachers must understand how reading assessments, reading instruction, and reading interventions work and implement said knowledge in the development of his/her curriculum to best benefit the students. The state of Utah has pledged to match district funds in order to facilitate Utah’s K-3 Reading Improvement program as a means of increasing reading proficiency through reading assessments, focused external reading interventions, and instruction for teachers about how to develop effective curriculums that will improve reading at all levels.

According to the Congress-commissioned meta-analysis of peer-reviewed literacy studies called the National Reading Panel, one especially effective curricular practice has been targeting students’ phonemic awareness. Phonemic awareness is the ability to hear, identify, and manipulate phonemes, which are the smallest unit of meaningful sound, in spoken words. One method of teaching phonemic awareness is by practicing clear and consistent articulation of phonemes and space between sounds in words and sentences; this will promote greater fluency for students.

On a similar note, systematic teaching of phonics was another recommended strategy that had an impact beyond simply improving students’ abilities in the targeted area. Phonics is the teaching of individual sound-based units of words in order to improve fluency.

Teachers can institute guided oral reading in their classrooms by playing audio recordings of a fluent reader reading text at a pace of 80-100 words per minute, having students read with fluent adults or practice with peer partners, or engaging in Readers’ Theater, an enjoyable opportunity for students to have fun and performing in groups while simultaneously fostering collaboration and increasing phonemic awareness by reading texts

---

Specifically, Readers’ Theater shows statistically significant results in improve literacy for a variety of starting reading levels at the additional costs of teacher instruction and distribution as well as purchase of scripts.\(^\text{73}\)

However, the largest conclusion from the National Reading Panel study was the importance of in-service professional development as it was positively correlated with increased student achievement.\(^\text{74}\) Thus, it is essential for Massachusetts to ensure that teachers receive the proper instruction in how to develop a CCS-based literacy curriculum in a way that promotes success for students.

3.4.2 Benefits

The shift to Common Core literacy standards occurred under the auspice of improving reading level comprehension and fluency.\(^\text{75}\) Funded by the Gates Foundation, Achieve and the National Governors Association crafted the CCS using scholarly research, assessment data, and “comparisons to standards from high-performing states and nations” for the English Language Arts section specifically.\(^\text{76}\) The desired impact of the shift in standards is an improvement in useful skills for students, allowing for greater success in higher education and future careers.

The results of a Congress-commissioned meta-analysis of peer-reviewed literacy studies called the National Reading Panel demonstrate student auditory training improved phonemic awareness as well as reading and spelling.\(^\text{77}\) A phonics addition to a curriculum improves reading, understanding of sound-spelling relationships, and decoding as well as understanding text. Similarly, when implemented by teachers, guided oral reading has been shown repeatedly to positively affect word recognition, reading fluency, and comprehension of all students.

3.4.3 Costs

If Common Core Standards were shown to have the expected grade level effects on reading standards, then there would be no need for further intervention as well as no additional cost incurred for the state of Massachusetts since it has already allotted the necessary funds to fully implement the new standards. Thus, the implementation of the CCS could confound any attempts to track the success of new reading interventions selected by the state. Researchers working for that state should therefore proceed cautiously in implementing any new curricular initiatives they wish to track during the projected thirteen year time period until the effects of implementing the CCS on their own can be fully evaluated, as their results will likely be muddied by the larger systemic changes.

As far as other curricular interventions, additional costs could be incurred if the state chose to include teacher-training in-services on specific curricular improvements. If the state chose to follow the suggestions of the National Reading Panel, which promoted phonemic awareness, systematic teaching of phonics, and guided oral reading, then the state would need to account for teacher training costs, which would include paying the curricular expert, the teachers for their time, and a location for the training. These additional costs would be marginal if included in the in-services already planned on teaching the new reading implementation strategies of the CCS.


