



Untangling the Evidence on Preschool Effectiveness: Insights for Policymakers

Beth Meloy, Madelyn Gardner, and Linda Darling-Hammond

Abstract

Research showing that high-quality preschool benefits children's early learning and later life outcomes has led to increased state engagement in public preschool. However, mixed results from evaluations of two programs—Tennessee's Voluntary Pre-K program and Head Start—have left many policymakers unsure about how to ensure productive investments. This brief and the report on which it is based present the most rigorous evidence on the effects of preschool and clarify how the findings from Tennessee and Head Start relate to the larger body of research showing that high-quality preschool enhances children's school readiness by supporting substantial early learning gains in comparison to children who do not experience preschool and can have lasting impacts far into children's later years of school and life. Therefore, the issue is not whether preschool "works," but how to design and implement programs that ensure public preschool investments consistently deliver on their promise.

For the full report on which this brief is based, see: <https://learningpolicyinstitute.org/product/untangling-evidence-preschool-effectiveness>.

Acknowledgments

The full report benefited from the insights and expertise of two external reviewers: William T. Gormley, Professor of Public Policy at Georgetown University and Co-Director of the Center for Research on Children in the United States; and Martha Zaslow, Director of the Office for Policy and Communications of the Society for Research in Child Development and a Senior Scholar at Child Trends.

Funding for this brief and the full report on which it is based was provided by the Heising-Simons Foundation, along with the general operating support from the Ford Foundation, the William and Flora Hewlett Foundation, and the Sandler Foundation.

Introduction

Differences in how children develop are substantially linked to their learning experiences. As early as 9 months of age, the differential experiences of children growing up in low-income households and children from more affluent homes are associated, on average, with a gap in their cognitive development. The developmental gaps continue to grow all the way through preschool, elementary, and secondary school unless other learning opportunities intervene.¹

Evidence from early learning programs in the 1960s and '70s demonstrated enormous benefits for children (see Table 1). Those who attended these high-quality programs, the Abecedarian Project, Chicago Child-Parent Centers, and the Perry Preschool Project, were more ready for school and less likely to be identified as having special needs or to be held back in elementary school than children who didn't attend. When those children grew up, they graduated high school and attended college at higher rates, and they were less likely to become teenage parents, commit crimes, or depend on welfare. Inspired by this evidence and long-term social returns on investment as high as \$17 for every \$1 spent,² many states have invested in preschool programs to provide learning opportunities that improve children's outcomes.

A large body of research on contemporary preschool programs finds similar benefits for children's school readiness and later outcomes. However, evaluations of two programs—Tennessee's Voluntary Pre-K program and Head Start—found mixed results, leaving policymakers and the public confused about how to interpret the findings and what to do to ensure productive investments.

This brief and the report on which it is based present the most rigorous available evidence on the effects of preschool and find that well-implemented preschool programs support substantial early learning gains and can have lasting impacts throughout school. We also explain

Table 1
Early Evaluations of Preschool Programs Document Benefits Throughout Adolescence and Adulthood

Program	Age(s)	Outcomes (relative to comparison children)
Abecedarian Project	12	<ul style="list-style-type: none"> • Better performance on tests of intelligence and cognitive skills
	15	<ul style="list-style-type: none"> • Better performance on reading and mathematics assessments • Fewer retentions in grade • Fewer special education placements
	21	<ul style="list-style-type: none"> • Better performance on tests of intelligence and cognitive skills • More years of total education • Higher college attendance rates • Lower incidence of teen pregnancy • Lower reported rates of drug use
	30	<ul style="list-style-type: none"> • More years of total education • Four times more likely to have completed a B.A. or higher • More likely to have been consistently employed • Better health outcomes (lower rates of prehypertension and risk factors for heart disease)
Child-Parent Centers	14–15	<ul style="list-style-type: none"> • Better performance on standardized reading and math tests • Fewer retentions in grade • Less likely to be placed in special education, and fewer years receiving special education services
	18–21	<ul style="list-style-type: none"> • Higher rate of high school completion and lower rates of dropout • More years of total education • Lower incidence of juvenile arrest • Fewer special education placements • Fewer retentions in grade • Less likely to experience child maltreatment
	23–24	<ul style="list-style-type: none"> • Higher rates of high school completion • More years of total education • Higher rates of college attendance • Lower rates of incarceration and convictions • Higher rates of enrollment in health insurance • Lower rates of depressive symptoms
	35	<ul style="list-style-type: none"> • Higher rates of postsecondary degree completion
Perry Preschool Project	19	<ul style="list-style-type: none"> • Higher average high school GPA • Fewer years spent in special education during school • Higher rates of high school graduation • More likely to be employed • More likely to be economically self-sufficient • Less likely to be arrested for a minor offense
	27	<ul style="list-style-type: none"> • More likely to be employed • Higher rate of high school graduation • Higher average educational attainment • Higher average monthly earnings • More likely to own their own home • Lower number of adult and lifetime arrests
	40	<ul style="list-style-type: none"> • More likely to be employed • Higher annual median earnings • Less likely to be arrested

