Puzzling It Out: The Current State of Scientific Knowledge on Pre-Kindergarten Effects

A Consensus Statement

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Introduction and Background

Ensuring that young children benefit from their early learning experiences is essential to building a strong and productive society. Scientific research has established that if all children are to achieve their developmental potential, it is important to lay the foundation during the earliest years for lifelong health, learning, and positive behavior. A central question is how well our public pre-kindergarten (pre-k) programs are doing to build this foundation. This consensus statement draws lessons about the ability of these programs to boost children's development from the most current scientific evaluations of scaled-up public pre-k programs funded by states and school districts.

Forty-two states and the District of Columbia, through 57 pre-k programs, have introduced substantial innovations in their early education systems by developing the infrastructure, program sites, and workforce required to accommodate pre-k education. These programs now serve nearly 30 percent of the nation's 4-year-olds and 5 percent of 3-year-olds. The populations they serve are diverse, with 22 percent of enrolled children identified as having special needs and 12 percent identified as dual language learners (DLLs). The promise of these innovations lies in the expectation that pre-k—as a first step into k-12 education—will boost children's school readiness, start children on trajectories of academic and life success, and produce a return on investment over time. Although state pre-k systems vary widely both within and across states, they share these aspirational goals.

In recent years, there has been increasing interest in assessing how well these short- and longer-term goals have been achieved. To what extent are pre-k programs not only providing a boost into kindergarten, but also serving as an enduring base for future learning? What should we expect pre-k to produce for our society? How can we ensure that children who attend these programs get as much out of them as they can? Today, these questions are the focus of attention among policymakers, practitioners, and scientists alike seeking to shape the future of pre-k education. Policymakers and practitioners are increasingly turning to scientists as partners in efforts to expand and improve their pre-k systems. Together we are striving to understand the role that pre-k can play in the larger educational enterprise and how to identify and replicate the most important features of successful pre-k programs in order to optimize this potential.

To be helpful, however, scientists need to resolve three unanswered questions arising from earlier studies. The first is the so-called "black box" question. Evaluations of small-scale early education demonstration programs that were designed and run by researchers during the 1960s and 1970s, such as the Abecedarian, Perry, and Early Training Project programs, documented impressive improvements in learning while children were in these programs.[2] Program attendees also showed later improvements in young adult outcomes like school completion and college attendance. As adults, they had higher earnings, less criminal activity, and better health. The benefits of these programs far exceeded their costs. This evidence continues to be cited as proof of concept that early education programs can produce both short- and long-term benefits. Despite our certainty that these early education programs caused these outcomes, we do not know what it was precisely about these programs that produced positive outcomes nearly 20 years later. What was it about the experiences provided by these programs that, apparently, put children on such a positive developmental trajectory? This is the "black box" question that scientists are now actively

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exploring. The answer is crucial to ensuring that pre-k programs are designed to optimize success.

We also need to address a second and related question about scaling-up from small scale to community-wide pre-k programs. The impressive results from small scale programs of the past have led many to ask what they can teach us about how to implement successful early education programs at a school district or state-wide scale in today's real world contexts. Transforming a small, well-funded and closely monitored program to a large-scale program offered to thousands of children is not easy. The challenges of scale-up are illustrated by the national Head Start program, for which consistently strong and enduring impacts have been elusive. Studies examining adolescent and adult outcomes for graduates of Head Start programs during the 1970s and 1980s found positive impacts into early adulthood, even in cases where test score gains were not evident in middle or high school.[3] But the results of a large-scale, randomized trial of Head Start launched in 2002 were much less encouraging. Despite a boost for children's academic skills at the end of their Head Start year, the Head Start Impact Study (HSIS) found that these initial gains rapidly dissipated once children began formal schooling.[4] More in-depth analyses of the HSIS are revealing wide variation in the extent of program exposure, program features, participant characteristics, and competing local alternatives from one center to another that combine to produce considerable variation in short-term Head Start impacts across children and sites.[5] Similar work on variation in longer-term impacts is in progress. But it is clear that scale-up brings with it wide variation in programs and that this variation must be considered in efforts to understand the conditions under which program impacts are the most positive.