\(^{77}\) "National Reading Panel." National Reading Panel. Eunice Kennedy Shriver National Institute of Child Health and Human Development. 27 Apr. 2014 <http://www.nichd.nih.gov/research/supported/Pages/nrp.aspx/>. 
3.4.4 Counterarguments

There are still many opponents to the CCS, despite their adoption by 46 states. Many argue that states were coerced into adopting CCS under the threat of losing their Race to the Top funding. Furthermore, Massachusetts has delayed implementing the standards due to rising worries regarding the lack of a tailored approach to learning surrounding the new CCS-based standardized assessments, pushing said enactment back to 2015.78 Opponents of CCS feel that it is the state’s prerogative to set standards for individualized school districts to implement, allowing for a localized approach to teaching. They suggest that states create their own personalized standards, model their standards after another state, or amend their current curricular standards by adding other types of interventions to bring students up to grade level.79 However, what opponents fail to realize is that CCS is in fact not a curriculum but a set of standards that allow for personalized implementation at the teacher level. Districts train teachers how to implement the new standards, and the teachers then build their own curriculum on the foundation of CCS. This allows for the personalization of the curriculum to the literacy needs of the local population.

3.5 Promise Zones

3.5.1 Mechanics

A promise zone is a set of programs that seeks to end the cycle of poverty by transforming dysfunctional neighborhoods into areas of opportunity. These promise zones focus on improving educational opportunity, building social capital, and cooperating with local businesses to ensure that young Americans obtain the skills needed to provide for themselves in a competitive job market. As part of his Promise Zone Initiative, President Obama has designated five communities across America that will begin implementing these changes with federal aid.80

Spanning 97 blocks in Central Harlem, the Harlem Children’s Zone (HCZ) is famous for being the nation’s first and only promise zone thus far, and serves as a prototype for the Promise Zone Initiative. The HCZ blends high quality school environment with a variety of community outreach programs, and has been effective at improving educational outcomes.

At the center of the HCZ is a “No Excuses” charter school called the Promise Academy (PA). The “No Excuses” movement supports giving principals significant latitude in developing school policies, regularly testing students to assess program efficacy, and expecting parents and teachers to commit time to students outside of the conventional school day.81 Admission into PA is determined by a school lottery, although the staff actively reaches out to students who live within the Zone’s boundaries, encouraging them to enter the lottery.

PA incorporates several interventions explored elsewhere in this paper. Both the school day and school year have been extended, to 8 hours and 210 days respectively. In addition, students attending PA are required to attend a mandatory 25-day summer program. Academic instruction focuses heavily on literacy and math, spending over two hours on the former and 90 minutes on the later daily. Students are tested frequently, and those who are below set proficiency levels also receive extra attention in the form of after-school tutoring or Saturday school. As a result, PA students who are below grade-level spend about twice as many hours in school as peers in similar academic conditions in public school. Even PA students who are at grade level or higher spend about 1.5 times as many hours in school as their peers in public school.82

Surrounding PA is a comprehensive network of community support programs. The HCZ strives to not only provide students with a strong education, but also to change the culture of the surrounding neighborhood and make it more conducive to academic achievement and encourage enrollment in college. These community interventions begin early, starting with a parenting workshop focusing on raising children from 0-3 years of age. As children get older, they may enroll in preparatory programs for pre-kindergarten that focus on social skill and language acquisition, and ultimately may join the HCZ’s own pre-kindergarten program. Once students reach

80 The White House, Office of the Press Secretary.
81 Carter, Samuel Casey: 8-11.
82 Curto, Vilsa E., Roland G. Fryer, and Meghan L. Howard: 18
middle and high school, they may participate in programs promoting fitness, the arts, career skills, and preparation for college. Dobbie and Fryer provide a comprehensive list of all the HCZ’s community support programs, which is omitted here for brevity.83

### 3.5.2 Benefits

Assessing the impacts of the HCZ as a whole is difficult, as one cannot feasibly create a randomized experiment that relocates some families, placing some in the Zone and others elsewhere. However, it is possible to take advantage of PA’s school lottery to simulate a randomized experiment. Will Dobbie and Roland G. Fryer of Harvard University have performed the only causal study of the HCZ to date, finding that the while PA has a positive academic impact, the community programming does not seem to do so. Their study forms the backbone of this section, as it is the most rigorous analysis of the HCZ to date. Though PA served elementary and middle school at the time of the study, Dobbie and Fryer were only able to provide causal estimates for PA middle school due to insufficient sample size in the elementary school.