Note: This table reports significant positive outcomes only. Outcomes tested and found to be non-significant are not included.
Source: See Appendix D in the full report for a list of sources.

how the findings from Tennessee and Head Start inform our overall conclusion that preschool is an effective intervention. We further find that the quality of a preschool program matters for its outcomes and that the method a study uses to compare children in a program to others outside the program shapes the interpretation of the research findings. When children who attend a specific preschool program are compared to those who did not attend preschool at all—as opposed to those who attended the same or another program—the benefits of preschool are clear.

The evidence supports moving beyond the question of whether preschool “works” and focusing instead on the more pressing question of how to design and implement programs that ensure public preschool investments consistently deliver on their promise.

Our Review

We reviewed studies that used strong research designs (randomized experiments or those with well-controlled comparison groups) to understand the impacts of 21 public preschool programs at school entry and beyond. For the studies of the impact of preschool on children’s school readiness, which has been extensively researched, we were extremely selective—including only evaluations with the strongest research designs (experiments and strong quasi-experiments). There are far fewer studies that follow preschool participants into the early elementary grades and beyond. For this timeframe, we included a wider range of research designs but maintained a high bar for the strength of each evaluation. Table 2 on page 11 lists the evaluations included in our review.

Note: See the full report at <https://learningpolicyinstitute.org/product/untangling-evidence-preschool-effectiveness> for a list of sources and a discussion of the methodology.

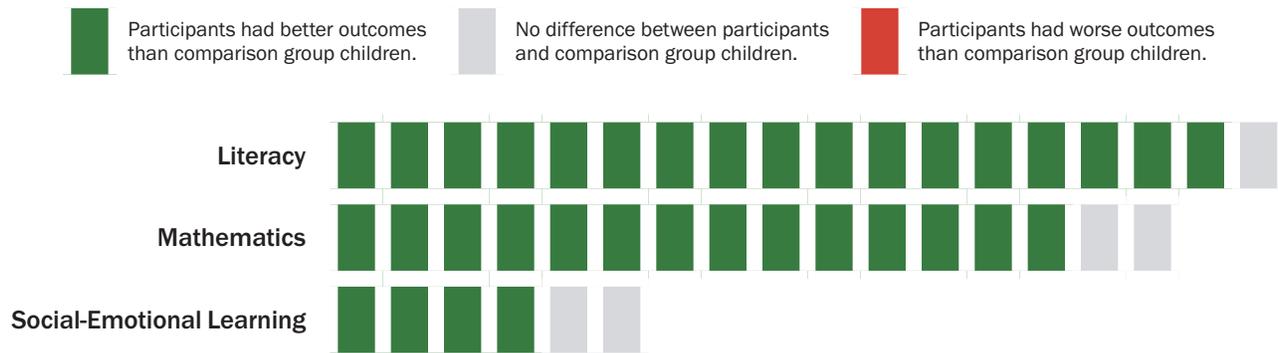
The Evidence

Most evaluations of preschool programs examine whether preschool effectively prepares children for school. These studies clearly show that children who attend preschool programs are better prepared for school than children who do not. Among the programs included in our review, researchers found clear benefits for participating children’s early literacy skills in 17 out of 18 where such skills were evaluated (see Figure 1). Likewise, researchers found benefits for children’s early mathematics skills in 14 out of the 16 programs where these skills were assessed. The few findings of “no difference” generally showed positive influences, though not large enough to be considered statistically significant, usually because of small sample sizes.³

Fewer studies examined children’s social-emotional skills and executive function at school entry by measuring outcomes such as self-control and attentiveness. Of the studies that looked at these outcomes, four out of six found benefits for at least one measure, including emotion recognition and teacher reports of student engagement and behavior. In one of the “no difference” studies, the evaluators of the program suggested that difficulty in consistently measuring these skills across different grade levels and teachers may explain the lack of significant findings.⁴

Figure 1 Impacts of Preschool at School Entry

Each box represents a separate evaluation of a preschool program.



Note: Evaluations usually include many measures of child outcomes across different domains. Additional domains not included here are described in the full report.

The evidence examining whether the effects of preschool persist as children progress through school also paints a largely positive, though somewhat less consistent, picture (see Figure 2). Some studies found enduring effects, underscoring that long-lasting benefits are possible. Others, however, found few differences between children in a particular preschool program and children to whom they were compared in later grades.

As we describe later in this brief, there are often challenges in maintaining a comparison group over time that allows for clear interpretation of trends. Nonetheless, of the studies in our review that measure children’s literacy beyond school entry, about half found significant benefits of preschool for children’s reading performance in elementary school—in several cases persisting up to 5th grade—and the other half found little difference between the children who attended the specific preschool program and other children who remained in the comparison group throughout school.