The third question is how much we can draw on lessons from this existing evidence base on an earlier generation of programs to guide the development of today's pre-k programs. State and district pre-k programs differ from the early demonstration childhood programs and from Head Start in both design and scope. Most of the early education programs studied in the past consisted of localized prototypes staffed by university-trained teachers and closely monitored by the program designers. Head Start, while national in scale, offers more comprehensive services than most state pre-k programs and operates under a uniform set of performance standards, which is decidedly not the case with pre-k programs. Other differences concern the participating children. The demonstration programs served narrowly targeted communities of highly disadvantaged young children, and Head Start is restricted primarily to children living below the poverty line. Pre-k programs sometimes serve only disadvantaged young children but sometimes are universally available. Today's low-income parents typically have had several more years of education and smaller families. They have also had greater access than in the past to publicly-funded early care and education programs other than pre-k, such as subsidized child care and Head Start programs that do not receive pre-k funds. As a result of these differences in design, scope, characteristics of participants, and access to alternative early education programs, the bar that pre-k must exceed in order to be judged effective has been rising over time. Finally, because most state and district pre-k programs are too new for their graduates to have reached adolescence, let alone adulthood, they are currently unable to provide evidence of the long-term outcomes generated by the earlier programs.

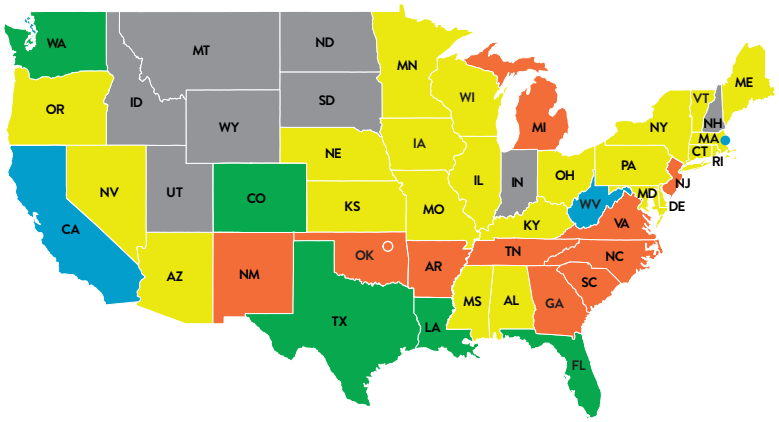
Understanding the impact of pre-k programs is thus an extremely complicated endeavor. Today, there are multiple puzzle pieces consisting of different pre-k delivery settings (schools, Head Start centers, child care centers) in different states with widely varying program features, teacher requirements, and performance standards, all of which need to be taken into account. Most programs are targeted toward disadvantaged children (with varying income cut-offs), but some are universally available; some serve much higher numbers of dual language learners and children with special needs. Funding levels also vary widely across states and districts.[6] Children enter pre-k with divergent prior early care and education—and home—experiences, and they move from pre-k into a vast range of elementary schools across the nation. If we ignore this variability in what happens before, during, and after the pre-k year, we run the risk of missing information that can help us understand how to design and re-engineer pre-k in specific locales to get the best results. In order to direct our energies and resources to the most promising directions for pre-k, we need to use a full dashboard of research tools. This approach will provide us

with the diversity of designs and assessments we need to accomplish three discrete if related tasks: to look inside the black box of pre-k for insights about effective classroom practices, to understand the challenges of scaling up early education programs, and to take account of the real-world complexity in which pre-k programs seek to foster children's growth and learning.

This statement provides a summary of what is currently known about how state and district pre-k programs affect children's learning immediately after program completion and into the elementary grades. We begin by reviewing the scientific evidence about early child development in the years before children experience pre-k, the varied experiences across pre-k classrooms, and what happens after pre-k when children enter elementary school. Only by placing the pre-k year in the developmental context of what comes before and after can we understand what to expect from pre-k programs and why. Next, we review the evaluation studies of the immediate and longer-run effects of pre-k by summarizing findings and explaining their implications for policy and practice. Because most of the graduates of today's pre-k programs are still young and program evaluations are continuing, these findings, like pre-k itself, are a work in progress.