School lotteries pose an interesting challenge for analysts. Students who win the lottery are randomly selected, which offers the perfect framework for causal inference. However, the group of lottery winners that ultimately attend PA is not randomized. Enrollees are self-selected, as families will make school choices based on everything from where their children’s friends are enrolled to beliefs about the strength of a school’s teachers. Since there are two filters students have to pass through to attend PA – lottery and self-selection – Dobbie and Fryer have to use different techniques to estimate the impact of PA at each of these levels.

First, they estimate the raw impact of winning the school lottery, comparing lottery winners against lottery losers. This estimate is called the Intent-to-Treat (ITT) effect, and it captures the impact of offering a student a seat in the school, regardless of whether they accept it. The ITT itself is the sum of the impact on students who win the lottery and enroll, the impact on students who win the lottery but go to school elsewhere, and the impact on students who lose the lottery. Lottery winners who enroll elsewhere may still be affected by winning a seat at PA; for example, parents may place their children in another school in order to give them access to a particular extracurricular activity or sports team. Similarly, parents of lottery losers may attempt to compensate for not attending PA by enrolling their child in extra tutoring elsewhere. In both cases, the act of determining lottery winners and losers itself may have a measurable effect, one that must be considered when implementing a lottery.

Second, Dobbie and Fryer estimate the impact of actually attending PA by comparing students who won the lottery and enrolled in the school against students who lost the lottery, but whom we believe would have enrolled had they won. To determine which lottery losers would have enrolled, Dobbie and Fryer examined the winning enrollees and attempted to match their characteristics with those of lottery losers, obtaining a group of lottery losers who strongly resemble the lottery winners. The resultant estimate is called the Treatment-on-Treated effect, and it directly measures the school’s effectiveness by comparing similar groups of students who only differ based on whether they attended PA.

Lottery entrants and winners were predominantly black and Hispanic, and in most cases were on free or reduced lunch plans. Given the racial makeup of the school, Dobbie and Fryer chose to compare PA middle-school student scores with the average test scores among white and black students in New York. They find that lottery winners display accelerating growth each year from 6th to 8th grade. The effect is even more positive for students who actually attend the PA middle school. Compared to the average white NYC student, the average PA middle school attendee enters middle school at the 20th percentile and graduates at the 45th, almost closing the racial achievement gap in math. The effects on English Language Arts (ELA) are less pronounced but still positive, with PA middle-school students moving past the control group once they reach eighth grade.84 These results are consistent with findings from Britain that reading performance depends less on school quality than math performance.85

Even more promising is the fact that the PA middle school positively impacts the entire student body, not just those at the top of their class. Comparing just the lottery winners and losers, PA’s gains in 6th grade math scores come mostly from students who struggled with math. By 8th grade, the entire group of lottery winners outperformed the lottery losers. Gains in ELA proficiency likewise came from the students on the lower end of

84 Dobbie, Will, and Roland G. Fryer Jr: 15.
85 Currie, Janet, and Duncan Thomas 105.
the spectrum. Thus, winning the lottery and attending the PA middle school each improve educational outcomes.

3.5.3 Costs

The full cost of maintaining the HCZ was approximately $19,272 per pupil in the 2008-2009 academic years. The Zone receives $12,443 per student from the state of New York, and spent an additional $4,657 on educational costs and $2,172 on community programs, per student. Entirely removing the community programs would save at least $2,172 per year, plus the portion of the New York grant used to community programs. The upper bound for the cost of PA itself is then $17,100.

A hidden cost of PA is its high teacher turnover rate. The first three years of the school’s operation saw 48, 32, and 14 percent of the teachers leaving, respectively. This high attrition rate is due in part to the rigorous demands of the position, and in part to the school’s firing of teachers who are not demonstrating positive results. Overseers of a similar school in Massachusetts would have to be prepared for such staffing difficulties in the inaugural years of their programs. More importantly, school districts would have to account for fluctuations in teacher allocation to ensure that their promise academies are not attracting strong teachers at the expense of other districts in the area. As such, maintaining a strong teacher supply, as explored will be of vital importance in replicating and scaling PA.

