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## Early childhood interventions for low-income children

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Early childhood is an important, but contested, topic of research related to the production of human capital, and the only period of childhood and adolescence with relatively little public investment. Some scholars interpret the early childhood intervention evidence as showing promising opportunities for addressing inequities in human capital, and consequently argue for significant expansion of public investment. Other scholars come to more cautious or even negative conclusions, worrying particularly about the degree of risk and uncertainty in current evidence regarding long-term payoffs to early childhood investments. In this article, we review the evidence on the potential of early childhood investments, particularly center-based early childhood education, to reduce economic inequality.

### Which early skills matter for success in school?

If policymakers want early childhood programs (sometimes referred to as preschool) for low-income children to build skills that will generate lasting changes, which skills should be targeted? Table 1 shows selected types of skills and behaviors. Investments in early childhood education could potentially have positive effects on each of these skills and behaviors, which could in turn help to improve subsequent educational attainment, skill development, and labor market participation.

Among these four areas, the largest skill and behavior gaps between high- and low-income elementary school students occur in achievement. For example, data from the Early Childhood Longitudinal study found that for kindergarteners, the gap in both math and reading achievement between the top and bottom socioeconomic status quintiles was over one standard deviation.<sup>1</sup> Although disparities in children’s skills are also evident along a number of different dimensions other than socioeconomic status, including gender and race,

**Table 1**  
**Key Skills and Behaviors for Preschool Children**

	Achievement	Engagement	Antisocial Behaviors	Mental Health
Description:	Concrete math and reading skills	Ability to control impulses and focus on tasks	Ability to get along with others	Sound mental health
Example test areas or question wording:	Knowing letters and numbers; beginning word sounds, word problems	Can’t sit still; can’t concentrate; score from a computer test of impulse control	Cheats or tells lies, bullies, is disobedient at school	Is sad, moody

**Source:** G. J. Duncan and K. Magnuson, “The Nature and Impact of Early Achievement Skills, Attention Skills, and Behavior Problems,” in *Whither Opportunity: Rising Inequality, Schools, and Children’s Life Chances*, eds. G. J. Duncan and R. J. Murnane (New York: Russell Sage Press, 2011).

**Table 2**  
**Predictive Importance for Later School Achievement**

School-entry:	Grades 1 to 8:	
	Reading	Math
Reading	0.24*	0.09*
Math	0.26*	0.41*
Engagement/ Attention	0.08*	0.10*
Antisocial Behavior (- Effect Expected)	0.01	0.01
Mental Health (- Effect Expected)	-0.01	0.01

**Source:** G. J. Duncan, C. J. Dowsett, A. Claessens, K. Magnuson, A. C. Huston, P. Klebanov, L. S. Pagani, M. Engel, J. Brooks-Gunn, H. Sexton, K. Duckworth, and C. Japel, "School Readiness and Later Achievement," *Developmental Psychology* 43, No. 6 (2007): 1428–1446.

the magnitude of these differences is dwarfed by those related to family income. The income-achievement gap has grown substantially over the past half century, while the black-white achievement gap, for example, has decreased over the same period.

We would hope that effects of K–12 schooling would be sufficient to greatly reduce the gaps that exist at kindergarten entry. Unfortunately, that does not appear to be the case; gaps in all of the skill and behavior areas persist throughout children’s schooling.<sup>2</sup>

In order to determine which skills and behaviors best predict later school success, we combined six different longitudinal studies from different countries. The results, shown in Table 2, show that school-entry achievement skills are considerably more predictive of future success than antisocial behavior at school entry, and somewhat more predictive than engagement and attention skills.

Taken together, this research suggests that, to have the greatest effect on later school success for low-income children, it is most important for preschool programs to concentrate on early math and literacy skills.

## Current preschool investments

Next, we must determine how well current early childhood education programs promote cognitive skills. The sometimes large and enduring differences in early skills, as well as their consequences for later learning, have not gone unnoticed by educators and policymakers. These differences helped to motivate the expansion of Head Start, as well as state

and local prekindergarten programs, and most recently President Obama’s proposed expansion of enrollment in high-quality early learning programs. While hundreds of evaluation studies of early childhood education programs have been published over the past 50 years, only a handful of programs have been prominently discussed in policy circles by advocates and critics: Perry Preschool, the Abecedarian program, Head Start, and more recently some state and local prekindergarten programs, such as those in Oklahoma and Boston.