The authors of this report are among the social scientists who have engaged with local and state policymakers and practitioners to conduct research about state and district pre-k programs. These research efforts have been designed to learn more about how to optimize pre-k programs so as to do as much good as possible and so that children have a better chance of succeeding in school and beyond. We have struggled with the many challenges that are inherent to assessing the impacts of pre-k education. Given the ongoing nature of work in this area and the need to accommodate local conditions, we are keenly aware that the research methods that have been deployed to understand pre-k impacts are not yet as strong as we would like and that our conclusions have yet to stand the test of time. This summary of what we have discovered across a wide variety of states and districts is motivated by a shared goal: to foster continued and collaborative policy, practice, and scientific innovation that can accelerate discovery of the most effective strategies for fulfilling the promise of pre-k education for children, families, and the nation. For a national map of pre-k evaluation studies, see below; for an overview of the pre-k studies we have reviewed, see Bibliography at the end of the book.

National Landscape of Pre–Kindergarten Evaluation Studies



Source for information about percentage of four-year-olds served by state pre-k programs: Steven W. Barnett, Alison H. Friedman-Krauss, Rebecca Gomez, Michelle Horowitz, G.G. Weisenfeld, Kristy Clarke Brown, and James H. Squires, *The State of Preschool 2015: State Preschool Yearbook* (New Brunswick, NJ: National Institute for Early Education Research, 2016).

State Pre-K Programs That Have Been Studied
(Includes Boston, Massachusetts, and Tulsa, Oklahoma, district-level programs.)

- Both short term and long term study
- Long term study only
- Short term study only
- No studies of existing programs
- No state pre-k program

Percentage of Four-Year-Olds Served by State Pre-K Programs in 2015

Less than 5%: Minnesota, Mississippi, Missouri, Nevada, Ohio, and Rhode Island

Between 5% and 25%: Alabama, Arizona, California, Colorado, Connecticut, Delaware, Kansas, Massachusetts, North Carolina, Oregon, Pennsylvania, Tennessee, Virginia, and Washington

Between 25% and 50%: Arkansas, Illinois, Kentucky, Louisiana, Maine, Maryland, Michigan, Nebraska, New Jersey, New Mexico, New York, South Carolina, and Texas

Greater than or equal to 50%: Georgia, Florida, Iowa, Oklahoma, Vermont, West Virginia and Wisconsin

Optimizing Pre-Kindergarten Education

Pre-k does not happen in a vacuum. It builds on the base provided by children's prior levels of development and experiences, which vary widely within and across homes and classrooms. Moreover, as we've noted, pre-k experiences themselves are heterogeneous and are layered on to the broader circumstances of children's lives while they are in pre-k. Following pre-k, children are exposed to widely divergent k-12 experiences that can either support or undermine the gains made in pre-k. Understanding children's experiences before, during, and after pre-k can help policymakers better weigh the evidence from evaluation studies of pre-k impacts and consider the most promising next steps for optimizing pre-k education. The following three sections address the three phases, each of which affects pre-k impacts: what happens before pre-k (the developmental base), what happens during (the experience), and what happens after (subsequent experiences). Each section presents the authors' consensus statement, followed by the key scientific findings on which the statement is based. See the box on page 29 for the complete list of consensus statements.

Impacts of Experiences Prior to Pre-Kindergarten

Studies of different groups of preschoolers often find greater improvement in learning at the end of the pre-k year for economically disadvantaged children and dual language learners than for more advantaged and English-proficient children.

