

Investing in Our Future: The Evidence Base on Preschool Education

Hirokazu Yoshikawa, Christina Weiland, Jeanne Brooks-Gunn, Margaret R. Burchinal, Linda M. Espinosa, William T. Gormley, Jens Ludwig, Katherine A. Magnuson, Deborah Phillips, Martha J. Zaslow



OCTOBER 2013



Society for Research in Child Development

FOUNDATION FOR CHILD DEVELOPMENT

Investing in Our Future: The Evidence Base on Preschool Education

Hirokazu Yoshikawa, Christina Weiland, Jeanne Brooks-Gunn, Margaret R. Burchinal, Linda M. Espinosa, William T. Gormley, Jens Ludwig, Katherine A. Magnuson, Deborah Phillips, Martha J. Zaslow*

Hirokazu Yoshikawa, New York University

Christina Weiland, University of Michigan

Jeanne Brooks-Gunn, Columbia University

Margaret R. Burchinal, Frank Porter Graham Child Development Institute, University of North Carolina

Linda M. Espinosa, University of Missouri, Columbia

William T. Gormley, Georgetown University

Jens Ludwig, University of Chicago

Katherine A. Magnuson, University of Wisconsin, Madison

Deborah Phillips, Georgetown University

Martha J. Zaslow, Society for Research in Child Development and Child Trends

You can find this report at

<http://fcd-us.org/resources/evidence-base-preschool>

<http://www.srcd.org/policy-media/policy-updates/meetings-briefings/investing-our-future-evidence-base-preschool>

* After the first two primary authors, the authors are listed alphabetically. The authors thank Deborah Phillips and the Foundation for Child Development for funding this work. The authors would also like to thank those who provided helpful reviews: J. Lawrence Aber, Mary Catherine Arbour, Karen Bierman, Maia Connors, Greg Duncan, Philip Fisher, Ruth Friedman, Eugene Garcia, Ron Haskins, Jacqueline Jones, Laura Justice, Nonie Lesaux, Joan Lombardi, Pamela Morris, Adele Robinson, Jack Shonkoff, Catherine Tamis-LeMonda, Elizabeth Votruba-Drzal, and Jane Waldfogel.

Executive Summary

Large-scale public preschool programs can have substantial impacts on children’s early learning. Scientific evidence on the impacts of early childhood education has progressed well beyond exclusive reliance on the Perry Preschool and Abecedarian programs. A recent analysis integrating evaluations of 84 preschool programs concluded that, on average, children gain about a third of a year of additional learning across language, reading, and math skills. At-scale preschool systems in Tulsa and Boston have produced larger gains of between a half and a full year of additional learning in reading and math. Benefits to children’s socio-emotional development and health have been documented in programs that focus intensively on these areas.

Quality preschool education is a profitable investment. Rigorous efforts to estimate whether the economic benefits of early childhood education outweigh the costs of providing these educational opportunities indicate that they are a wise financial investment. Available benefit-cost estimates based on older, intensive interventions, such as the Perry Preschool Program, as well as contemporary, large-scale public preschool programs, such as the Chicago Child-Parent Centers and Tulsa’s preschool program, range from three to seven dollars saved for every dollar spent.

The most important aspects of quality in preschool education are stimulating and supportive interactions between teachers and children and effective use of curricula. Children benefit most when teachers engage in stimulating interactions that support learning *and* are emotionally supportive. Interactions that help children acquire new knowledge and skills provide input to children, elicit verbal responses and reactions from them, and foster engagement in and enjoyment of learning. Recent evaluations tell us that effective use of curricula focused on such specific aspects of learning as language and literacy, math, or socio-emotional development provide a substantial boost to children’s learning. Guidelines about the number of children in a classroom, the ratio of teachers and children, and staff qualifications help to increase the likelihood of—but do not assure—supportive and stimulating interactions. Importantly, in existing large-scale studies, only a minority of preschool programs are observed to provide excellent quality and levels of instructional support are especially low.

Supporting teachers in their implementation of instructional approaches through coaching or mentoring can yield important benefits for children. Coaching or mentoring that provides support to the teacher on how to implement content-rich and engaging curricula shows substantial promise in helping to assure that such instruction is being provided. Such coaching or mentoring involves modeling positive instructional approaches and providing feedback on the teacher’s implementation in a way that sets goals but is also supportive. This can occur either directly in the classroom or through web-based exchange of video clips.

Quality preschool education can benefit middle-class children as well as disadvantaged children; typically developing children as well as children with special needs; and dual language learners as well as native speakers. Although early research focused only on programs for low-income children, more recent research focusing on universal preschool programs provides the opportunity to ask if preschool can benefit children from middle-income as well as low-income families. The evidence is clear that middle-class children can benefit substantially, and that benefits outweigh costs for children from middle-income as well as those from low-income families. However, children from low-income backgrounds benefit more. Children with special needs who attended Tulsa's preschool program showed comparable improvements in reading and pre-writing skills as typically developing children. Further, at the end of first grade, children with special needs who had attended Head Start as 3-year-olds showed stronger gains in math and social-emotional development than children with special needs who had not attended Head Start. Studies of both Head Start and public preschool programs suggest that dual language learners benefit as much as, and in some cases more than, their native speaker counterparts.

A second year of preschool shows additional benefits. The available studies, which focus on disadvantaged children, show further benefits from a second year of preschool. However, the gains are not always as large as from the first year of preschool. This may be because children who attend two years of preschool are not experiencing a sequential building of instruction from the first to the second year.

Long-term benefits occur despite convergence of test scores. As children from low-income families in preschool evaluation studies are followed into elementary school, differences between those who received preschool and those who did not on tests of academic achievement are reduced. However, evidence from long-term evaluations of both small-scale, intensive interventions and Head Start suggest that there are long-term effects on important societal outcomes such as high-school graduation, years of education completed, earnings, and reduced crime and teen pregnancy, even after test-score effects decline to zero. Research is now underway focusing on why these long-term effects occur even when test scores converge.

There are important benefits of comprehensive services when these added services are carefully chosen and targeted. When early education provides comprehensive services, it is important that these extensions of the program target services and practices that show benefits to children and families. Early education programs that have focused in a targeted way on health outcomes (e.g., connecting children to a regular medical home; integrating comprehensive screening; requiring immunizations) have shown such benefits as an increase in receipt of primary medical care and dental care. In addition, a parenting focus can augment the effects of preschool on children's skill development, but only if it provides parents with modeling of positive interactions or opportunities for practice with feedback. Simply providing information through classes or workshops is not associated with further improvements in children's skills.

Investing in Our Future: The Evidence Base on Preschool Education

Hirokazu Yoshikawa, Christina Weiland, Jeanne Brooks-Gunn, Margaret R. Burchinal, Linda M. Espinosa, William T. Gormley, Jens Ludwig, Katherine A. Magnuson, Deborah Phillips, Martha J. Zaslow**

The expansion of publicly-funded preschool education is currently the focus of a prominent debate. At present, 42% of 4-year-olds attend publicly funded preschool (28% attend public prekindergarten programs, 11% Head Start, and 3% special education preschool programs).¹ A vigorous debate about the merits of preschool education is underway, although at times it has not included the most recent available evidence. The goal of this brief is to provide a non-partisan, thorough, and up-to-date review of the current science and evidence base on early childhood education (ECE). Our interdisciplinary group of early childhood experts reviewed rigorous evidence on why early skills matter, the short- and long-term effects of preschool programs on children's school readiness and life outcomes, the importance of program quality, which children benefit from preschool (including evidence on children from different family income backgrounds), and the costs versus benefits of preschool education. We focus on preschool (early childhood education) for four-year-olds, with some review of the evidence for three-year-olds when relevant. We do not discuss evidence regarding programs for 0 – 3 year olds.

Early skills matter, and preschool can help children build these skills.

The foundations of brain architecture, and subsequent lifelong developmental potential, are laid down in a child's early years through a process that is exquisitely sensitive to external influence. Early experiences in the home, in other care settings, and in communities interact with genes to shape the developing nature and quality of the brain's architecture. The growth and then environmentally based pruning of neuronal systems in the first years support a range of early skills, including cognitive (early language, literacy, math), social (theory of mind, empathy, prosocial), persistence, attention, and self-regulation and

**After the first two primary authors, the authors are listed alphabetically. The authors thank Deborah Phillips and the Foundation for Child Development for funding this work. The authors would also like to thank those who provided helpful reviews: J. Lawrence Aber, Mary Catherine Arbour, Karen Bierman, Maia Connors, Greg Duncan, Philip Fisher, Ruth Friedman, Eugene Garcia, Ron Haskins, Jacqueline Jones, Laura Justice, Nonie Lesaux, Joan Lombardi, Pamela Morris, Adele Robinson, Jack Shonkoff, Catherine Tamis-LeMonda, Elizabeth Votruba-Drzal, and Jane Waldfogel.

executive function skills (the voluntary control of attention and behavior).² Later skills—in schooling and employment—build cumulatively upon these early skills. Therefore investment in early learning and development is more efficient and can generate more benefits than costs relative to investment later in the life cycle.³ The evidence reviewed below addresses the role of preschool in helping children build these skills.

Rigorous evidence suggests positive short-term impacts of preschool programs on children’s academic school readiness and mixed impacts on children’s socio-emotional readiness.