Study methods can make a difference in results. For example, two evaluations of the same program—North Carolina Pre-K—had very different findings. One study found no effect on children’s literacy skills at the end of kindergarten,⁵ and the other found benefits for children’s performance on standardized reading tests in 3rd through 5th grade.⁶ The two studies had very different designs and measured literacy skills using different tests. They also used different comparison groups. The differences in findings are likely due to these differences in research methods and timing.

Of the 13 studies that examine children’s mathematics performance throughout school, 10 document significant benefits, including some that persist well into middle school. One other study found a positive influence, though not large enough to be considered significant. Two of the studies, however, found that preschool participants performed less well than the children to whom they were compared on at least one measure of mathematics skills in the early elementary grades. These evaluations of Head Start and the Tennessee Voluntary Pre-K program are discussed in depth later in this brief. In both cases, we discuss concerns with the study design and comparison group composition in later grades. We also discuss how issues related to both program and later elementary school quality can affect the interpretation of these results.

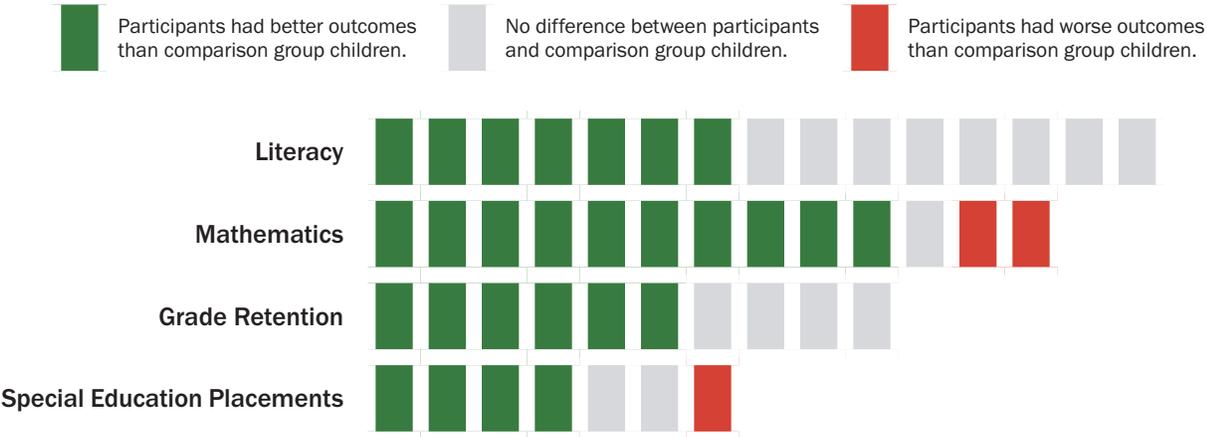
Finally, some preschool evaluations also examine impacts on grade retention and special education placements. Among the studies that examined special education placements, most (4 out of 7) found reductions in special education placements in elementary school for participating children, and two found no effect. The other study—of Tennessee Voluntary Pre-K—found that children who participated in preschool were significantly more likely to be placed in special education when they entered elementary school.⁷ In that case, involvement with the public school system at an earlier age likely led to earlier identification of underlying developmental delays.

Of the studies that measured grade retention, most (6 out of 10) found a reduction for participating children in being held back in grade. Two evaluations of Tulsa’s early childhood education programs did not find evidence of a difference between preschool participants and those in the comparison group. Both studies found fairly low rates of grade retention for all children, and in both cases, the evaluators suggested that many of the children to whom participants were compared attended other high-quality preschool programs, meaning both groups may have benefited equally from their early learning experiences.

Lower rates of grade retention and special education placements come with significant and immediate cost savings for school systems and society. School districts spend an average of \$13,119 per child each year,⁸ a cost that is doubled whenever a student is retained in grade. Retaining a child in grade also increases the likelihood of future retentions, compounding the associated costs.⁹ Furthermore, the annual cost of providing special education services can be more than twice that of a general education program, and early identification of special needs—and education that addresses them early on—can reduce the number of years that special services are needed, further reducing the overall costs to schools and society.

Figure 2
Impacts of Preschool Throughout School

Each box represents a separate evaluation of a preschool program.



Note: Evaluations usually include many measures of child outcomes across different domains. Additional domains not included here are described in the full report.

Research Design Can Have Substantial Implications for Study Findings

Determining a preschool program's effectiveness requires researchers to compare children who attend that preschool program to similar children who do not, so that any differences can be attributed to the program. Early studies of early childhood education compared children who attended preschool to those who had no formal early learning experiences because preschool was not widely available.