3.5.4 Counterarguments

Educational gains from the PA middle school are much larger than those estimated for other interventions, such as paying students to attend school and turn in homework, reducing class size, and the Head Start program. However, students at PA appear to perform only as well as the median charter student in New York. Accounting for factors such as the proportion of students on free and reduced lunch, PA students rank at the 55th percentile in math and the 39th percentile ELA. Despite its extensive investment in community programming, the HCZ falls roughly in the middle of the charter pack, raising the question of whether such programs are cost-effective, or even necessary.

Dobbie and Fryer provide the answer in the way of several compelling arguments that the HCZ’s community programs are not the driver of its students test scores. Two comparisons best summarize their findings. First, non-enrolled siblings of PA students who live in the Zone still have access to all of the community programs, but do not show any academic growth as a result, showing that community programs in isolation don’t boost performance. Second PA students who live outside the zone and therefore have reduced access and exposure to the community programs display the same growth as students inside it, suggesting that the school alone is enough boost performance.

Thus, while the HCZ model achieves its goals of boosting academic performance, particularly for students who are struggling, it does not appear to do so by catalyzing cultural change in the surrounding neighborhood. Rather, the HCZ appears to focus on measuring student needs and responding to them in a personalized manner with instruction from high-quality teachers. Any future implementations of promise zones will require a clear definition of the policy’s goals and establishment of strict metrics by which to test it. In cases where Dobbie and Fryer’s methodology is impossible to replicate, Robin Smith provides guidelines for alternative evaluation techniques.

Given the high cost developing the infrastructure necessary for a promise zone and the difficulty of assessing their effectiveness, we do not recommend a replication of the full HCZ model. However, the Promise Academy’s demonstrated ability to reach the lowest-performing students makes it a model charter school to emulate.

---

91 Dobbie, Will, and Roland G. Fryer Jr: 3-4.
92 Smith, Robin E: 8-9.
3.6 Outside Tutoring

3.6.1 Mechanics

This section will discuss two highly effective high-dosage tutoring programs, one at Match charter school, a public charter school which works primarily with low-income students in the Boston area, and the Apollo 20 program, which operates school turnaround models in 20 of the Houston Independent School District’s lowest performing schools. Both schools have populations made up primarily of traditionally underserved populations. The Apollo 20 project is a particularly valuable reference point because the 20 schools were randomly selected from a pool of low-performing schools, allowing for rigorous evaluation of the program’s effectiveness.

High dosage tutoring refers to tutoring programs that seek to raise student achievement by tutoring students in small groups for a large amount of time. In the Apollo 20 program, for example, students received approximately 190 hours of tutoring in addition to attending regular school hours over the course of a year. This form of intense tutoring, unlike the reading interventions described in section 3.2, can occur at all grade levels for all students. Ideally, these tutoring sessions allow teachers and tutors to more carefully gear instruction to the needs of particular students and thus help students make faster progress. High dosage tutoring can have student-to-tutor ratios ranging from from 1:1 to 4:1. Both Match and the Apollo 20 program give all students tutoring, arguing that giving it to only some could create negative stigma around receiving tutoring and that all students can benefit from additional academic growth.

Apollo 20 tutors are required to have a Bachelor's degree and a strong aptitude in the relevant subject. Highly effective programs tend to recruit more applicants than needed so as to be able to select tutors based on demonstrated ability in instruction. For example in the Apollo 20 program discussed below, 1158 individuals submitted applications but the program only made 319 offers, an acceptance rate below 30%. Similarly, some of the best programs run their own training regimens for their tutors. At Match charter school, for instance, many tutors are enrolled in the school’s affiliated teacher preparation program and tutor in addition to taking classes that prepare them to become classroom teachers in highly effective charter schools.

Apollo 20 tutors are paid $20,000 a year. In some instances, tutors are paid end of year bonuses based on the performance of their students on standardized assessments. In the Apollo 20 program, tutors were paid an average of $3,346 extra per year.