Effects on language, literacy, and mathematics. Robust evidence suggests that a year or two of center-based ECE for three- and four-year-olds, provided in a developmentally appropriate program, will improve children’s early language, literacy, and mathematics skills when measured at the end of the program or soon after.⁴ These findings have been replicated across dozens of rigorous studies of early education programs, including small demonstration programs and evaluations of large public programs such as Head Start and some state Pre-K programs. Combining across cognitive (e.g., IQ), language (e.g., expressive and receptive vocabulary) and achievement (e.g., early reading and mathematics skills) outcomes, a recent meta-analysis including evaluations of 84 diverse early education programs for young children evaluated between 1965 and 2007 estimated the average post-program impact to be about .35 standard deviations.⁵ This represents about a third of a year of additional learning, above and beyond what would have occurred without access to preschool. These data include both the well-known small demonstration programs such as Perry Preschool, which produced quite large effects, as well as evaluations of large preschool programs like Head Start, which are characterized both by lower cost but also more modest effects. Two recent evaluations of at-scale urban prekindergarten programs, in Tulsa and Boston, showed large effects (between a half of a year to a full year of additional learning) on language, literacy and math.⁶

Effects on socio-emotional development. The effects of preschool on socio-emotional development⁷ are not as clear-cut as those on cognitive and achievement outcomes. Far fewer evaluation studies of general preschool (that is, preschool without a specific behavior-focused component) have included measures of these outcomes. And relative to measures of achievement, language and cognition, socio-emotional measures are also more varied in the content they cover and quality of measurement.

A few programs have demonstrated positive effects on children’s socio-emotional development. Perry Preschool was found to have reduced children’s externalizing behavior problems (such as acting out or aggression) in elementary school.⁸ More recently, the National Head Start Impact Study found no effects in the socio-emotional area for four-year-old children, although problem behavior, specifically hyperactivity, was reduced after one year

of Head Start among three-year-olds.⁹ An evaluation of the Tulsa prekindergarten program found that prekindergarten attendees had lower levels of timidity and higher levels of attentiveness, suggesting greater engagement in the classroom, than was the case for other students who neither attended prekindergarten nor Head Start. However, there were no differences among prekindergarten and other children in their aggressive or hyperactive behavior.¹⁰ A recent explanation for the divergence of findings is suggested by meta-analytic work on aggression, which found that modest improvements in children's aggressive behavior occurred among programs that made improving children's behavior an explicit goal.¹¹

Effects on health. The effects of preschool on children's health have been rigorously investigated only within the Head Start program; Head Start directly targets children's health outcomes, while many preschool programs do not. Head Start has been shown to increase child immunization rates. In addition, there is evidence that Head Start in its early years of implementation reduced child mortality, and in particular mortality from causes that could be attributed plausibly to aspects of Head Start's health services, particularly immunization and health screening (e.g. measles, diabetes, whooping cough, respiratory problems).¹² More recently, the National Head Start Impact Study found somewhat mixed impacts on children's health outcomes between the end of the program and the end of first grade.¹³ Head Start had small positive impacts on some health indicators, such as receipt of dental care, whether the child had health insurance, and parents' reports of whether their child had good health, at some post-program time points but not at others. Head Start had no impact at the end of first grade on whether the child had received care for an injury within the last month or whether the child needed ongoing care. The positive impacts of Head Start on immunization, dental care and some other indicators may be due to features of its health component—the program includes preventive dental care, comprehensive screening of children, tracking of well-child visits and required immunizations, and assistance if needed with accessing a regular medical home. In contrast to the literature on Head Start and health outcomes, there are almost no studies of the effects of public prekindergarten on children's health.

A second year of preschool shows additional benefits.

Few studies have examined the relative impact of one vs. two years of preschool education, and none that randomly assigned this condition. All of the relevant studies focus on disadvantaged children. The existing evidence suggests that more years of preschool seem to be related to larger gains, but the added impact of an additional year is often smaller than the gains typically experienced by a four-year-old from one year of participation.¹⁴ Why the additional year generally results in smaller gains is unclear. It may be that children who attend multiple years experience the same curriculum across the two years rather than experiencing sequenced two-year curricula, as programs may mix three-year-old and four-year-olds in the same classroom.

Children show larger gains in higher-quality preschool programs.

Higher-quality preschool programs have larger impacts on children’s development while children are enrolled in the program and are more likely to create gains that are sustained after the child leaves preschool. Process quality features—children’s immediate experience of positive and stimulating interactions—are the most important contributors to children’s gains in language, literacy, mathematics and social skills. Structural features of quality (those features of quality that can be changed by structuring the setting differently or putting different requirements for staff in place, like group size, ratio, and teacher qualifications) help to create the conditions for positive process quality, but do not ensure that it will occur.

For example, smaller group sizes and better ratios of staff to children provide the right kind of setting for children to experience more positive interactions. But these conditions by themselves are not enough. Teacher qualifications such as higher educational attainment and background, certification in early childhood, or higher than average compensation for the field are features of many early education programs that have had strong effects. Yet here too, research indicates that qualifications alone do not ensure greater gains for children during the course of the preschool years.¹⁵ To promote stronger outcomes, preschool programs should be characterized by both structural features of quality and ongoing supports to teachers to assure that the immediate experiences of children, those provided through activities and interactions, are rich in content and stimulation, while also being emotionally supportive.

The aspects of process quality that appear to be most important to children’s gains during the preschool years address two inter-related dimensions of teacher-child interaction. First, interactions explicitly aimed at supporting learning, that foster both higher-order thinking skills in general and learning of content in such specific areas as early math and language, are related to gains, as discussed further later in this brief. Second, learning across multiple domains is enhanced in the context of warm, responsive teacher-child relationships and interactions that are characterized by back and forth—serve and return—conversations to discuss and elaborate on a given topic.^{16,17} Both the warm and responsive interaction style and learning-focused interactions also predict the persistence of gains into the school years.¹⁸ Some evidence suggests that children who have more opportunities to engage in age-appropriate activities with a range of varied materials such as books, blocks, and sand show larger gains during the preschool years (and those gains are maintained into the school years).¹⁹

Quality in preschool classrooms is in need of improvement, with instructional support levels particularly low.

Both longstanding and more recent research reveal that the average overall quality of preschool programs is squarely in the middle range of established measures. In large-scale studies of public prekindergarten, for example, only a minority of programs are observed to provide excellent quality; a comparable minority of programs are observed to provide poor quality.²⁰ It is therefore not surprising that impacts of most of the rigorously evaluated

public prekindergarten programs fall shy of those in Tulsa and Boston (showing gains in the small to moderate range for reading and math, that is, a few months of added learning, rather than the half-year to full-year of additional learning that was found in Tulsa and Boston).²¹ Head Start programs also show considerable variation in quality. While few programs are rated as having “poor” quality, research suggests that as in studies of many public prekindergarten programs, Head Start programs on average show instructional quality levels well below the midpoint of established measures.²² In sum, there is variation in quality in both Head Start and prekindergarten nationally, with no clear pattern of one being stronger in quality than the other in the existing research. It is important to note here that funding streams are increasingly mixed on the ground, with prekindergarten programs using Head Start performance standards or programs having fully blended funds; thus, these two systems are no longer mutually exclusive in many locales.

High-quality programs implemented at scale are possible, according to recent research. Evaluation evidence on the Tulsa and Boston prekindergarten programs shows that high-quality public Pre-K programs can be implemented across entire diverse cities and produce substantial positive effects on multiple domains of children’s development. Assuring high quality in these public programs implemented at scale has entailed a combination of program standards, attention to teacher qualifications and compensation, additional ongoing on-site quality supports such as the ones described previously, and quality monitoring.

A promising route to quality: Developmentally focused, intensive curricula with integrated, in-classroom professional development.

Curricula can play a crucial role in ensuring that children have the opportunity to acquire school readiness skills during the preschool years. Preschool curricula vary widely. Some, typically labeled “global” curricula, tend to have a wide scope, providing activities that are thought to promote socio-emotional, language, literacy, and mathematics skills and knowledge about science, arts, and social studies. Other curricula, which we label “developmentally focused,” aim to provide intensive exposure to a given content area based on the assumption that skills can be better fostered with a more focused scope.²³

Few global curricula have been evaluated rigorously. However, existing evidence from independent evaluators suggests no or small gains associated with their use, when compared with other commercially available curricula, researcher-developed curricula or curricula developed by individual teachers.²⁴ A revised version of a widely used global curriculum is currently being evaluated via a randomized trial.²⁵

As for developmentally focused curricula, several recent experimental evaluations have demonstrated moderate to large gains in the targeted domains of children’s development, for math curricula,²⁶ language and literacy curricula,²⁷ and curricula directed at improving socio-emotional skills and self-regulation, compared with usual practice in preschool

classrooms,²⁸ which typically involve more global curricula. In these studies, for the group receiving the developmentally focused curriculum, it is generally added to a global curriculum that is already in place.

Most of the successful curricula in these recent evaluations are characterized by intensive professional development that often involves coaching at least twice a month, in which an expert teacher provides feedback and support for in-classroom practice, either in person or in some cases through observation of videos of classroom teaching. Some curricula also incorporate assessments of child progress that are used to inform and individualize instruction, carried out at multiple points during the preschool year. These assessments allow the teacher to monitor the progress of each child in the classroom and modify her content and approach accordingly.