Children enter pre-k classrooms with widely varying prior experiences. The science is clear: early experiences in the home, in other care settings, and in communities are built into the developing brain and body with life-long effects on learning, adaptive behavior, and health. These experiences provide either a sturdy or fragile foundation upon which young children's pre-k teachers construct the next stage on their educational progressions. Supportive early-life conditions foster curiosity, trust, learning, self-regulation, and steady growth. Adverse early life conditions such as extreme poverty, exposure to violence, and parental disengagement disrupt developing brain networks and can undermine a young child's capacity to learn and to develop healthy relationships.[7]

At their most effective, pre-k programs can provide young children with the kinds of enriching and supportive early environments that protect and nurture the developing brain and thus foster all facets of healthy development. These experiences may matter more for children whose early experiences confront them with high or sustained levels of adversity or who lack the rich verbal and other cognitive inputs that predict young children's readiness for school. Researchers who study pre-k education often find that children who have had early experiences of economic scarcity and insecurity gain more from these programs than their more advantaged peers.[8]

Why might this be the case? The brain's basic architecture and circuitry develop rapidly during the early childhood years. Experiences in pre-k aimed at addressing the consequences of adversity and providing environments rich in language and cognitive stimulation thus have the potential to strengthen critical neural networks associated with learning. For children who have not had the benefit of these experiences in other home or child care settings, pre-k has the potential to boost early skill and behavioral development, which is manifested as relatively strong early learning gains from pre-k education. In effect, these children's development is powered up when they are afforded specific and supportive opportunities to acquire or strengthen the skills, knowledge, and attitudes that predict strong performance in school.

Dual language learners have also been found to show relatively large benefits from pre-k education.[9] Relative to their monolingual peers, DLLs tend to have stronger self-regulation skills, likely due to both cultural factors and the brain benefits of learning two languages. However, they tend to lag behind their peers in academic skill levels, thus bringing a unique mix of strengths and challenges to pre-k classrooms.[10] Research to date finds that pre-k enrollment can enable these children to make progress in English language proficiency and in their academic skills, each of which likely supports growth in the other. As a result, DLLs can experience especially rapid growth in early learning when exposed to supportive and rich learning opportunities in pre-k.

Does this mean that pre-k programs should only be offered to subgroups of children whose prior experiences suggest

that they will profit the most? Not necessarily. The early demonstration programs, with their strong evidence of effectiveness, were highly targeted. Yet, part of what might render a pre-k classroom advantageous for an economically disadvantaged child or a DLL, as well as for their more advantaged and English speaking peers, is the value of being immersed among a diverse array of classmates with whom to learn, for example, language skills and socially inclusive attitudes.

Impacts of Experiences During Pre-Kindergarten

Pre-k programs are not all equally effective. Several effectiveness factors may be at work in the most successful programs. One such factor supporting early learning is a well implemented, evidence-based curriculum. Coaching for teachers, as well as efforts to promote orderly but active classrooms, may also be helpful.

The fundamental purpose of all education systems, including pre-k, is to build a productive and prosperous society by ensuring that all children acquire the building block skills, attitudes, and knowledge that will set them on a path towards success in school and in subsequent endeavors as workers, parents, and citizens. A primary rationale for pre-k education is to ensure that all children get off to a good start on this path.

Evidence from the developmental and education sciences supports this rationale. Children who have a solid grounding in early developing skills are in a better position to gain from instruction that is focused on more advanced skills. Learning letter words and sounds supports the development of vocabulary and the capacity to share well-formed narratives, while learning to count supports children's understanding of mathematical concepts such as cardinality, relative size, and problem-solving (calculating, measuring) skills. Learning to share and take turns prepares a child for collaborative projects. Strong conceptual skills—a rich vocabulary, a range of problem-solving strategies, a base of scientific and cultural knowledge, strong narrative skills—in turn make for more productive and efficient subsequent learning. Engaged young learners also display positive attitudes about school and about themselves as students, as well as foundational capacities to focus attention, remember and follow directions, avoid distractions, and get along with others. These attitudes and capacities scaffold learning and learning supports these attitudes and capacities. Learning, like development, is cumulative, continuous, and self-reinforcing.[11]

Yet, we know that not all pre-k programs successfully support early learning. It is decidedly not the case that just any pre-k program operating under just any circumstances will provide young children with the inputs they need to produce, let along sustain, early developmental gains. So, what components of a pre-k program are especially important to accomplishing these goals? What might be the factors that make one pre-k program more effective than another?