3.6.2 Benefits

High dosage tutoring has demonstrated significant success at raising student achievement and is frequently found in high performing school environments. In a comprehensive study of high performing charter schools, Harvard Professor Roland Fryer identified it as one of five traits of highly effective schools. Match Charter School in Boston, where all students now receive daily high dosage tutoring in both math and English, reports that in the year tutoring was introduced MCAS proficiency rates rose from an already impressive 70 percent to 100 percent.

Evidence from rigorous random-assignment evaluations also suggests that high dosage tutoring is a particularly effective way of increasing student achievement. In a randomized study known as the Apollo 20 program, Harvard Professor Roland Fryer finds that students in forth, sixth, and ninth grade (the only grades tested) who receive high-dosage tutoring show significantly more academic progress on standardized assessments than students who do not. In professor Fryer’s study, students who received high dosage tutoring in secondary school grew approximately 100 percent more on standardized assessments than peers who did not receive tutoring. Professor Fryer finds larger growth for high school students.

---

96 Fryer, Roland.
3.6.3 Costs
Tutoring is a cost-intensive intervention. In Professor Fryer’s rigorous Apollo 20 intervention, tutoring costs an additional $2,500 per student, a cost covered by donations from outside foundations. Match Charter School does not report costs publicly but is likely to be similarly quite expensive.

Nonetheless, given the remarkable achievement gains made by students who receive high quality high dosage tutoring, in particular the more than doubled growth mentioned above, Professor Fryer estimates that tutoring will have long-term positive economic returns as a result of improved life outcomes and reduced need for government expenditure. Professor Fryer estimates that his tutoring program has a roughly 18 percent long-term return on investment.

3.6.4 Counterarguments
Further research and experimentation is likely needed to determine whether high dosage tutoring could be implemented at scale in a cost-effective and successful way.

One potential concern is whether tutoring at the scale of an entire district or state would be as efficacious as tutoring in smaller programs such as Match or Apollo 20. One obvious concern would be the ability to recruit equally high levels of human capital. In Fryer’s Apollo 20 program, administrators screened 1158 tutor applicants and offered positions to only 319 tutors. A program implemented at a larger scale might be unable to draw an applicant pool so much larger than the number of tutors needed and might therefore struggle to remain as selective, perhaps ultimately hiring lower-quality tutors. On a similar note, Match and Apollo 20 employ rigorous screening processes, asking potential tutors to participate in full-day screening sessions, a practice that may not be replicable on a larger scale.

Alternatively, program implementation may become less effective at scale regardless of the capabilities of individual tutors. If, for example, the rigorous and data-driven approaches used in both Match and Apollo 20 programs are difficult to enforce as programs grow larger, then student achievement growth may also grow smaller.

Similar concerns apply to costs. While Professor Fryer and Match were able to find effective tutors for the number of students needed while paying relatively low salaries, a district’s ability to recruit effective tutors for all of its students may be contingent on an ability to pay higher salaries.

3.7 Virtual Schools
3.7.1 Mechanics
This section discusses the use of state virtual schools as an intervention to improve students’ reading levels specifically. Virtual schools use computers and broadband networks to implement extended learning time programs for reading interventions. As of 2013, there are 26 states that have operational virtual schools with a total enrollment of 740,000 students. Online learning is becoming increasingly popular due to the greater accessibility of technology, which allows students to complete distance learning; for example, virtual schools enable being taught in geographically removed areas to retain the kind of structure usually associated with physically present teachers. Virtual schools allow teachers to provide individualized teaching to students, thereby keeping them motivated and engaged in the virtual classroom setting.

Students of all grade levels enroll in virtual schools to supplement their classroom learning, though there is no guarantee that the material taught in the virtual school will align exactly with what is taught in classrooms. The Government Accountability Office estimates that providers in 40% of districts do not align their material with classroom curricula. However, this statistic may soon change with the implementation of the Common Core Standards as state-sponsored virtual schools will be altering their curricula to adhere to the new state curriculum standards.