This recent set of studies suggests that intensive, developmentally focused curricula with integrated professional development and monitoring of children's progress offer the strongest hope for improving classroom quality as well as child outcomes during the preschool years. However, more evidence is needed about the effectiveness of such curricula, particularly studies of curricula implemented without extensive support of the developer, or beyond initial demonstrations of efficacy.²⁹ That is, the majority of rigorously conducted trials of developmentally focused curricula have included extensive involvement of the developer(s) and involve relatively small numbers of children. There have been only a few trials of curricula in “real world” conditions—meaning without extensive developer(s) involvement and across a large program. Some notable recent results in “real world” conditions show promise that substantial effects can be achieved,³⁰ but more such studies are needed given the widely noted difficulties in taking interventions to scale.³¹

A recent development in early childhood curricula is the implementation of integrated curricula across child developmental domains (for example, socio-emotional and language; math and language), which retain the feature of defined scope for each area. In two recent successful instances, efforts were made to ensure feasible, integrated implementation; importantly, supporting coaches and mentor teachers were trained across the targeted domains and curricula.³²

In addition to in-classroom professional development supports, the pre-service training and education of teachers is of critical concern in the field of preschool education. However, here evaluation research is still scant. Recent innovations include increasing integration of practica and in-classroom experiences in higher education teacher preparation courses; hybrid web-based and in-person training approaches; and attention to overlooked areas of early childhood teacher preparation such as work with children with disabilities, work with

children learning two languages, or teaching of early math skills. However, these innovations have yet to be fully evaluated for their impact on teacher capacities or preschool program quality.³³

Over the course of elementary school, scores for children who have and have not attended preschool typically converge. Despite this convergence, there is some evidence of effects on outcomes in early adulthood.

As children in preschool evaluation studies are followed into elementary school, the differences between those who received preschool and those who did not are typically reduced, based on the available primary-school outcomes of evaluations (chiefly test scores of reading and math achievement). This phenomenon of reduced effect sizes on test scores over time is often labeled “fadeout.”³⁴ We use the term convergence, as this term more accurately captures how outcomes like test scores of children who participated versus did not participate in preschool converge over time as the non-attenders catch-up. There is not yet a strong evidence base on reasons for the convergence of test scores in follow-up evaluations of children after early childhood. A number of factors may be involved—for example, low quality of primary schooling, particularly for students in disadvantaged areas, may fail to build on the gains created by early childhood education.³⁵ Having 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.

Persistence of effects in landmark, small demonstration programs. A handful of small-scale demonstration programs show that while the language, literacy, and mathematics test scores of children participating versus not participating in preschool programs tend to converge as children progress through their K-12 schooling careers, the programs nonetheless appear to produce effects on a wide range of behavioral, health, and educational outcomes that persist into adulthood. The existing evidence pertains to low-income populations. The two most well-known randomized experimental tests of preschool interventions with long-term outcome data—Perry Preschool and Abecedarian—provided striking evidence of this. Both programs produced large initial impacts on achievement test scores. Though some effects remained, the size of these impacts fell in magnitude as children aged. Nonetheless, there were very large program effects on schooling attainment and earnings during adulthood.³⁶ The programs also produced striking results for criminal behavior; fully 60-70% of the dollar-value of the benefits to society generated by Perry Preschool come from impacts in reducing criminal behavior.³⁷ In Abecedarian, the

treatment group's rate of felony convictions or incarceration by age 21 is fully one-third below that of the control group.³⁸ Other effects included reductions in teen pregnancy in both studies for treatment group members and reductions in tobacco use for treatment group members in Abecedarian.

Persistence of effects in programs at scale. Patterns of converging test scores but emerging impacts in adulthood are present in some other noteworthy preschool programs as well. These also focus on disadvantaged populations. For example, in studies of Head Start, there appear to be long-term gains in educational, behavioral and health outcomes even after test score impacts decline to zero. Specifically, a number of quasi-experimental studies of Head Start children who participated in the program in the 1960's, 1970's and 1980's find test score effects that are no longer statistically significant within a few years after the children leave the program. But even though Head Start participants have test scores that look similar to other children by early to mid elementary school, these studies show that Head Start children wind up completing more years of schooling, earning more, being healthier, and (in at least some studies) may be less likely to engage in criminal behavior.³⁹ Two studies have examined the medium-term persistence of gains of publicly funded state prekindergarten programs. One of these has followed children through third grade and found persistent mathematics gains, but not reading gains, through third grade for boys.⁴⁰ The second study has followed children through first grade and has found convergence of participating and non-participating children's cognitive skills and mixed impacts on children's behavioral outcomes.⁴¹

Future Directions in Sustaining Short-Term Gains from Preschool. Despite several promising studies of long-term gains, we caution that the vast majority of preschool program evaluations have not assessed outcomes substantially beyond the end of the program. Strategies for sustaining short-term gains for children require more exploration and evaluation. One path to sustaining short-term gains may be to maximize the short-term impact by ensuring that quality of preschool is high, according to the approaches described previously. Another is to work towards greater continuity in learning goals and approaches across the preschool and early elementary years and ensuring instructional quality and support for health and socio-emotional learning in kindergarten and the early elementary grades. And finally, efforts to bolster three major influences that parents have on children's development—their psychological well-being; their parenting behaviors; and their economic security—have been a focus in Head Start but not in other preschool programs. Intensifying and further specifying these components may increase the impact of preschool. Recent advances in successful parenting interventions, which provide great specificity and intensive focus on the dimension of parenting behavior targeted (e.g., specific behavior management approaches or contingent responsiveness), have yet to be integrated with preschool systems.⁴² A recent meta-analytic study suggests that a parenting-focused component can be an important complement to preschool and produce added gains in children's cognitive skills. The key is that the component on parenting be delivered via modeling of positive interactions or opportunities for practice with feedback. Didactic workshops or classes in

which parents merely receive information about parenting strategies or practices appeared to produce no additive benefits beyond those from the early education component of preschool alone.⁴³ Efforts to integrate recent advances in adult education and workforce development programs (a new set of two- or dual-generation programs), similarly, are just now being evaluated.⁴⁴

Preschool's effects for different subgroups.

Family income. Recent evidence suggests that high-quality preschool positively contributes to the language, literacy, and mathematics skills growth of both low- and middle-income children, but has the greatest impact on children living in or near poverty. Until recently, it has been difficult to compare the effectiveness of high-quality preschool across income groups, because almost all of the earlier studies focused on programs that targeted children from poor families. For example, the median percentage of families in poverty in rigorous early childhood education evaluations identified in a recent meta-analysis was 91%.⁴⁵ One study from the 1980's of the positive impacts of preschool education on children from well-to-do families suggested substantial positive impacts on boys.⁴⁶ More recently, the advent of universal prekindergarten in a small number of states and communities has permitted comparisons based on income. In two studies of public prekindergarten programs, positive and substantial impacts on language, literacy, and mathematics skills were found for both low- and middle-income children. In both of these studies, the impacts were larger for children living in or near poverty (as indicated by free- or reduced-lunch status), but still substantial for their less disadvantaged peers.⁴⁷

Race/ethnicity. Overall, the current research evidence suggests that children of different racial/ethnic groups benefit from preschool. Many of the most prominent evaluations from the 1960's, 1970's and 1980's (e.g., Perry, Abecedarian, and the Chicago Child-Parent Centers) focused on African American students, with no comparisons of effects possible across different racial/ethnic groups. Several more recent studies have compared effects for students from different racial/ethnic backgrounds. The Head Start Impact Study reached somewhat different conclusions for three-year-olds and four-year-olds: for three-year-olds, positive post-program impacts were strongest for African Americans and Hispanics, relative to White, non-Hispanic children; for four-year-olds, positive impacts were smaller for Hispanics, again relative to White, non-Hispanic children.⁴⁸ The Tulsa study found substantial improvements in school readiness for prekindergarten participants from all racial and ethnic groups. Effect sizes were moderate to large for all racial and ethnic groups studied (White, Black, Hispanic, Native American) but especially large for Hispanics.⁴⁹ The Boston study found substantial benefits in language, literacy, mathematics, and executive functioning domains for children from all racial and ethnic groups. Effect sizes were especially large for Hispanics and for Asian Americans, though the sample size for Asian Americans was relatively small.⁵⁰

Dual language learners and children of immigrants. Positive impacts of preschool can be as strong or stronger for dual language learners and children of immigrants, compared with their English-speaking or native-born counterparts. Given the specific challenges and opportunities faced in school by dual language learner (DLL) students⁵¹ and the growing number of such students in the U.S., it is important to know how high-quality preschool programs impact them in particular, as well as the features of quality that are important to their development. National non-experimental evidence suggests that positive effects of preschool on early reading and math achievement are as strong for children of immigrants as for children of the native-born.⁵² In the Tulsa prekindergarten program, effects for Hispanic students who came from homes where Spanish was the primary spoken language (DLL students) were larger than effects for Hispanic students who came from homes where English was the primary spoken language.⁵³ And the National Head Start Impact Study found significantly stronger positive impacts of Head Start on language and school performance at the end of kindergarten for DLL students, relative to their native speaking counterparts.