In contrast, most contemporary studies compare children in a specific preschool with children who have a different early learning experience that may be in an equally high-quality preschool. In a case such as this, the findings of “no difference” mean that the children in the preschool program of interest do about as well as children who attended other preschool programs. Preschool may still have a positive effect, as both sets of children may be performing better than they would have without preschool and better than children who did not attend preschool at all. The only way to test the question of whether preschool matters is by comparing outcomes for children who did attend the preschool program under study and those who attended no preschool at all.

Researchers typically strive to ensure similarity of children being compared, and they may account for the early learning experiences of children who do not attend the program under study. Their success in creating comparable groups—and in making the appropriate comparisons within them—has important implications for the strength of their conclusions. However, not all studies are able to accomplish this goal.

Sometimes researchers are able to randomly choose which children can attend a program. Essentially, whether a child is able to enroll is determined by the flip of a coin. Those who do not attend become part of the comparison group. Evaluations using this approach have been particularly influential in the preschool debate because the children being compared should be quite similar if the selection is truly random and the sample size is large enough. Meanwhile, their early learning experiences, it is presumed, should be quite different. However, in practice, when a child is not chosen for the program being evaluated, her parents are often likely to enroll her in another preschool program. And, for many reasons, children chosen for the comparison group may drop out of the study, often making the groups no longer comparable. Both of these circumstances can influence the evaluation's findings and weaken the strength of its conclusions.

Whether—and how—researchers account for the early learning experiences of children in the comparison group also matters to the interpretation of findings. Studies that account for the early learning experiences of children in the comparison group can answer two questions: (1) What are the benefits of the preschool program for all eligible children, including those with the means and motivations to access high-quality alternatives? and (2) What are the benefits of the program for those children who live in homes or communities that lack those alternatives? These are critically important questions to be able to answer in early childhood research, as differences in the experiences of comparison groups often account for different findings.

Note: See the full report for an in-depth discussion of the methodology.

The implications of research design are clear in the case of one famous Head Start study. The study participants, who had attended Head Start, were compared to children who had either also attended Head Start, had attended another preschool program, or had attended no preschool program. Thus, the results were difficult to interpret and, in fact, showed little difference between the groups. As described in the box that follows, when Head Start participants were compared to children who did not attend any preschool program, the positive benefits of Head Start were obvious.

Do Head Start Gains “Fade Out”?

Head Start is a comprehensive, nationwide program for 3- and 4-year-old children in families with low incomes. Over the 50-year existence of Head Start, numerous evaluations have found benefits for children who participate compared to similar children who did not attend.¹⁰ However, in 2012, the Head Start Impact Study found that early benefits of the program were undetectable by 1st grade: that is, the Head Start participants were not performing noticeably better than children in the comparison group.¹¹ The findings left policymakers with a lingering question: Do Head Start gains disappear?

The answer is: not necessarily. There are many possible explanations for these findings. For example, many of the children who were not admitted to Head Start by random assignment (and were not considered Head Start participants by evaluators) still attended preschool—and many of them attended other Head Start programs. As a result, in part, the study compared Head Start participants to other Head Start participants, masking the true effects of the program.¹² A recent re-analysis compared Head Start participants who would have stayed home if the evaluation had not allowed them to attend Head Start to children who did stay home when they didn't have access to Head Start. The study found large positive impacts on children's vocabulary in 1st grade for Head Start participants.¹³ This evidence suggests that the benefits of Head Start may be larger and longer lasting for children without access to alternative care arrangements.

Several other evaluations of Head Start also showed benefits for longer term outcomes, such as grade retention, graduation rates, and educational attainment in adolescence and adulthood, despite finding similar “fade-out” on short-term outcomes like test scores.¹⁴ Collectively, the evidence suggests that Head Start effectively prepares young children for school and that the relative size of the persistent benefits is more substantial when Head Start graduates are compared to children who were unable to attend preschool.

Furthermore, evidence suggests that policymakers should look beyond the Head Start years to the quality of elementary education to understand why the effects appear more or less lasting. A 2017 analysis found compelling evidence of the relationship between later school quality and the apparent impact of Head Start on child outcomes.¹⁵ The study compared the adult outcomes of children who were differentially exposed to increases in Head Start spending and public k–12 school spending, and it found that for children from low-income families, the longer term benefits of Head Start spending were larger when followed by access to better funded schools. Likewise, the increases in k–12 spending were more impactful when children were exposed to greater early childhood spending. This evidence suggests that investments in elementary school may be critical to sustaining gains from preschool.