Developmental science tells us that a key ingredient is the instructional, social, and emotional "serve-and-return" interactions that occur daily between teachers and children, as well as among classmates. The odds for better outcomes are improved when these back and forth interactions are consistent and responsive. This brain building interplay motivates and deepens learning, enables children to organize and focus their attention and other capacities needed to learn, and promotes peer cooperation and support.

What, then, enables these kinds of interactions? Scientists are working to identify the circumstances that most effectively support educationally rich interactions and that can be affected by policy measures such as guidelines, standards, and regulations that aim to improve the effectiveness of pre-k teachers and the early education they provide. We have identified several factors that together seem to be "good bets" for supporting strong early learning in pre-k and other settings: the use of (1) curricula that are known to build foundational skills and knowledge, coupled with (2) professional development and coaching that enable teachers (3) to create organized and engaging classrooms.

Effective curricula provide engaging activities focused on skills and concepts that are ripe for learning by young children and that provide an essential foundation for more demanding, conceptually rich learning opportunities to follow. There is growing evidence that stronger achievement outcomes occur when teachers rely on curricula that focus on a given skill area such as language/literacy, math and self-regulation as distinct

from curricula that attempt to address and incorporate all domains of development simultaneously, sometimes referred to as "global" curricula. These outcomes are seen in the skill area of focus (e.g., math), and often in other areas as well (e.g., literacy). Because young children enter a classroom with differing starting points and rates of learning, effective curricula include carefully sequenced lessons that support, build on, and can be adapted to each stage in a child's learning progression.[12] Additionally, early learning is supported when children experience instruction that scaffolds the deeper, underlying processes that support learning at this age, such as reasoning and explaining, persisting when challenges are met, and transferring skills from one task to the next.[13]

The second effectiveness factor that we consider to be a good bet is professional development and coaching. Curricula are only as effective as their implementation. A teacher's effective use of curricula, including knowing how to tailor and differentiate instruction for individual children, requires training, guidance in classroom practice, and continuing education—just as pilots, physicians, and engineers need ongoing training and practice to adjust and refine their skills to meet changing conditions. Integrated, on-going professional development and coaching are equally important to the effective implementation of curricula.[14]

The third good-bet factor with strong potential to support early learning is an organized, positive, and engaging classroom. Time spent in transitioning between activities—which can consume large portions of the day in poorly organized classrooms—is time lost to learning and playing. Predictable routines enable young children to become increasingly independent as they initiate their own learning. Children who experience primarily positive, supportive interactions with their teachers are more comfortable exploring, making mistakes, and thus seeking out and persisting with challenging tasks.[15]

Current research indicates that this triad of evidence-based curricula, integrated training and coaching, and a positive, organized classroom offers a promising approach to achieving strong pre-k outcomes for all young children.

Impacts of Experiences After Pre-Kindergarten

Children's early learning trajectories depend on the quality of their learning experiences not only before and during their pre-k year, but also following the pre-k year. Classroom experiences early in elementary school can serve as charging stations for sustaining and amplifying pre-k learning gains. One good bet for powering up later learning is elementary school classrooms that provide individualization and differentiation in instructional content and strategies.

Increasing attention is being drawn to the contribution of children's post pre-k educational environments as they affect longer-term pre-k impacts.[16] It is logical, if we want the effects of pre-k to last, that we broaden our lens to examine what happens to pre-k graduates when they move on to elementary school. Few would doubt that the contribution of, say, 2nd grade to a child's middle-school achievement is affected by what happened before in 1st grade and later in 3rd, 4th, and 5th grades. Similarly, the long-term impacts of the pre-k year cannot be viewed in isolation from subsequent years of schooling. Under the best of circumstances, pre-k education has enabled children to master many of the routines (e.g. following directions, cooperating with other children) and pre-academic skills that will enable them to take advantage of both higher behavioral expectations and more advanced material in kindergarten. This assumes, of course, that they will be held to higher expectations and presented with more advanced material as they move into elementary school. The initial boost will have to be recharged.