Generally, the same features of quality that are important to the academic outcomes of monolingual English speaking children appear to be important to the development of DLL children. However, a feature of early childhood settings that may be important specifically to the development of DLL children is language of instruction. There is emerging research that preschool programs that systematically integrate both the children's home language and English language development promote achievement in the home language as well as English language development.⁵⁴ While there are no large meta-analytic studies of bilingual education in preschool, meta-analyses of bilingual education in elementary school and several experimental preschool studies have reached this conclusion.⁵⁵ Home language development does not appear to come at the cost of developing English language skills, but rather strengthens them. Thus, programs that intentionally use both languages can promote emergent bilingualism, a characteristic that may be valuable in later development.⁵⁶

Children with special needs. More research is needed replicating and extending initial findings of positive effects for children with special needs. The Head Start Impact Study found that children with special needs randomly assigned to Head Start as 3-year-olds made significant gains in math and social-emotional development at the end of first grade compared with peers assigned to the control group.⁵⁷ Research on the Tulsa prekindergarten program found that children with mild to moderate special needs who participated in prekindergarten experienced significant improvements—comparable to those for typically developing children—in their reading skills and writing skills, though not necessarily in math. There is a need to test these patterns in other studies.

The benefits of quality preschool outweigh the costs.

High-quality preschool programs are one of many possible ways to support children's development, and it is important to ask whether the benefits from such programs can offset their considerable costs. Cost-benefit frameworks enable researchers to assess the value of social investments.⁵⁸ Key to this technique is a systematic accounting of the costs and benefits of an intervention, based on a careful comparison of outcomes for those individuals who participated in the program and otherwise similar individuals who did not. Early childhood education costs refer to all expenditures necessary to provide the program, including staff time and capital investments. Benefits typically take one of two forms. First, benefits may come from cost savings, such as reduced spending for special education and grade retention, as well as lower involvement in the child protection, welfare, and criminal justice systems. Second, benefits may flow from greater economic productivity, especially higher earnings as adults. It is also important to note that benefits can accrue not only to the individuals who directly participated in preschool programs, but also to society (e.g., the value of not being a crime victim). When both costs and benefits are quantified, researchers can produce an estimate of a program's benefits relative to its costs.

Rigorous efforts to estimate benefit-cost ratios of preschool have yielded very positive results, suggesting that early childhood education can be a wise financial investment. Using data on the long-term life outcomes of program participants and non-participants, assessments of the Perry Preschool program⁵⁹ and the Chicago Child-Parent Centers⁶⁰ both yielded estimates of about 7 to 1 or higher. Estimates of the longer and thus more costly Abecedarian Project (program length of 5 years) have produced a lower estimate of approximately 2.5 to 1.⁶¹ Other scholars, lacking hard evidence on long-term impacts for program participants and non-participants who have not yet become adults, have made projections by blending evidence on short-term results from the program with evidence on the relationship between short-term results and adult outcomes from other sources. Such efforts have yielded estimates for universal prekindergarten programs (available to children from all income groups) that range from 3 to 1 to 5 to 1.⁶² The divergence of estimates across programs suggests that it may be hard to predict the exact rate of return for programs. However, the best current evidence suggests that the impact of quality preschool per dollar spent on cognitive and achievement outcomes is larger than the average impact of other well-known educational interventions per dollar spent, such as class-size reductions in elementary schools.⁶³

The consistent finding of benefits that substantially exceed preschool program costs indicates that high-quality early childhood education programs are among the most cost-effective educational interventions and are likely to be profitable investments for society as a whole.

Conclusion

The goal of this research brief has been to summarize the most recent rigorous research for inclusion in the important public discussion that is now occurring about preschool education. When taken together with earlier foundational studies, the growing body of research on preschool both confirms but also extends the previous evidence in important directions.

Recent meta-analyses drawing together the evidence across decades of evaluation research now permit us to say with confidence that preschool programs can have a substantial impact on early learning and development. Positive effects on children's development are found for language, literacy and early math skills; for social and emotional outcomes; and in children's health. Whereas earlier evidence was limited to small, tightly controlled demonstration projects, the more recent evidence supports this conclusion for rigorously evaluated high quality preschool programs implemented at scale. While earlier studies were limited to a focus on children from low-income families, some more recent studies of preschool implemented at scale encompass families from a wider socioeconomic range, and for the first time, make it possible to say that preschool education benefits children from middle-income as well as low-income families (although children from low-income children benefit more). The most recent research also makes clear that there are positive effects for dual language learner children as well as for those whose home language is English, and for children with special needs as well as for typically developing children.

While there is clear evidence that preschool education boosts early learning for children from a range of backgrounds, we also see a convergence of test scores during the elementary school grades so that there are diminishing differences over time on tests of academic achievement between children who did and did not attend preschool. Yet the most recent research is showing an accumulation of evidence that even when the difference in test scores declines to zero, children who have attended preschool go on to show positive effects on important adolescent and young adult outcomes, such as high school graduation, reduced teen pregnancy, years of education completed, earnings, and reduced crime. Why there are long term effects even with a convergence of test scores is an important focus of current research.

The evidence continues to grow that the foundation for positive effects on children are interactions with teachers that combine stimulation and support. Such interactions build children's higher-order thinking skills as well as knowledge of specific content (such as early math and language skills), and at the same time are warm, responsive and elicit reciprocal interactions. Features of quality that focus on structural elements, such as group size, ratio, and teacher qualifications are important in that they help to increase the likelihood of such interactions, but they do not ensure that stimulating and supportive interactions will occur.

Multiple recent studies suggest a highly promising route to quality in preschool education: providing support for teachers to implement specific evidence-based curricula and instruction through coaching and mentoring. These studies have shown positive effects in strengthening both teacher-child interactions and children's learning in targeted domains. This evidence is particularly important given that large-scale studies of both state-funded preschool and Head Start show that there is a need to improve quality, and especially the quality of instruction.

Beyond coaching and mentoring in support of instruction and curricula, what other factors strengthen the boost provided to children from preschool education? There is evidence that a second year of preschool shows additional benefits to children. However, more work is needed to consider how a second year could intentionally build on children's growth in a first year of preschool. In addition, while comprehensive services can strengthen outcomes, the most recent research indicates that it is important to target such services so that they focus on evidence-based practices. For example, a recently conducted meta-analysis indicates that the positive effects of preschool education can be augmented when a parenting education component is added, but only when this component focuses on providing parents the opportunity to see modeling of positive interactions or to practice such interactions. Such effects do not occur when programs simply provide parents with information.

Finally, while it has been clear for some time that high-quality preschool education yields more in benefits to society than its initial costs, the most recent work indicates that there is a positive return on investment for a range of differing preschool programs, from those that are more intensive and costly to those that require less initial investment. In sum, quality preschool education is an investment in our future.

Which evaluation designs are strong enough to produce trustworthy evidence?

*We draw in this section from a fuller discussion in: National Forum on Early Childhood Policies and Programs (2007). **Early Childhood Program Evaluations: A Decision-Maker's Guide**. Cambridge, MA: Harvard Center on the Developing Child, National Forum on Early Childhood Programs and Policies. http://developingchild.harvard.edu/index.php/download_file/-/view/68/*

We have focused as much as possible in this brief on studies that use the most rigorous study designs and on meta-analyses that reveal patterns in effects across many studies. We define as “rigorous” studies that use designs that compare children or parents who receive program services with a “virtually identical” comparison group of children or parents who do not receive those services.

The ideal method for assessing program effects is an experimental study referred to as a randomized controlled trial or RCT. In an RCT, children who are eligible to participate in a program are entered into a “lottery” where they either win the chance to receive services or are assigned to a comparison (control) group. Parents or program administrators have no say in who wins and loses this lottery. If sufficient numbers of children end up in the program and control groups, and the implementation of random assignment is successful (i.e., there are no significant differences between the two groups in their demographics or in the outcomes of interest prior to the intervention), then any post-program differences in achievement, behavior, or other outcomes of interest between the two groups can be attributed to the program with a high degree of confidence.

Although random assignment of children or parents to program and comparison groups is the “gold standard” for program evaluation, sometimes this is not possible.

In some circumstances, a randomized controlled trial is not feasible. One of the most frequently used alternative methods available to program evaluators is called a Regression-Discontinuity Design (RDD). In this case, assignment to either the control or the intervention group is defined by a cut-off point along some continuum (such as age). For example, a number of public prekindergarten evaluations have taken advantage of strict birthday cut-off dates for program eligibility. In some states, children who are four years old as of September 1 are eligible for enrollment in Pre-K, while those who turn four after September 1 must wait a year to attend. The key comparison in an RDD is between children with birthdays that just make or just miss the cutoff, since they presumably differ only in the fact that the older children attend Pre-K in the given year while the younger

ones do not. Comparing kindergarten entry achievement scores for children who have completed a year in Pre-K with the scores measured at the same time for children who just missed the birthday cutoff and are about to enter Pre-K can be a strong indicator of program impacts, provided that there is evidence that the cutoff policy was not manipulated by participants and adjustments are made for differential selection into “treatment” and “control” research groups.⁶⁴ Other methods used in recent nonexperimental preschool studies include propensity score weighting, individual, sibling or state fixed-effects, and instrumental-variables analysis.⁶⁵

Why some evaluation designs are problematic.