We use evidence from strong evaluation studies published between 1960 and 2007, looking specifically at effect sizes at the end of treatment.<sup>3</sup> Figure 1 shows average effect size of each program, with the size of the bubble reflecting sample size. While the results of high-quality early childhood interventions such as Perry Preschool and the Abecedarian Program may often be cited by preschool advocates, the figure illustrates that these programs are not typical; overall, the average effect size is modest, and declining over time. Taken as a whole, the average effect size for early childhood education on cognitive and achievement scores was 0.35 standard deviations at the end of the programs’ treatment periods. However, average effect sizes vary substantially and studies with the largest effect sizes tended to have the fewest subjects (as indicated by bubble size). When the estimates are weighted to reflect this, the average effect drops to 0.21 standard deviations.

The fact that these programs appear to have declined in effectiveness over time is likely due to a dramatic change in the counterfactual over this period. That is, the conditions encountered by children in the control groups of these studies have improved substantially.<sup>4</sup> First, children in comparison groups are now more likely to attend some other type of center-based child care or preschool program, rather than only parental care. This is illustrated in Figure 2, which shows that the proportion of three- and four-year-olds enrolled in preschool has grown substantially over time. For example, for children whose families were in the lowest income quartile, the probability of being in center-based care has increased from around 15 percent in 1970, to about 50 percent in 2010. There have been similar improvements in factors that may affect the quality of the home environment. For example, in the early 1960s, mothers of children in the lowest income quintile had an average of less than nine years of schooling; by the 1980s, this had increased to over 11 years. Family size has also decreased over this period. Taken together, all of these improvements for the low-income population as a whole mean that preschool programs have a much higher bar to clear in order to have significant program effects. The fact that conditions have improved for everyone

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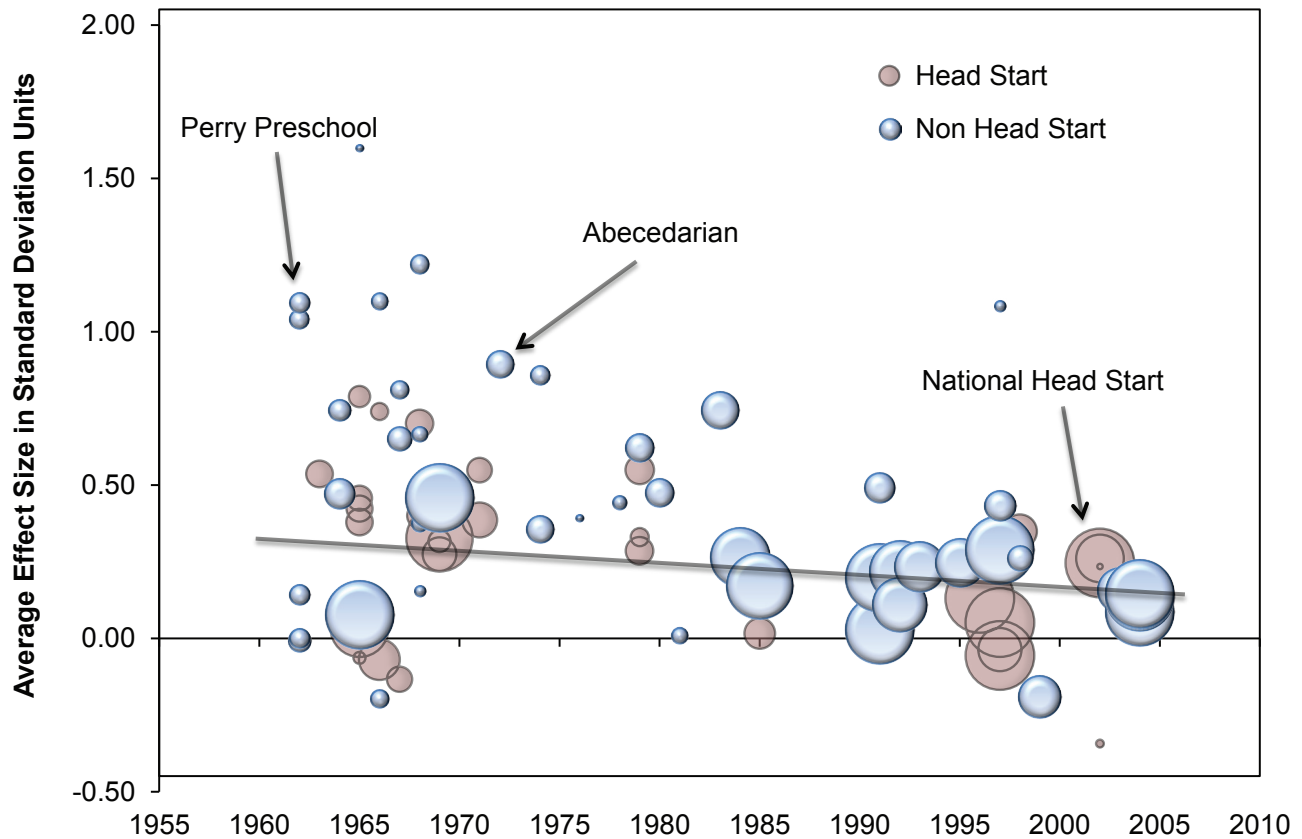