Research indicates that successful programs incorporate common elements of preschool quality, such as well-qualified educators, a developmentally appropriate curriculum, and adequate learning time.¹⁶ Most or all of these elements are present in the programs that demonstrate the strongest and most persistent impacts on children.¹⁷

In studies of the longer term effects of preschool programs, the importance of quality teaching in early elementary grades also should not be discounted. In addition to findings that investments in elementary schools influence the strength of ongoing preschool effects,¹⁸ researchers have found that the level of challenge provided by kindergarten teachers matters for later outcomes. A national study of kindergarten instruction found that many kindergarten teachers provide relatively uniform instruction that covers basic skills, even when alumni of a preschool program have likely already mastered these skills.¹⁹ It also found that too much time spent on this basic content suppresses learning gains, whereas more time spent on more advanced content is positively associated with student learning. If kindergarten does not build on what children have learned in preschool and allow them to explore new ideas, preschool attendees may become disengaged and gradually lose ground relative to their peers.

Considerations of program quality as well as the nature of the comparison group in the Tennessee study have been raised as concerns that may account for its unexpected findings, as described in the box below.

Does Tennessee’s Evaluation Prove That Preschool Doesn’t Work?

Tennessee’s Voluntary Pre-K program began as a success story: Initial results showed the program enhances children’s school readiness in language, literacy, and mathematics. However, a follow-up evaluation appears to show no differences between program participants and comparison children on language development by 1st grade, and found that children in the study’s comparison group actually surpassed program alumni on mathematics and reading skills by 2nd grade.²⁰

These results understandably received attention, in part because of the study’s design, which allowed the evaluators to randomly choose children either to attend the program or not. However, many of the children who were not chosen to participate in the program dropped out of the study at the start, and only one third of the remaining children agreed to additional developmental assessments in 3rd grade.²¹ These were children whose parents returned a set of permission forms, calling the comparability of the comparison children to program alums into question.

A more recent follow-up evaluation of the Tennessee Voluntary Pre-K program accessed 3rd grade state achievement test scores and was able to include a broader group of comparison children.²² This study, like its predecessor, found that children in the study’s comparison group scored higher than program alumni on both reading and mathematics tests in 3rd grade. Do these findings mean that the Tennessee Voluntary Pre-K program—or that preschool as an intervention—doesn’t work?

Not necessarily. There are a few other possible explanations. First, methodological issues may contribute to the study’s findings. For example, in the Tennessee evaluation, the group of children to whom participants were compared was more advantaged than program alumni in nearly every way reported by the program evaluators.²³ These children were older, more likely to be White, less likely to be Black or Hispanic, and more likely to be native English speakers. Although these differences were not large enough to be statistically significant, it is possible that the cumulative impact of these advantages influenced the study’s overall findings.

Further, it is possible that the more advantaged group of children to whom participants were compared went to better resourced elementary schools. Recent research has demonstrated the impact of elementary school investments on the magnitude and persistence of the impacts of early childhood programs.²⁴ If participant children attended more poorly resourced, lower quality elementary schools, their kindergarten teachers may have been ill equipped to support the development of children who varied substantially in the knowledge and skills they brought into the classroom.

In addition, the evaluators did not account for the early learning experiences of children who did not attend the program, some of whom attended other preschools.²⁵ Without direct comparisons of participants to children who did and did not attend other preschool programs, the results are difficult to interpret. It is impossible to know from the analysis whether the effects of the program were different for children without access to alternative early learning experiences, as was the case with Head Start.

Notably, earlier reports out of Tennessee foreshadowed this trend of initial gains for preschool participants followed by convergence or, in some cases, lower scores for program attendees in elementary school. Therefore, the quality of Tennessee's program, which evidence suggests may have been meaningfully different from programs that demonstrate effectiveness, is likely the more compelling explanation for these findings.²⁶ The evaluation's findings clearly demonstrate that program participants saw immediate benefits from program participation; however, it is possible that the quality of early instruction children received in their preschool year did not instill the type of deep understanding of mathematical and literacy concepts that would set the foundation for continued growth.

This explanation is supported by an evaluation of the quality of a sample of Tennessee Voluntary Pre-K classrooms. The study found substantial variation in observed teacher-child interaction quality, with some classrooms scoring quite high and others extremely low.²⁷ In the low-quality classrooms, teachers spent only a little more than half of their time engaged in learning activities, which may reflect poor classroom management or difficulties embedding learning into everyday routines and play. Further, critical elements of quality were completely missing from the program. For example, researchers observed that teachers received little support for professional development to improve instruction. The evidence suggests the quality of Tennessee's program may have been meaningfully different from programs that demonstrate effectiveness. In a recent assessment of statewide program quality, Tennessee's program met only 5 of the 10 new quality benchmarks set forth by the National Institute for Early Education Research (NIEER).

Given these considerations, it seems that the results of the Tennessee program evaluation warrant further investigation to understand their meaning, both in Tennessee and in relation to preschool more broadly.

Note: See the full report for a list of sources.