Evaluations that select comparison groups in other ways should be approached with healthy skepticism. The key concern is how well children enrolled in the program are matched to children in the comparison group, as countless studies have shown how difficult it is to select comparison groups that are unbiased. Especially important indicators of the quality of the match are assessments of outcomes of interest for both program and comparison-group children taken just prior to the point of program entry, as well as indicators of parental “motivation” if possible. The closer the match on multiple characteristics, the more one can trust the findings. Evaluations that do not detail pre-service characteristics of program and comparison-group children should be viewed suspiciously.

For example, simple comparisons of state standardized test scores before and after the implementation of large-scale ECE do not take into account how the population of children may differ across time. As one possibility, increased immigration into a state might bring children who speak English as a second language and tend to score lower on tests, compared with children who speak English as a first language. If so, any effect of ECE programs in raising the average level of achievement will be obscured when examining trends in state test scores. Economic conditions may change too across time—these can have important effects on children’s achievement when assessed at different timepoints.⁶⁶

Generalizing study results to other populations.

An additional important consideration when interpreting the results from any study is the population from which study participants were sampled. This is the population to whom study results apply. For example, results from studies that include only preschool children from low-income families apply only to children from that demographic. Results do not generalize to preschool children from higher-income families. How preschools were selected is equally important. A sample of preschools that volunteered to implement a new curriculum, for example, has more limited implications than a broader sample of preschools that were mandated to implement a new curriculum.

Endnotes

- 1 Among the nation's 3-year olds, 4% attend public prekindergarten, 8% attend Head Start, and 3% attend special education preschool programs; National Institute on Early Education Research (2012). *The state of preschool 2012*. New Brunswick, NJ: Author.
- 2 Harvard Center on the Developing Child (2007). *The science of early childhood development: Closing the gap between what we know and what we do*. Cambridge, MA: Author.
- 3 Blair, C., & Razza, R. P. (2007). Relating effortful control, executive function, and false belief understanding to emerging math and literacy ability in kindergarten. *Child Development*, 78, 647-663; Caspi, A., Moffitt, T. E., Newman, D. L., & Silva, P. A. (1996). Behavioral observations at age 3 years predict adult psychiatric disorders: Longitudinal evidence from a birth cohort. *Archives of General Psychiatry*, 53, 1033-1039; Duncan, G. J., Dowsett, C. J., Claessens, A., Magnuson, K., Huston, A. C., Klebanov, P., ... & Japel, C. (2007). School readiness and later achievement. *Developmental Psychology*, 43, 1428-1446; Heckman, J. J. (2006). Skill formation and the economics of investing in disadvantaged children. *Science*, 312, 1900-1902; Harvard Center on the Developing Child. (2011). *The foundations of lifelong health are built in early childhood*. Cambridge, MA: Author. Shonkoff, J. P., Boyce, W. T., & McEwen, B. S. (2009). Neuroscience, molecular biology, and the childhood roots of health disparities. *JAMA*, 301, 2252-2259.
- 4 Camilli, G., Vargas, S., Ryan, S., & Barnett, W. S. (2010). Meta-analysis of the effects of early education interventions on cognitive and social development. *The Teachers College Record*, 112, 579-620; Wong, V. C., Cook, T. D., Barnett, W. S., & Jung, K. (2008). An effectiveness-based evaluation of five state prekindergarten programs. *Journal of Policy Analysis and Management*, 27, 122-154.
- 5 Advisory Committee on Head Start Research and Evaluation (2012). *Advisory committee on Head Start research and evaluation: Final report*. Washington, DC; Administration for Children and Families; Campbell, F. A., Ramey, C. T., Pungello, E., Sparling, J., & Miller-Johnson, S. (2002). Early childhood education: Young adult outcomes from the Abecedarian project. *Applied Developmental Science*, 6, 42-57; Duncan, G. J., & Magnuson, K. (2013). Investing in preschool programs. *Journal of Economic Perspectives*, 27, 109-132; Leak, J., Duncan, G. J., Li, W., Magnuson, K., Schindler, H., & Yoshikawa, H. (2010, March). Is timing everything? How early childhood education program impacts vary by starting age, program duration and time since the end of the program. Paper presented at the Biennial Meeting for the Society for Research on Child Development, Montreal, Quebec, Canada; Puma, M., Bell, S. Cook, R., Heid, C., & Lopez, M. (2005). *Head Start impact study: First year findings*. Washington, D.C.: U.S. Department of Health and Human Services, Administration for Children and Families; Reynolds, A.J. (2000). *Success in early intervention: The Chicago Child-Parent Centers*. Lincoln, Nebraska: University of Nebraska Press; Schweinhart, L. J., Montie, J., Xiang, Z., Barnett, W. S., Belfield, C. R., & Nores, M. (2005). *Lifetime effects: The HighScope Perry Preschool study through age 40*. Ypsilanti, MI: HighScope Press.
- 6 Gormley, W., Gayer, T., Phillips, D.A., & Dawson, B. (2005). The effects of universal Pre-K on cognitive development. *Developmental Psychology*, 41, 872-884; Weiland, C., & Yoshikawa, H. (2013). Impacts of a prekindergarten program on children's mathematics, language, literacy, executive function, and emotional skills. *Child Development*.
- 7 For example, positive behaviors showing empathy, cooperation, or prosocial orientations, or problem behaviors such as antisocial, aggressives, hyperactive, impulsive, withdrawn, depressed, or anxious behaviors.
- 8 Heckman, J., Pinto, R., & Savelyev, P. A. (2012). *Understanding the mechanisms through which an influential early childhood program boosted adult outcomes* (NBER Working Paper No. 18581). Cambridge, MA: National Bureau of Economic Research.
- 9 Puma, M., Bell, S. Cook, R., Heid, C., & Lopez, M. (2005). *Head Start impact study: First year findings*. Washington, D.C.: U.S. Department of Health and Human Services, Administration for Children and Families.
- 10 Gormley, W. T., Phillips, D. A., Newmark, K., Welti, K., & Adelstein, S. (2011). Social-emotional effects of early childhood education programs in Tulsa. *Child Development*, 82, 2095-2109.
- 11 Schindler, H.S., Kholoptseva, J., Oh, S.S., Yoshikawa, H., Duncan, G.J., Magnuson, K.A., & Shonkoff, J.S. (2013). Preventing aggression and antisocial behaviors through preschool interventions: A meta-analytic study. Manuscript in preparation.
- 12 Currie, J., & Thomas, D. (1995). Does Head Start make a difference? *The American Economic Review*, 85, 341-364; Ludwig, J., & Miller, D. L. (2007). Does Head Start improve children's life chances? Evidence from a regression discontinuity design. *Quarterly Journal of Economics*, 122, 159-208.
- 13 U.S. Department of Health and Human Services. (2010). *Head Start impact study: Final report*. Washington, DC: Administration for Children and Families, Office of Planning, Research and Evaluation.
- 14 Arteaga, I.A., Humpage, S., Reynolds, A.J., & Temple, J.A. (in press). One year of preschool or two? Is it important for adult outcomes? Results from the Chicago Longitudinal Study of the Chicago Parent-Child Centers. *Economics of Education Review*; Magnuson, K., Meyers, M., Ruhm, C., & Waldfogel, J. (2004). Inequality in preschool education and school readiness. *American Educational Research Journal*, 41, 115-157; Phillips, D., & Adams, G. (2001). Child care and our youngest children. *The Future of Children*, 11, 35-51; Reynolds, A. J. (1995). One year of preschool intervention or two: Does it matter?. *Early Childhood Research Quarterly*, 10, 1-31; Sammons, P., Sylva, K., Melhuish, E., Taggart, B., Elliot, K., & Siraj-Blatchford, I. (2002). *The effective provision of pre-school education (EPPE) project: Measuring the impact of pre-school on children's cognitive progress over the pre-school period* (Vol. 8). London, England: Institute of Education, University of London/Department for Education and Skill; Tarullo, L., Xue, Y., & Burchinal, M. (2013, April). Are two years better than one? Examining dosage of Head Start attendees using propensity score matching methodology. In A. Madigan (Chair), *Does program dosage predict outcomes in Head Start and Early Head Start*. Symposium presented at the Biennial Meeting of the Society for Research in Child Development, Seattle, WA.
- 15 Burchinal, M., Howes, C., Pianta, R., Bryant, D., Early, D., Clifford, R., & Barbarin, O. (2008). Predicting child outcomes at the end of kindergarten from the quality of pre-kindergarten teacher-child interactions and instruction. *Applied Developmental Science*, 12, 140-153.; Burchinal, M., Vandergrift, N., Pianta, R., & Mashburn, A. (2010). Threshold analysis of association between child care quality and child outcomes for low-income children in pre-kindergarten programs. *Early Childhood Research Quarterly*, 25, 166-176; Early, D. M., Maxwell, K. L., Burchinal, M., Alva, S., Bender, R. H., Bryant, D., ... & Zill, N. (2007). Teachers' education, classroom quality, and young children's academic skills: Results from seven studies of preschool programs. *Child Development*, 78, 558-580. Zaslow, M., Anderson, R., Redd, Z., Wessel, J., Tarullo, L. & Burchinal, M. (2010). *Quality dosage, thresholds, and features in early childhood settings: A review of the literature*. OPRE 2011-5. Washington, DC: Office of Planning, Research and Evaluation, Administration for Children and Families, U.S. Department of Health and Human Services
- 16 Howes, C., Burchinal, M., Pianta, R., Bryant, D., Early, D., Clifford, R., & Barbarin, O. (2008). Ready to learn? Children's pre-academic achievement in pre-kindergarten programs. *Early Childhood Research Quarterly*, 23, 27-50.; Mashburn, A. J., Pianta, R. C., Hamre, B. K., Downer, J. T., Barbarin, O. A., Bryant, D., ... Howes, C. (2008). Measures of classroom quality in prekindergarten and children's development of academic, language, and social skills. *Child Development*, 79, 732-749.
- 17 Harvard Center on the Developing Child (2007). *A science-based framework for early childhood policy*. Cambridge, MA: Author; Justice, L., Mashburn, A. J., Pence, K., & Wiggins, A. (2008). Experimental evaluation of a preschool language curriculum: Effects on classroom quality and children's expressive language skills. *Journal of Speech, Language, and Hearing Research*, 51, 1-19; Wasik, B. A., Bond, M. A., & Hindman, A. H. (2006). The effects of a language and literacy intervention on Head Start children and teachers. *Journal of Educational Psychology*, 98, 63-74.