There are two types of virtual school learning: synchronous, in which teachers and students...
communicate in real time, and asynchronous, in which teachers and students are separated geographically and temporally. Figure 16 shows the advantages and disadvantages of each type of classroom structure.

The effectiveness of a synchronous virtual classroom in teaching reading mirrors that of an actual classroom. This type of reading intervention still allows guided reading to be taught as it would in a physical classroom; the only difference is that the teacher is geographically-distant. Contrary to the stereotypes of virtual learning, synchronous learning still allows for active discussions and facilitates social interaction. There are several ways in which one can enable smooth discussion that mimics that of a physical classroom, such as electronic hand-raising, which emphasizes respectful discourse and the inherent value of each student’s contributions.

Students reported that a synchronous learning environment was extremely convenient, and parents found that it was more amenable to their schedules as it minimized commuting and other associated costs. Students also claimed that their attention was more focused in this model of short classes and that they understood the material better as compared to typical classrooms. Synchronous reading interventions are an excellent way to accommodate students’ learning needs.

In terms of teaching reading virtually in an asynchronous manner, the Scholastic Reading Counts! Program and the Colorado Literacy Tutor Project’s Foundations to Literacy are two successful examples. The Scholastic Reading Counts! Program incentivizes learning to read through a rewards-based system in which students accrue points based on completing exams that assess reading comprehension. The Colorado Literacy Tutor Project’s Foundations to Literacy is an asynchronous computer program that allows students to develop basic reading skills with the help of a virtual tutor. An animated reading tutor that is tailored guides students to their needs in order to help them increase their reading comprehension. In order to aid in students’ clear speaking and understanding of the tasks as well, the virtual tutor uses recorded speech rather than synthetic speech. The virtual tutor helps students read the interactive books in a way that is designed to help students who have difficulty reading words, only moving on to comprehension and fluency after a student has demonstrated mastery of the material.

In addition to these two model asynchronous virtual learning systems, there are many more supplemental platforms that have the ability to help students to learn to read, using methods from teaching them phonics to making the learning interactive. Given the great variation between programs, they generally need to be evaluated on a case-by-case basis for learning and cost effectiveness.

---


3.7.2 Benefits

There are many benefits to reading interventions through virtual schools. A study by the U.S. Department of Education has shown that “students perform modestly better” overall in blended learning environments, which means that students who attend regular schools and supplement their learning with online courses are most likely to succeed.\(^{103}\) This is perhaps due to the fact that virtual, interactive classrooms personalize the process, allowing a teacher to pinpoint a student’s weaknesses early.

It is important to target and individualize supplemental learning to raise reading levels, as seen through the success of the Florida Virtual Schools. Students, parents, and teachers are able to create an individualized intervention curriculum that will bring students up to state-mandated reading standards by choosing which supplemental courses in which to enroll.\(^{104}\) The online nature of the program allows assessment data to be collected electronically, so that teachers and parents can monitor a student’s progress effectively. Furthermore, the individualized instruction propagated by virtual schools mimics the positive effects of smaller class sizes and purports to be a more successful reading intervention, because teachers are able to customize their teaching strategies to fit the interests of a single student or group of students.\(^{105}\) Effectively, students are able to learn at their own pace. In the case of synchronous virtual classrooms, reading instruction would still mirror the process of reading being taught in a physical classroom. Another theorized benefit of virtual schools is the access that it provides access to a variety of resources which teachers and students may not otherwise be able to enjoy.\(^{106}\)

Virtual schools are a new option for students, parents, and governments alike.

3.7.3 Costs

The cost-effectiveness of virtual schools depends on several factors. Due to the passage of “An Act Establishing Commonwealth Virtual Schools” in 2013, the cost of initially creating supplemental virtual school programs in Massachusetts will be incurred by the state, as private donors cannot establish state-approved virtual schools.\(^{107}\) As of 2014, there are no state-funded virtual school supplemental options located in Massachusetts. However, if the state chooses to establish these supplemental learning courses, the marginal cost of each additional student is minimal; it is only the initial costs of establishing the school that may serve as a barrier.