Figure 1. Average cognitive effect at the end of treatment.

Source: G. J. Duncan and K. Magnuson, "Investing in Preschool Programs," *Journal of Economic Perspectives* 27, No. 2 (2013): 109–131.

must be taken into account in designing effective preschool policies and comparing evaluation results; the quality of programming and related services needs to be even higher than before in order to have as large an effect.

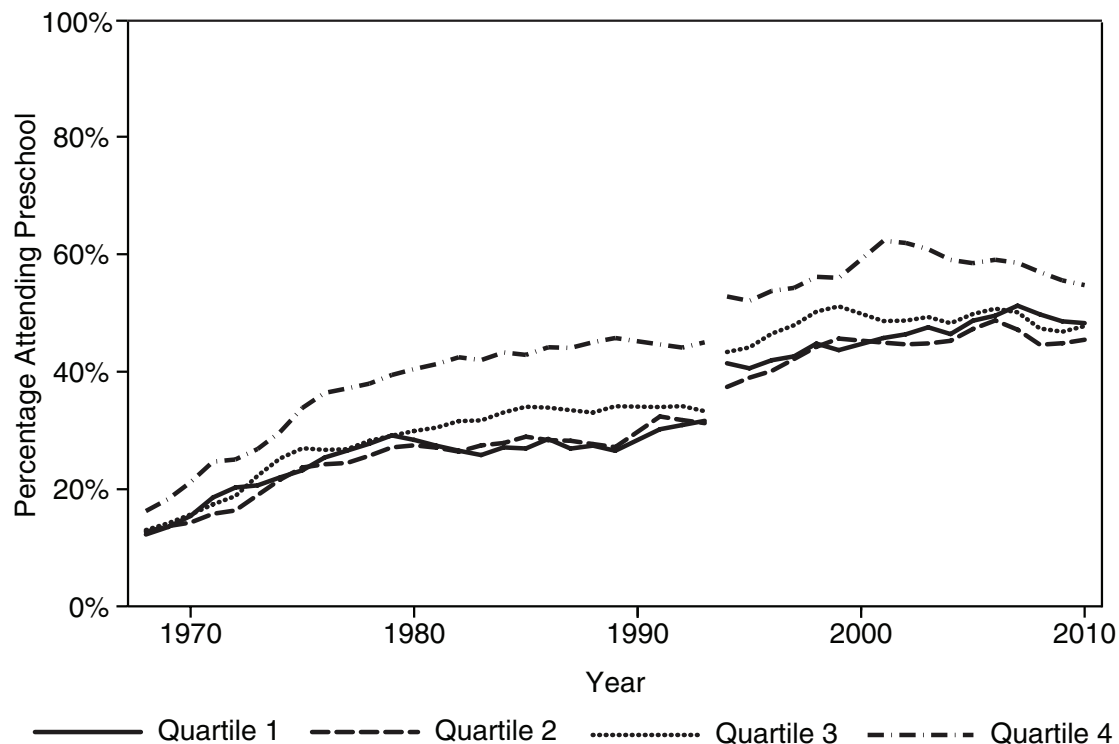
Our analysis of past program outcomes yielded several other potentially useful lessons. First, programs that begin earlier in life seem to generate larger effects than do those that start later. Note that because of higher required staff-to-child ratios for younger children, these earlier-starting programs are also considerably more expensive. Second, programs that last longer do not necessarily produce proportionately better results. This could be because preschool programs do not necessarily structure their activities and curricula in a progression that continuously builds skills; for example, the activities and learning opportunities in the second year of a preschool may not differ much from those experiences in the first year. Finally, effects appear to persist for approximately 15 years before there is no longer a difference between treatment and control groups.