- 18 Burchinal, M. R., Howes, C. Pianta, R., Bryant, D., Early, D., Clifford, R., & Barbarin, O. (2008). Predicting child outcomes at the end of kindergarten from the quality of pre-kindergarten teacher-child interactions and instruction. *Applied Developmental Science*, 12, 140-153; Dickinson, D.K., & Porche, M. (2011). Relationship between language experiences in preschool classrooms and children's kindergarten and fourth grade language and reading abilities. *Child Development*, 82, 3, 870-886.; Vandell, D. L., Belsky, J., Burchinal, M., Steinberg, L., Vandergrift, N., & NICHD Early Child Care Research Network. (2010). Do effects of early child care extend to age 15 years? *Child Development*, 81, 737-756.
- 19 Burchinal, M.R., Peisner-Feinberg, E., Bryant, D.M., & Clifford, R. (2000). Children's social and cognitive development and child care quality: Testing for differential associations related to poverty, gender, or ethnicity. *Applied Developmental Science*, 4, 149-165; Howes, C., Burchinal, M., Pianta, R., Bryant, D., Early, D., Clifford, R., & Barbarin, O. (2008). Ready to learn? Children's pre-academic achievement in pre-kindergarten programs. *Early Childhood Research Quarterly*, 23, 27-50; Love, J. M., Harrison, L., Sagi-Schwartz, A., van Ijzendoorn, M. H., Ross, C., Ungerer, J. A.,... Chazan-Cohen, R. (2003). Child care quality matters: How conclusions may vary with context. *Child Development*, 74, 1021-1033; Peisner-Feinberg, E., & Burchinal, M. (1997). Relations between preschool children's child-care experiences and concurrent development: The cost, quality, and outcomes study. *Merrill-Palmer Quarterly*, 43, 451-477; Peisner-Feinberg, E. S., Burchinal, M. R., Clifford, R. M., Culkin, M. L., Howes, C., Kagan, S. L., & Yazejian, N. (2001). The relation of preschool child-care quality to children's cognitive and social development trajectories through second grade. *Child Development*, 72, 1534-1553; Sylva, K., Melhuish, E., Sammons, P., Siraj-Blatchford, I., & Taggart, B. (2012). Preschool quality and educational outcomes at age 11: Low quality has little benefit. *Journal of Early Childhood Research*, 9, 109-124; Votruba-Drzal, E., & Chase-Lansdale, P.L. (2004). Child care and low-income children's development: Direct and moderated effects. *Child Development*, 75, 296-312.
- 20 Mashburn, A. J., Pianta, R. C., Hamre, B. K., Downer, J. T., Barbarin, O. A., Bryant, D., & ... Howes, C. (2008). Measures of classroom quality in prekindergarten and children's development of academic, language, and social skills. *Child Development*, 79, 732-749. Moiduddin, E., Aikens, N., Tarullo, L., West, J., & Xue, Y. (2012). *Child outcomes and classroom quality in FACES 2009*. OPRE Report 2012-37a. Washington, DC: Office of Planning, Research and Evaluation, Administration for Children and Families, U.S. Department of Health and Human Services. For example, a study of 692 Pre-K classrooms in these 11 states using the Classroom Assessment Scoring System (CLASS) observation of classroom quality found the largest proportion of classrooms (31.4%) to show a profile involving positive emotional climate but only mediocre instructional support. While nearly the same proportion of the classrooms combined strong social, emotional, and instructional support to children, 18.5% of the classrooms had a profile involving mediocre emotional climate and low instructional support, and 18.8% were observed to have poor quality overall, lacking in both social and emotional support and instructional quality.
- 21 Specifically, moderate to large impacts on language, literacy, and math outcomes, ranging from several months to an entire year of additional learning, relative to comparison groups, in Gormley, W., Gayer, T., & Phillips, D.A. (2008). Preschool programs can boost school readiness. *Science*, 320, 1723-24; Gormley, W., Gayer, T., Phillips, D.A., & Dawson, B. (2005). The effects of universal Pre-K on cognitive development. *Developmental Psychology*, 41, 872-884; Phillips, D., Gormley, W.T., & Lowenstein, A. (2009). Inside the pre-kindergarten door: Classroom climate and instructional time allocation in Tulsa's Pre-K programs. *Early Childhood Research Quarterly*, 24, 213-228; Weiland, C., Ulvestad, K., Sachs, J., & Yoshikawa, H. (2013). Associations between classroom quality and children's vocabulary and executive function skills in an urban public prekindergarten program. *Early Childhood Research Quarterly*, 28, 199-209; Weiland, C., & Yoshikawa, H. (2013). Impacts of a prekindergarten program on children's mathematics, language, literacy, executive function, and emotional skills. *Child Development*. Small to moderate impacts in Lipsey, M. W., Hofer, K. G., Dong, N., Farran, D. C., & Bilbrey, C. (2013). *Evaluation of the Tennessee voluntary prekindergarten program: End of Pre-K results from the randomized control design* (Research Report). Nashville, TN: Vanderbilt University, Peabody Research Institute; Wong, V. C., Cook, T. D., Barnett, W. S., & Jung, K. (2008). An effectiveness-based evaluation of five state prekindergarten programs. *Journal of Policy Analysis and Management*, 27, 122-154.
- 22 Moiduddin, E., Aikens, N., Tarullo, L., West, J., & Xue, Y. (2012). *Child outcomes and classroom quality in FACES 2009*. OPRE Report 2012-37a. Washington, DC: Office of Planning, Research and Evaluation, Administration for Children and Families, U.S. Department of Health and Human Services. Total scores using the Early Childhood Environment Rating Scale in large samples of Pre-K and Head Start show slightly higher scores for Head Start than Pre-K classrooms. For example, when the Early Childhood Environment Rating Scale-Revised was used in a sample representative of public Pre-K classrooms in four states and of specific regions of two additional very large states, the average total score was 3.86. The average score on the same measure used in a representative sample of Head Start classrooms in 1997 was slightly higher. More recent data for a representative sample of Head Start programs, though using an abbreviated version of this observational measure, showed an average score of 4.3. At the same time, however, observations using the CLASS in the 2009 observations of a representative sample of Head Start programs clearly show that levels of instructional quality were low, as in many studies of public pre-kindergarten classrooms.
- 23 Clements, D. H. (2007). Curriculum research: Toward a framework for 'research-based curricula'. *Journal for Research in Mathematics Education*, 38, 35-70.
- 24 Bierman, K. L., Domitrovich, C. E., Nix, R. L., Gest, S. D., Welsh, J. A., Greenberg, M. T., ... Gill, S. (2008). Promoting academic and social-emotional school readiness: The Head Start REDI program. *Child Development*, 79, 1802-1817; Clements, D. H., & Sarama, J. (2007b). Effects of a preschool mathematics curriculum: Summative research on the Building Blocks project. *Journal for Research in Mathematics Education*, 38, 136-163; Preschool Curriculum Evaluation Research Consortium (2008). *Effects of preschool curriculum programs on school readiness (NCER 2008-2009)*. Washington, DC: National Center for Education Research, Institute of Education Sciences, U.S. Department of Education. Washington, DC: U.S. Government Printing Office.
- 25 Teaching Strategies. (2012). *The Creative Curriculum system for preschool pilot study: Initial baseline report*. Retrieved August 9, 2013 from <http://www.teachingstrategies.com/content/pageDocs/System-Pilot-Study-Baseline-Report-Layman-4-2012.pdf>.
- 26 Clements, D. H., & Sarama, J. (2008). Enhancing young children's mathematical knowledge through a pre-kindergarten mathematics intervention. *Early Childhood Research Quarterly*, 19, 99-120; Clements, D. H., & Sarama, J. (2008). Experimental evaluation of the effects of a research-based preschool mathematics curriculum. *American Educational Research Journal*, 45, 443-494.
- 27 Bierman, K. L., Domitrovich, C. E., Nix, R. L., Gest, S. D., Welsh, J. A., Greenberg, M. T., ... Gill, S. (2008). Promoting academic and social-emotional school readiness: The Head Start REDI program. *Child Development*, 79, 1802-1817; Fantuzzo, J. W., Gadsden, V. L., & McDermott, P. A. (2011). An integrated curriculum to improve mathematics, language, and literacy for Head Start children. *American Educational Research Journal*, 48, 763-793; Farver, J. M., Lonigan, C. J., & Eppe, S. (2009). Effective early literacy skill development for young Spanish-speaking English language learners: An experimental study of two methods. *Child Development*, 80, 703-719; Landry, S.H., Anthony, J.L., Swank, P.R., & Monseque-Bailey, P. (2009). Effectiveness of comprehensive professional development for teachers of at-risk preschoolers. *Journal of Educational Psychology*, 101, 448-465; Lonigan, C. J., Farver, J. M., Phillips, B. M., & Clancy-Menchetti, J. (2011). Promoting the development of preschool children's emergent literacy skills: A randomized evaluation of a literacy-focused curriculum and two professional development models. *Reading and Writing*, 24, 305-337; Neuman, S. B., & Cunningham, L. (2009). The impact of professional development and coaching on early language and literacy practices. *American Educational Research Journal*, 46, 532-566; Powell, D. R., Diamond, K. E., Burchinal, M. R., & Koehler, M. J. (2010). Effects of an early literacy professional development intervention on Head Start teachers and children. *Journal of Educational Psychology*, 102, 299-312; Preschool Curriculum Evaluation Research Consortium (2008). *Effects of preschool curriculum programs on school readiness (NCER 2008-2009)*. Washington, DC: National Center for Education Research, Institute of Education Sciences, U.S. Department of Education. Washington, DC: U.S. Government Printing Office; Wasik, B. A., Bond, M. A., & Hindman, A. H. (2006). The effects of a language and literacy intervention on Head Start children and teachers. *Journal of Educational Psychology*, 98, 63-74; Whitehurst, G. J., Zevenbergen, A. A., Crone, D. A., Schultz, M. D., Velting, O. N., & Fischel, J. E. (1999). Outcomes of an emergent literacy intervention from Head Start through second grade. *Journal of Educational Psychology*, 91, 261-272.