Conclusion

The weight of a sizable body of evidence indicates that preschool programs make a substantial difference in preparing children for school.²⁸ The evidence about continued effects beyond school entry is also positive, but less consistent. Sorting out these findings requires an examination of the way that different studies construct comparison groups—whether children in those groups are truly comparable to the children who attended the preschool program under study and whether they themselves attended a different preschool.

In order to generate meaningful impacts, early learning experiences need to be rich and engaging.²⁹ Implementing a high-quality preschool program well—offering compensation and support that attract and retain a highly qualified workforce; a program day that provides adequate, productive learning time and activities; and child assessments used to individualize learning—is complex and often expensive.³⁰ Finally, although preschool quality is important, even the highest quality preschool cannot inoculate children from the detrimental effects of poverty or poor elementary and secondary schools. Sustained benefits likely require investments in children and their families that are also sustained from preschool through grade school and beyond.

Preschool Pays for Itself

Preschool programs are often held up as savvy investments, in large part due to economic analyses signaling large returns on investment. Estimates of returns on investment in preschool range from the modest—\$2 for every \$1 invested when examined just a few years after preschool³¹—to the substantial—\$17 for every \$1 invested when tracked through adulthood.³²

What explains this variability? The timing of cost-benefit analyses and the outcomes that evaluators measure directly affect the size of an estimated return. The largest returns have been observed among high-intensity programs that have documented long-term benefits such as lower rates of incarceration and higher earnings well into adulthood. More modest returns from contemporary programs, on the other hand, are usually based on short-term benefits such as reductions in special education placements and grade retention in elementary and middle school.³³ These can be expected to predict longer term benefits as children grow into adulthood and are more likely to graduate and gain productive employment.

Importantly, however, no cost-benefit analysis of a preschool program has ever found zero return, and any return that exceeds \$1 for every \$1 spent means the program more than pays for itself.

Table 2
Programs and Studies of Outcomes Included in This Analysis

Program	Timing of Evaluation:	
	School Entry	Throughout School ^a
Arkansas Better Chance Program	Husted, Barnett, Jung, & Thomas (2007)	Jung, Barnett, Husted, & Francis (2013)
Boston Public Schools K1	Weiland & Yoshikawa (2013)	
California Transitional Kindergarten	Manship, Holod, Quick, Ogut, Brodziak de los Reyes, et al. (2017)	Manship, Holod, Quick, Ogut, Brodziak de los Reyes, et al. (2017)
Connecticut School Readiness Program	The Connecticut Academy of Science and Engineering (2016)	
Florida Pre-Kindergarten Early Intervention		Figlio & Roth (2009)
Florida Voluntary Pre-K		Miller & Bassok (in press)
Georgia's Pre-K Program	Peisner-Feinberg, Schaaf, LaForett, Hildebrant, & Sideris (2014)	Cascio & Schanzenbach (2013) ^b
Head Start	U.S. Department of Health and Human Services (2010)	U.S. Department of Health and Human Services (2012); U.S. Department of Health and Human Services (2010); Deming (2009)
Michigan Great Start Readiness Program	Wong, Cook, Barnett, & Jung (2008) ^{b,c}	
New Jersey Abbott Preschool Program	Frede, Jung, Barnett, Lamy, & Figueras (2007)	Barnett, Jung, Youn, & Frede (2013)
New Mexico Pre-K	Hustedt, Barnett, Jung, & Friedman (2010)	
North Carolina Pre-K	Peisner-Feinberg & Schaaf (2011)	Peisner-Feinberg, Mokrova, & Anderson (2017); Dodge, Bai, Ladd, & Muschkin (2016)
Oklahoma 4-Year-Old Program	Wong, Cook, Barnett, & Jung (2008) ^b	Cascio & Schanzenbach (2013) ^b ; Smith (2016)
San Francisco Preschool for All	Applied Survey Research (2013)	
South Carolina 4K and First Steps to Success	Wong, Cook, Barnett, & Jung (2008) ^b	
Tennessee Voluntary Pre-K	Lipsey, Farran, & Durkin (2018)	Lipsey, Farran, & Durkin (2018)
Tulsa ECE Programs: CAP Tulsa Head Start	Gormley, Phillips, & Gayer (2008) ^b	Phillips, Gormley, & Anderson (2016)
Tulsa ECE Programs: Universal Pre-K	Gormley, Phillips, & Gayer (2008) ^b	Hill, Gormley, & Adelstein (2015); Gormley, Phillips, & Anderson (2017)
Virginia Preschool Initiative	Huang (2017)	Virginia University Research Consortium on Early Childhood (2015)
Washington ECEAP		Bania, Kay, Aos, & Pennucci (2014)
West Virginia Pre-K	Wong, Cook, Barnett, & Jung (2008) ^b	
Total Studies and Programs	14 studies of 18 programs	19 studies of 14 programs

^a To capture a robust cross-section of literature on outcomes beyond school entry, we include studies of both early elementary school (grades k–3) and later grades (grade 4 through adulthood) where possible. In cells where multiple studies are listed, evaluations of both grade spans met the methodological bar for inclusion.