These supplemental courses will be paid for by the state under the targeted assistance-program provided by the Title I provision of the 1965 Elementary and Secondary Education Act, bringing eligible students up to grade level standards.\(^{108}\) School districts are required to put aside 20% of their Title I funding for school choice and supplemental learning, which can typically be recouped with in-school interventions like supplemental teacher tutoring. By adding a virtual schools option for supplemental reading interventions, districts will not be able to recoup all of their supplemental Title I funding, as some of it would go towards the virtual school. This possible decrease in funding due to re-distributed Title I funds could diminish support from teachers and districts for the creation of virtual schools. However, the creation of state-sponsored virtual schools could either provide jobs for new teachers in Massachusetts or allow teachers to earn supplemental income, possibly counteracting the negative impact of the loss of Title I funding and growing the economy overall. Additionally, online supplemental courses would reduce instructional costs for the state in an asynchronous setting, as the class sizes can be very large, but still intimate and personalized.


3.7.4 Counterarguments

There are, of course, opponents to virtual school-based reading interventions. Some argue that supplemental courses in virtual schools may lack the authority necessary to incentivize student action. However, this problem is solved in synchronous classrooms, as there is a geographically removed teacher present, though this still does not solve the authentication issue of ensuring that the student is completing his/her assigned work by him/herself.

Similarly, there is also the issue of ensuring that students are completing the supplemental courses. This would require parent supervision, which could be problematic for working parents.

Additionally, opponents argue that the success of the virtual interventions must be closely monitored by the state, ensuring that each school has been properly accredited and financially audited. As it is difficult to currently estimate the costs of a general virtual-schools based intervention, an annual audit would establish a precedent and ensure that state funds were being properly spent.

Furthermore, virtual schooling requires computers and webcams for most modern incarnations of synchronous learning. Not all families have computers, posing a problem that would require parental transportation to a public library in order to solve. This adds time costs as well as transportation costs to the equation of virtual school-based reading interventions. Thus, virtual schools could be too much of a financial burden on low-income households.

Lastly, opponents also worry about the problem of funding. Though virtual schools are less expensive to maintain than regular schools, due to their limited fixed costs, virtual schools are still granted the same per-student funding from governments. Opponents argue that too much money is being spent on virtual schools at the cost of typical brick-and-mortar schools, which opponents anecdotally believe to have shown more success. Proponents argue the opposite – that funding is too low because it is allocated without regard to the increased student-to-teacher ratios in both synchronous and asynchronous settings. Both groups are therefore displeased with the current level of funding. In general, virtual school interventions are highly controversial, despite the modern technology that makes them increasingly easier.

4. Conclusions

The goal of this paper is to provide an overview of a wide range of potential education interventions in order to give readers a balanced view of the current policy options. In order to do so, we began in Section 2 by discussing the economic consequences of failing to act, with a focus on the consequences of failing to improve educational outcomes at a young age, and then presented a profile of the current situation in education in Massachusetts, in order to contextualize the studies and figures we had provided earlier. In Section 3, we moved on to presenting seven different popular strategies for educational interventions, to provide a survey of the current education policy field so that readers would be able to pick and choose the interventions that seemed strongest to them as opportunities for further research. Overall this report has sought to present a reasonable case for the cost-effectiveness of acting now in order to save money later and to provide readers with reasonable evaluations of several different ways to act now. We will conclude by now providing you with a condensed bibliography, which we hope will serve as a useful reference for readers hoping to perform further research on interventions that seemed particularly promising.


110 Jones, Athena. "Virtual schools on the rise, but are they right for K-12 students?" Schools of Thought RSS. CNN. 26 Apr. 2014 <http://schoolsofthought.blogs.cnn.com/2012/01/30/virtual-schools-on-the-rise-but-are-they-right-for-k-12-students/>.
5. Additional Reading

2. Economic Impact of Investment in Education

3.2 Kindergarten and First Grade Reading Interventions

3.3 Expanded Learning Time

3.4 Curriculum

3.5 Promise Zones
Smith, Robin E. How to Evaluate Choice and Promise Neighborhoods. The Urban Institute, 2011.

3.6 Outside Tutoring

3.7 Virtual Schools