- 28 Bierman, K. L., Domitrovich, C. E., Nix, R. L., Gest, S. D., Welsh, J. A., Greenberg, M. T., ... Gill, S. (2008). Promoting academic and social-emotional school readiness: The Head Start REDI program. *Child Development*, 179, 1802–1817; Raver, C. C., Jones, S. M., Li-Grining, C. P., Zhai, F., Metzger, M., & Solomon, B. (2009). Targeting children's behavior problems in preschool classrooms: A cluster-randomized controlled trial. *Journal of Consulting and Clinical Psychology*, 77, 302–316; Riggs, N. R., Greenberg, M. T., Kusché, C. A., & Pentz, M. A. (2006). The mediational role of neurocognition in the behavioral outcomes of a social-emotional prevention program in elementary school students: Effects of the PATHS curriculum. *Prevention Science*, 7, 91-102.
- 29 Advisory Committee on Head Start Research and Evaluation (2012). *Advisory Committee on Head Start Research and Evaluation: Final Report*. Washington, DC; Administration for Children and Families; Lonigan, C. J., Farver, J. M., Phillips, B. M., & Clancy-Menchetti, J. (2011). Promoting the development of preschool children's emergent literacy skills: A randomized evaluation of a literacy-focused curriculum and two professional development models. *Reading and Writing*, 24, 305-337.
- 30 Clements, D. H., Sarama, J., Farran, D. C., Lipsey, M. W., Hofer, K. G., & Bilbrey, C. (2011, March). An examination of the Building Blocks math curriculum: Results of a longitudinal scale-up study. In K. G. Hofer (Chair), *The Effects of Pre-kindergarten and Pre-kindergarten Curricula on Emergent Math and Literacy Skills*. Symposium conducted at the Annual Conference of the Society for Research on Educational Effectiveness, Washington, D.C.; Weiland, C., & Yoshikawa, H. (2013). Impacts of a prekindergarten program on children's mathematics, language, literacy, executive function, and emotional skills. *Child Development*.
- 31 Durlak, J. A., & Dupre, E. P. (2008). Implementation matters: A review of research on the influence of implementation on program outcomes and the factors affecting the implementation. *American Journal of Community Psychology*, 41, 327-350; Granger, R. C. (2010). *Improving practice at scale. William T. Grant Foundation 2009 Annual Report*. New York: William T. Grant Foundation.
- 32 E.g., language and socio-emotional development in Bierman, K. L., Domitrovich, C. E., Nix, R. L., Gest, S. D., Welsh, J. A., Greenberg, M. T., ... Gill, S. (2008). Promoting academic and social-emotional school readiness: The Head Start REDI program. *Child Development*, 179, 1802–1817; language and math in Weiland, C., & Yoshikawa, H. (2013). Impacts of a prekindergarten program on children's mathematics, language, literacy, executive function, and emotional skills. *Child Development*. In addition, widely used curricula that have in the past taken more of a global approach are now developing more sequenced and intensive versions (e.g., the Creative Curriculum). These have yet to be assessed in rigorous impact evaluations.
- 33 Horm, D. M., Hyson, M., & Winton, P. J. (2013). Research on early childhood teacher education: Evidence from three domains and recommendations for moving forward. *Journal of Early Childhood Teacher Education*, 34, 95-112; Whitebook, M., Austin, L. J., Ryan, S., Kipnis, F., Almaraz, M., & Sakai, L. (2012). *By default or by design? Variations in higher education programs for early care and education teachers and their implications for research methodology*. Berkeley, CA: Center for the Study of Child Care Employment.
- 34 A recent meta-analysis of ECE programs over the last five decades showed that the rate of declines in effect size for cognitive and achievement outcomes averaged .03 effect size a year after end of program. This means that the average post-test effect size on these outcomes of .35 would be reduced to .10 after roughly 8 years. If a program results in a larger gain than .35, then this analysis suggests that the continuing gains are larger as well. Leak, J., Duncan, G. J., Li, W., Magnuson, K., Schindler, H., & Yoshikawa, H. (2010, March). Is timing everything? How early childhood education program impacts vary by starting age, program duration and time since the end of the program. Paper presented at the Biennial Meeting for the Society for Research on Child Development, Montreal, Quebec, Canada.
- 35 Magnuson, K., Ruhm, C., & Waldfogel, J. (2007). The persistence of preschool effects: Do subsequent classroom experiences matter? *Early Childhood Research Quarterly*, 22, 18-38; Zhai, F., Raver, C.C., & Jones, S.M. (2012). Quality of subsequent schools and impacts of early interventions: Evidence from a randomized controlled trial in Head Start settings. *Children and Youth Services Review*, 34, 946-954. Another possibility is that in aiming for third grade test scores, early elementary school teachers may be focusing especially strongly on those children who do not have strong initial skills. Research to clarify and distinguish among multiple possibilities will make a valuable contribution.
- 36 Campbell, F. A., Ramey, C. T., Pungello, E., Sparling, J., & Miller-Johnson, S. (2002). Early childhood education: Young adult outcomes from the Abecedarian project. *Applied Developmental Science*, 6, 42-57; Heckman, J. J., Moon, S. H., Pinto, R., Savellyev, P. A., & Yavitz, A. (2010). The rate of return to the HighScope Perry Preschool Program. *Journal of Public Economics*, 94, 114-128; Schweinhart, L.J., Barnett, W.S., & Belfield, C.R. (2005). *Lifetime effects: The High/Scope Perry Preschool Study through age 40*. Ypsilanti, MI: High/Scope Press.
- 37 Belfield, C.R., Nores, M., Barnett, W.S., & Schweinhart, L.J. (2006). The High/Scope Perry Preschool Program: Cost-benefit analysis using data from the age-40 followup. *Journal of Human Resources*, 41, 162-190.
- 38 Campbell, F. A., Ramey, C. T., Pungello, E., Sparling, J., & Miller-Johnson, S. (2002). Early childhood education: Young adult outcomes from the Abecedarian project. *Applied Developmental Science*, 6, 42-57.
- 39 Deming, D. (2009). Early childhood intervention and life-cycle skill development: Evidence from Head Start. *American Economic Journal: Applied Economics*, 1, 111-134; Garces, E., Currie, J., & Thomas, D. (2002). Longer term effects of Head Start. *The American Economic Review*, 92, 999-1012; Johnson, R. (2013). *School quality and the long-run effects of Head Start*. Manuscript in preparation; Ludwig, J., & Miller, D. L. (2007). Does Head Start improve children's life chances? Evidence from a regression discontinuity design. *Quarterly Journal of Economics*, 122, 159-208.
- 40 Hill, C., Gormley, W., & Adelstein, S. (2012). *Do the short-term effects of a strong preschool program persist?* Center for Research on Children in the United States, Working Paper # 18.
- 41 Lipsey, M. W., Hofer, K. G., Dong, N., Farran, D. C., & Bilbrey, C. (2013). *Evaluation of the Tennessee voluntary prekindergarten program: Kindergarten and first grade follow-up results from the randomized control design*. Nashville, TN: Vanderbilt University, Peabody Research Institute.
- 42 Fisher, P. A., Gunnar, M. R., Dozier, M., Bruce, J., & Pears, K. C. (2006). Effects of therapeutic interventions for foster children on behavioral problems, caregiver attachment, and stress regulatory neural systems. *Annals of the New York Academy of Sciences*, 1094, 215-225; Landry, S. H., Smith, K. E., Swank, P. R., & Guttentag, C. (2008). A responsive parenting intervention: The optimal timing across early childhood for impacting maternal behaviors and child outcomes. *Developmental Psychology*, 44, 1335-1353.
- 43 Grindal, T., Bowne, J., Yoshikawa, H., Duncan, G.J., Magnuson, K.A., & Schindler, H. (2013). *The added impact of parenting education in early childhood education programs: A meta-analysis*. Manuscript in revise and resubmit.
- 44 Ascend at the Aspen Institute (2012). *Two generations, one future: moving parents and children beyond poverty together*. Washington, DC: The Aspen
- 45 Leak, J., Duncan, G. J., Li, W., Magnuson, K., Schindler, H., & Yoshikawa, H. (2010, March). Is timing everything? How early childhood education program impacts vary by starting age, program duration and time since the end of the program. Paper presented at the Biennial Meeting for the Society for
- 46 Larsen, J. M., & Robinson, C. C. (1989). Later effects of preschool on low-risk children. *Early Childhood Research Quarterly*, 4, 133-144.