### What policy levers are available?

Given the evidence that preschool is effective at boosting school readiness, we now turn to the question of how policies can raise the quality of programs that are available. One way to do this is through curriculum requirements. Most

preschool programs, particularly those with public funding and guidelines, use some form of curriculum to organize learning activities related to early academic skills—typically general concepts, early reading, and numeracy or math. These curricula may be either developed by the program itself or purchased from a commercial provider, and they differ in terms of the specificity of their content. Some provide lesson plans designed with a “whole child approach” including aspects that focus on multiple domains of development, and others target specific skills, such as literacy or math. As is the case in all educational settings, there is often considerable variability in the extent to which teachers implement curriculum as intended. Whole-child curricula are by far the most common; this is the type required for use in all Head Start centers. Despite this popularity, there is no strong evidence that whole-child curricula are preferable to those that are locally developed.

The Preschool Curriculum Evaluation Research (PCER) initiative assessed the effects of 14 different curricula implemented in early childhood classrooms serving primarily low-income children.<sup>5</sup> In each of 12 different projects, early childhood classrooms or centers were randomly assigned to a target curriculum or to a control condition, typically the standard local curriculum. During the pre-kindergarten year, initial analyses of these data found that 8 of the 14 curricula had a positive effect on teacher instruction, but only two had statistically significantly positive effects on



**Figure 2. Percentage of 3- and 4-year-olds enrolled in preschool by family income quintile.**

**Notes:** Authors' calculations from October Current Population Survey. Data shown are from three-year moving averages. The break in 1994 is due to a change in the wording of the question.

**Source:** G. J. Duncan and K. Magnuson, "Investing in Preschool Programs," *Journal of Economic Perspectives* 27, No. 2 (2013): 109–131.

child outcomes. A recent reanalysis of these data by Duncan and colleagues, which pools across curricula based on their content in order to better detect significant small to moderate effects, concluded that content-specific curricula focused on literacy and math are better able to promote academic skills than are more general "whole-child" curricula.<sup>6</sup> Considering classroom quality (measured by observation at the end of preschool), both whole-child and literacy-focused curricula were better than locally developed curricula.<sup>7</sup> A math-focused curriculum was (unsurprisingly) found to include many more math activities than did whole-child curricula. Considering child school readiness, there were no effects of the most popular whole-child curriculum compared to locally developed curricula. A math-focused curriculum did result in higher math scores. Some literacy-focused curricula were more effective than others at improving literacy skills; overall, the effect of these curricula on literacy scores was positive but small.

The Building Blocks math program is an example of a recently developed curriculum focused on a specific developmental domain. The curriculum includes large- and small-group instruction focused on teaching math skills in a focused and sequential manner, and hands-on and computer activities that promote children's active involvement in solving problems and explaining their solutions.<sup>8</sup> An experimental evaluation found that the curriculum resulted in large improvements in children's math knowledge when compared with a different math curriculum (effect size of 0.47 standard deviations) and

a control group using the standard local curriculum (effect size of 1.07 standard deviations).<sup>9</sup>

An example of a public preschool program that has taken seriously the need to identify exemplary curricula and implement them well is the Boston Pre-Kindergarten Program. The program developed their curriculum by integrating proven literacy, math, and social skills interventions. The academic component combined two curricula, Building Blocks for math instruction and Opening the World of Learning for language and literacy. Extensive teacher training and coaching was provided. The rigorous evaluation found large effects on vocabulary, math, and reading (effect sizes of 0.45 to 0.62 standard deviations). This compares to an average effect size for early childhood education on cognitive and achievement scores for programs evaluated between 1960 and 2007, illustrated in Figure 1, of only 0.35 standard deviations. The Boston Pre-Kindergarten Program also had somewhat smaller impacts on executive functions—mental skills that assist the brain in organizing and acting on information (effect sizes of 0.21 to 0.28).<sup>10</sup>

While evidence is accumulating, much more research related to preschool curriculum development and evaluation is needed. This work is critically important, but not easy for several reasons. First, the costs associated with successful implementation are not negligible, often requiring substantial investments in materials and teacher training time. Second, there are often non-financial obstacles to overcome. The



early childhood education workforce frequently works long hours for low salaries, which often results in workers with low levels of education and high rates of job turnover. Sometimes, these circumstances can make implementation challenging, especially in community-based settings. The associated research costs are also often quite high, because it is expensive to conduct experimental evaluations that include individual child assessments across multiple sites.