^b This is a multi-program study.

^c Following our review, a new and expanded version of this evaluation was released. For more information see: Barnett, W. S., Jung, K., Friedman-Krauss, A., Frede, E. C., Nores, M., Hustedt, J. T., Howes, C., & Daniel-Echols, M. (2018). State prekindergarten effects on early learning at kindergarten entry: An analysis of eight state programs. *AERA Open*, 4(2), 1–16.

Endnotes

- Halle, T., Forry, N., Hair, E., Perper, K., Wandner, L., Wessel, J., & Vick, J. (2009). *Disparities in early learning and development: Lessons from the Early Childhood Longitudinal Study—Birth Cohort (ECLS-B)*. Washington, DC: Child Trends.
- Campbell, F. A., Pungello, E. P., Burchinal, M., Kainz, K., Pan, Y., Wasik, B. H., Barbarin, O., Sparling, J. J., & Ramey, C. T. (2012). Adult outcomes as a function of an early childhood educational program: An Abecedarian Project follow-up. *Developmental Psychology*, 48(4), 1033–1043; Reynolds, A. J., Ou, S., & Temple, J. (2018). A multicomponent, preschool to third grade preventive intervention and educational attainment at 35 years of age. *Journal of the American Medical Association Pediatrics*, 172(3), 247–256; Schweinhart, L. J., Montie, J., Xiang, Z., Barnett, W. S., Belfield, C. R., & Nores, M. (2005). *Lifetime effects: The High/Scope Perry Preschool Study through age 40*. Monographs of the High/Scope Educational Research Foundation, No. 14. Ypsilanti, MI: High/Scope Press.
- Wong, V. C., Cook, T. D., Barnett, W. S., & Jung, K. (2008). An effectiveness-based evaluation of five state pre-kindergarten programs. *Journal of Policy Analysis and Management*, 27(1), 122–154.
- Peisner-Feinberg, E. S., Schaaf, J. M., LaForett, D. R., Hildebrandt, L. M., & Sideris, J. (2014). *Effects of Georgia's Pre-K Program on children's school readiness skills: Findings from the 2012–2013 evaluation study*. Chapel Hill, NC: University of North Carolina, FPG Child Development Institute.
- Peisner-Feinberg, E. S., Mokrova, I. L., & Anderson, T. L. (2017). *Effects of participation in the North Carolina Pre-Kindergarten Program at the end of kindergarten: 2015–2016 statewide evaluation*. Chapel Hill, NC: University of North Carolina, FPG Child Development Institute.
- Dodge, K. A., Bai, Y., Ladd, H. F., & Muschkin, C. G. (2016). Impact of North Carolina's early childhood programs and policies on educational outcomes in elementary school. *Child Development*, 88(3), 1–19.
- Lipsey, M. W., Farran, D. C., & Durkin, K. (2018). Effects of the Tennessee Prekindergarten Program on children's achievement and behavior through third grade. *Early Childhood Research Quarterly*, 45, 155–176.
- U.S. Department of Education, National Center for Education Statistics. (2018). *The condition of education (NCES 2018-144)*, Public School Expenditures.
- Xia, C., & Glennie, E. (2005). *Cost-benefit analysis of grade retention*. Raleigh, NC: Duke University, Center for Child and Family Policy, 1–7.
- See, e.g., Garces, E., Thomas, D., & Currie, J. (2002). Longer-term effects of Head Start. *American Economic Review*, 92(4), 999–1012; Carneiro, P., & Ginja, R. (2014). Long-term impacts of compensatory preschool on health and behavior: Evidence from Head Start. *American Economic Journal: Economic Policy* 6(4), 135–173; Deming, D. (2009). Early childhood intervention and life-cycle skill development: Evidence from Head Start. *American Economic Journal: Applied Economics*, 1(3), 111–134.
- U.S. Department of Health and Human Services, Administration for Children and Families. (2010). *Head Start Impact Study: Final report*. Washington, DC: Author.
- U.S. Department of Health and Human Services, Administration for Children and Families. (2010). *Head Start Impact Study: Final report*. Washington, DC: Author.
- Feller, A., Grindal, T., Miratrix, L., & Page, L. (2016). Compared to what? Variation in the impacts of early childhood education by alternative care type. *Annals of Applied Statistics*, 10(3), 1245–1285.
- See, e.g., Garces, E., Thomas, D., & Currie, J. (2002). Longer-term effects of Head Start. *American Economic Review*, 92(4), 999–1012; Carneiro, P., & Ginja, R. (2014). Long-term impacts of compensatory preschool on health and behavior: Evidence from Head Start. *American Economic Journal: Economic Policy* 6(4), 135–173.