- 47 In Tulsa, Oklahoma, across multiple cohorts of students, researchers found substantial benefits from prekindergarten participation for children from poor (free lunch; up to 130% of the federal poverty line), near-poor (reduced-price lunch; 130%-185% of the poverty line), and middle-class (full-price lunch; >185% of the poverty line) families. The studies on these cohorts used a rigorous regression-discontinuity design, taking advantage of a long-standing age-cutoff requirement to enter the program in a particular year. In 2003 and 2006, positive effects on children's language, literacy, and mathematics skills were higher for free-lunch students than for ineligible students but statistically and substantively significant for both. In 2006, children from poor families entering kindergarten were 11 months ahead, children from near-poor families entering kindergarten were 10 months ahead, and children from middle-class families entering kindergarten were 7 months ahead of the control group (test scores for the treatment group and the control group were converted into age-equivalent test scores, using national norms from the Woodcock-Johnson Test). Gormley, W., Gayer, T., & Phillips, D.A. (2008). Preschool programs can boost school readiness. *Science*, 320, 1723-24; Gormley, W., Gayer, T., Phillips, D.A., & Dawson, B. (2005). The effects of universal Pre-K on cognitive development. *Developmental Psychology*, 41, 872-884. In Boston, Massachusetts, researchers also used a regression discontinuity design and found that both children eligible for free / reduced-price lunch and more middle-class children improved their language, literacy, and mathematics outcomes, emotional development, and some executive functioning outcomes as a result of Pre-K. Impacts were statistically significantly larger on some assessments for children from low-income families. Weiland, C., & Yoshikawa, H. (2013). Impacts of a prekindergarten program on children's mathematics, language, literacy, executive function, and emotional skills. *Child Development*.
- 48 These were statistically significant differences in impacts across these groups. U.S. Department of Health and Human Services. (2010). *Head Start Impact Study: Final report*. Washington, DC: Administration for Children and Families, Office of Planning, Research and Evaluation.
- 49 Gormley, W., Gayer, T., Phillips, D.A., & Dawson, B. (2005). The effects of universal Pre-K on cognitive development. *Developmental Psychology*, 41, 872-884, p. 880.
- 50 Weiland, C., & Yoshikawa, H. (2013). Impacts of a prekindergarten program on children's mathematics, language, literacy, executive function, and emotional skills. *Child Development*, p. 11.
- 51 The term dual language learners (DLLs) is used to refer to children learning more than one language in the home and ECE settings during the early childhood years (ages 0-5); other terms, such as English (LEP), English Learners (ELs), Non-English speaking (NES), English as a second language (ESL), and Bilinguals are used to refer to children in grades K-12 who are learning English in addition to a home language.
- 52 Magnuson, K., Lahaie, C., & Waldfogel, J. (2006). Preschool and school readiness of children of immigrants. *Social Science Quarterly*, 87, 1241-1262.
- 53 Tests were conducted in English; Gormley, W.T. The effects of Oklahoma's Pre-K program on Hispanic children. *Social Science Quarterly*, 89, 916-936, p. 928.
- 54 Barnett, W. S., Yaroz, D.J., Thomas, J., Jung, K., & Blanco, D. (2007). Two-way immersion in preschool education: An experimental comparison. *Early Childhood Research Quarterly*, 22, 277-293; Durán, L.K., Roseth, C.J., & Hoffman, P. (2010). An experimental study comparing English-only and transitional bilingual education on Spanish-speaking preschoolers' early literacy development. *Early Childhood Research Quarterly*, 25, 207-217; Winsler, A., Díaz, R.M., Espinosa, L., & Rodríguez, J.L. (1999) When learning a second language does not mean losing the first: Bilingual language development in low-income, Spanish-speaking children attending bilingual preschool. *Child Development*, 70, 349-362.
- 55 Goldenberg, C. (2012). Research on English Learner instruction. In M. Calderón (Ed.), *Breaking through: Effective instruction & assessment for reaching English Learners* (pp. 39-61). Bloomington, IN: Solution Tree Press; Slavin, R., Madden, N., Calderón, M., Chamberlain, A., & Hennessy, M. (2011). Reading and language outcomes of a multiyear randomized evaluation of transitional bilingual education. *Educational Evaluation and Policy Analysis*, 33, 47-58.
- 56 Bialystok, E. (2001). *Bilingualism in development: Language, literacy, & cognition*. New York: Cambridge University Press; Saiz, A., & Zoido, E. (2005). Listening to what the world says: Bilingualism and earnings in the United States. *Review of Economics and Statistics*, 87, 523-538.
- 57 Phillips, D., & Meloy, E. (2012). High-quality school-based Pre-K can boost early learning for children with special needs. *Exceptional Children*, 78, 471-90; U.S. Department of Health and Human Services. (2010). *Head Start Impact Study: Final report, executive summary*. Washington, DC: Administration for Children and Families, Office of Planning, Research and Evaluation, p.xxiv.
- 58 Gramlich, E. (1998). *A guide to benefit-cost analysis, 2nd edition*. Prospect Heights, IL: Waveland Press.; Weimer, D., & Vining, A. (2011). *Policy analysis: Concepts and practice, 5th edition*. Boston: Longman.
- 59 Heckman, J. J., Moon, S. H., Pinto, R., Savelyev, P. A., & Yavitz, A. (2010). The rate of return to the HighScope Perry Preschool Program. *Journal of Public Economics*, 94, 114-128
- 60 Reynolds, A.J., Temple, J.A., Robertson, D.L., & Mann, E.A. (2002). Age 21 cost-benefit analysis of the Title I Chicago Child-Parent Centers. *Educational Evaluation and Policy Analysis*, 24, 267-303; Reynolds, A. J. Temple, J. A., White, B., Ou, S., & Robertson, D. L. (2011). Age-26 cost benefit analysis of the Child-Parent Center Early Education Program. *Child Development*, 82, 379-404.
- 61 Barnett, W.S., & Massie, L. (2007). Comparative benefit-cost analysis of the Abecedarian program and its policy implications. *Economics of Education Review*, 26, 113-25.
- 62 Bartik, T., Gormley, W.T., & Adelstein, S. (2012). Earnings benefits of Tulsa's Pre-K program for different income groups. *Economics of Education Review*, 31, 1143-61; Karoly, L., & Bigelow, J. (2005). *The economics of investing in universal preschool education in California*. Santa Monica, CA: RAND Corporation; Southern Education Foundation. (2011). *The promise of Georgia Pre-K*. Atlanta, GA: Author.
- 63 Bartik, T., Gormley, W.T., & Adelstein, S. (2012). Earnings benefits of Tulsa's Pre-K program for different income groups. *Economics of Education Review*, 31, 1143-61; Borman, G. D., Hewes, G. M., Overman, L. T., & Brown, S. (2003). Comprehensive school reform and achievement: A meta-analysis. *Review of educational research*, 73, 125-230; Heckman, J. J., Moon, S. H., Pinto, R., Savelyev, P. A., & Yavitz, A. (2010). The rate of return to the HighScope Perry Preschool program. *Journal of Public Economics*, 94, 114-128; Karoly, L. A., Kilburn, M. R., & Cannon, J. S. (2005). Early childhood interventions: Proven results, future promise. Santa Monica, CA: RAND Corporation; Krueger, A. B. (1999). Experimental estimates of education production functions. *The Quarterly Journal of Economics*, 114, 497-532
- 64 See Weiland & Yoshikawa (2013) for discussion of some of the threats to validity in RDD designs, and approaches to addressing them.
- 65 For a recent review of such methods, see Murnane, R. J., & Willett, J. B. (2010). *Methods matter: Improving causal inference in educational and social science research*. New York: Oxford University Press.
- 66 Ananat, E. O., Gassman-Pines, A., Francis, D. V., & Gibson-Davis, C. M. (2011). *Children left behind: The effects of statewide job loss on student achievement* (NBER Working Paper No.17104). Cambridge, MA: National Bureau of Economic Research.