## A note about infant and toddler development

Finally, all the discussion of preschool leaves out infants and toddlers. These earliest years of life are an important period of development, and warrant greater policy and programmatic attention. The models of early learning programs that are developmentally appropriate for preschoolers cannot be simply extended downward for younger children at the same cost for the same effect. Some model home visiting programs and parenting programs for mothers of infants have also demonstrated the potential to have important impacts on children's trajectories, with potential implications for human capital accumulation.<sup>11</sup> Yet, at this time what is most needed are continued efforts to innovate and evaluate the feasibility and effectiveness of theoretically informed interventions for very young children.

## Conclusions

Development during early childhood provides an important foundation for human capital development, with important long-run links to economic earnings and opportunity later in life. The accumulated evidence suggests that there are multiple aspects of early skills—achievement, behavior, and mental health—for which improvement early in life can positively affect children's life chances. There is also accumulating evidence that attending good-quality preschools for a year or two results in long-lasting improvements in educational attainment and earnings, even when short-term improvements in concrete achievement skills fade during the elementary school years. Taken together, this argues for the importance of early childhood investments as a way to increase economic opportunity.

Currently, about 25 percent of children do not attend preschool before they enter kindergarten. Because low-income children are least likely to be enrolled compared with higher-income children, and because income gaps in early development forecast lower levels of human capital accumulation, improving attendance should be a first priority for policy. Other targets for investment include improving learning through research-based curricula and programs for infants and toddlers. ■

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<sup>1</sup>G. J. Duncan and K. Magnuson, "The Nature and Impact of Early Achievement Skills, Attention Skills, and Behavior Problems," in *Whither Opportunity: Rising Inequality, Schools, and Children's Life Chances*, eds. G. J. Duncan and R. J. Murnane (New York: Russell Sage, 2011).

<sup>2</sup>Duncan and Magnuson, "The Nature and Impact of Early Achievement Skills, Attention Skills, and Behavior Problems."

<sup>3</sup>K. Magnuson and G. J. Duncan, "Can Early Childhood Interventions Decrease Inequality of Economic Opportunity?" Draft paper prepared for the Federal Reserve Bank of Boston Conference, Inequality of Economic Opportunity in the United States, October 17–18, 2014, Boston, MA.

<sup>4</sup>G. J. Duncan and K. Magnuson, "Investing in Preschool Programs," *Journal of Economic Perspectives* 27, No. 2 (2013): 109–131.

<sup>5</sup>Preschool Curriculum Evaluation Research Consortium, *Effects of Preschool Curriculum Programs on School Readiness: Report from the Preschool Curriculum Evaluation Research Initiative*, Washington, DC: National Center for Education Research, 2008. Available at <http://www.researchconnections.org/childcare/resources/14449/pdf>.

<sup>6</sup>G. J. Duncan, A. Auger, M. Burchinal, T. Domina, and M. Bitler, "Boosting School Readiness with Preschool Curricula and Quality," UC Irvine, Manuscript, 2014.

<sup>7</sup>Math-focused curricula were not considered in this analysis.

<sup>8</sup>J. Sarama and D. H. Clements, "Building Blocks for Early Childhood Mathematics," *Early Childhood Research Quarterly* 19, No. 1 (2004): 181–189.

<sup>9</sup>D. H. Clements and J. Sarama, "Experimental Evaluation of the Effects of a Research-Based Preschool Mathematics Curriculum," *American Educational Research Journal* 45, No. 2 (2008): 443–494.

<sup>10</sup>G. J. Duncan and R. J. Murnane, *Restoring Opportunity: The Crisis of Inequality and the Challenge for American Education* (Cambridge, MA: Harvard Education Press, 2013); C. Weiland and H. Yoshikawa, "Impacts of a Prekindergarten Program on Children's Mathematics, Language, Literacy, Executive Function, and Emotional Skills," *Child Development* 84, No. 6 (2013): 2112–2130.

<sup>11</sup>D. L. Olds, L. Sadler, and H. Kitzman, "Programs for Parents of Infants and Toddlers: Recent Evidence from Randomized Trials," *Journal of Child Psychology and Psychiatry* 48, No. 3–4 (2007): 355–391.

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