- Johnson, R. C., & Jackson, C. K. (2017). *Reducing inequality through dynamic complementarity: Evidence from Head Start and public school spending* (No. w23489). Cambridge, MA: National Bureau of Economic Research.
- Wechsler, M., Melnick, H., Maier, A., & Bishop, J. (2016). *The building blocks of high-quality early education programs*. Palo Alto, CA: Learning Policy Institute; Wechsler, M., Kirp, D., Tinubu Ali, T., Gardner, M., Maier, A., Melnick, H., & Shields, P. (2016). *The road to high-quality early learning: Lessons from the states*. Palo Alto, CA: Learning Policy Institute.
- Johnson, R. C., & Jackson, C. K. (2017). *Reducing inequality through dynamic complementarity: Evidence from Head Start and public school spending* (No. w23489). Cambridge, MA: National Bureau of Economic Research.
- Claessens, A., Engel, M., & Curran, F. C. (2014). Academic content, student learning and the persistence of preschool effects. *American Educational Research Journal*, 51, 403–434.
- Lipsey, M. W., Farran, D. C., & Hofer, K. G. (2016). *Effects of a state prekindergarten program on children's achievement and behavior through third grade*. Nashville, TN: Vanderbilt University, Peabody Research Institute.
- Lipsey, M. W., Farran, D. C., & Hofer, K. G. (2016). *Effects of a state prekindergarten program on children's achievement and behavior through third grade*. Nashville, TN: Vanderbilt University, Peabody Research Institute.
- Lipsey, M. W., Farran, D. C., & Durkin, K. (2018). Effects of the Tennessee Prekindergarten Program on children's achievement and behavior through third grade. *Early Childhood Research Quarterly*, 45, 155–176.
- Lipsey, M. W., Farran, D. C., & Durkin, K. (2018). Effects of the Tennessee Prekindergarten Program on children's achievement and behavior through third grade. *Early Childhood Research Quarterly*, 45, 155–176.
- Johnson, R. C., & Jackson, C. K. (2017). *Reducing inequality through dynamic complementarity: Evidence from Head Start and public school spending* (No. w23489). Cambridge, MA: National Bureau of Economic Research.
- Lipsey, M. W., Farran, D. C., & Hofer, K. G. (2016). *Effects of a state prekindergarten program on children's achievement and behavior through third grade*. Nashville, TN: Vanderbilt University, Peabody Research Institute; Lipsey, M. W., Farran, D. C., & Durkin, K. (2018). Effects of the Tennessee Prekindergarten Program on children's achievement and behavior through third grade. *Early Childhood Research Quarterly*, 45, 155–176.
- Strategic Research Group. (2011). *Assessing the impact of Tennessee's pre-kindergarten program: Final report*. Columbus, OH: Author.
- Farran, D., Hofer, K., Lipsey, M., & Bilibrey, C. (2014). *Variations in the Quality of TN-VPK Classrooms*. Presentation at the Society for Research on Education Effectiveness Conference, Washington, DC.
- Peisner-Feinberg, E. S., Mokrova, I. L., & Anderson, T. L. (2017). *Effects of participation in the North Carolina Pre-Kindergarten Program at the end of kindergarten: 2015–2016 statewide evaluation*. Chapel Hill, NC: University of North Carolina, FPG Child Development Institute.
- Wechsler, M., Melnick, H., Maier, A., & Bishop, J. (2016). *The building blocks of high-quality early education programs*. Palo Alto, CA: Learning Policy Institute.
- Meloy, B., Gardner, M., Wechsler, M., & Kirp, D. (2019). "What Can We Learn From State-of-the-Art Early Childhood Education Programs?" in Reynolds, A. R., & Temple, J. A. (Eds.). *Sustaining Early Childhood Learning Gains: Program, School, and Family Influences*, pp. 101–132. Cambridge: Cambridge University Press.
- Cannon, J., Kilburn, M. R., Karoly, L., Mattox, T., Muchow, A., & Buenaventura, M. (2017). *Investing Early: Taking Stock of Outcomes and Economic Returns From Early Childhood Programs*. Santa Monica, CA: RAND Corporation.
- Barnett, W. S., Belfield, C. R., & Nores, M. (2005). "Lifetime Cost-Benefit Analysis" in Schweinhart, L. J., Montie, J., Xiang, Z., Barnett, W. S., Belfield, C. R., & Nores, M. (Eds.). *Lifetime effects: The High/Scope Perry Preschool Study through age 40*. Monographs of the High/Scope Educational Research Foundation, No. 14. Ypsilanti, MI: High/Scope Press.
- Cannon, J., Kilburn, R., Karoly, L., Mattox, T., Muchow, A., & Buenaventura, M. (2017). *Investing Early: Taking Stock of Outcomes and Economic Returns From Early Childhood Programs*. Santa Monica, CA: RAND Corporation.