So the key questions become: How can we ensure that we have an effective pre-k through elementary system? How can we remodel our education system to weave what we know about early skills development and appropriate early education practices into the fabric of subsequent stages of education? What supports do teachers who bridge early and elementary education need to ensure that young learners are able to build on their early gains?

In answering these questions, we need to be mindful of what scientists have learned about skill development and the importance of sustaining environments.[17] There is no point at which development proceeds on automatic pilot. Continued

learning—maintaining initial skill advantages and gaining new skills—requires next-stage environments that build effectively on the base created by earlier environments. Pre-k provides the foundation on which the elementary grades build the next level of learning. Pre-k can thus be viewed as powering up early learning, for which the elementary grades need to provide essential charging stations that sustain and amplify the learning gains made by children in pre-k. Absent re-charging, progress will likely be stalled, and the benefits from any boost provided by pre-k education may be lost.

Integrating pre-k programs into the broader education system to sustain and expand pre-k gains as young children enter elementary school is among the most important tasks now facing practitioners and policymakers alike. A central challenge is to ensure that each child is carried forward in her learning from one grade to the next, starting with the transition from pre-k to kindergarten. Children not only need opportunities to demonstrate their mastery of skills, but also to be appropriately challenged. Absent explicit attention to ongoing learning for each child, children can spend precious classroom time exposed to material that they have already mastered or that is over their heads.[18] Too much redundancy or lessons that are too advanced run the risk of inadvertently creating learning dead zones that interrupt educational progress and may squander pre-k gains.

In sum, the odds of beneficial pre-k impacts are greatest when children's experiences prior to, during, and after pre-k are collectively considered as part of the equation for success. This entails understanding the circumstances of the young children who are entering pre-k classrooms, closely observing what happens inside the pre-k classroom to optimize children's experiences during their time in pre-k, and considering how the education systems in which pre-k is embedded can be remodeled to better support pre-k optimization. We now turn to the evidence on pre-k's role in providing both a boost into kindergarten and a base for supporting children's educational progress in the longer-term.

Evidence for Immediate and Longer-Run Pre-Kindergarten Impacts

A number of evaluations of the impact of state and district pre-k programs have been conducted in recent years. Their findings are often, but not universally, positive. However, we urge caution in interpreting their results. State and district pre-k programs vary widely in their characteristics, and we would therefore expect them to produce varied effects. Further, as described above, pre-k effects are influenced by the experiences the participating children have prior to pre-k and, for longer-term effects, by the experiences they have afterwards. With such diversity in programs and experiences, it is not meaningful to talk about state-sponsored pre-k as if it were a single intervention for which we would expect research to reach a general conclusion about whether it "works." What communities, localities, and states need to know is how well their programs are doing to boost children's school readiness and later success. And more general knowledge is needed about the program characteristics that are most essential for producing short- and long-run learning and the circumstances that adequately support the operation of such programs at scale.

Answering these questions will require a large body of differentiated evaluation research that is not yet available. While notable progress has been made, it is important to recognize that much work still needs to be done. Research on the effects of pre-k programs has mainly focused on academic outcomes, notably cognitive skills, achievement, and grade level promotion and retention. Less is known about effects on social-emotional outcomes that might be important for later academic and life success. Further, more studies have investigated the effects of pre-k at the end of the pre-k year or the beginning of kindergarten than have addressed longer-term effects.

Also clouding the picture is the methodological variation represented in the extant research. Studies have employed different methods, some stronger and some weaker, as ways to assess pre-k effects. This is not because researchers do not know the difference. Rather, it is because implementation of pre-k programs at scale makes research difficult to do, and the available resources and presenting circumstances often require compromises. Gauging the effects of pre-k requires that outcomes for children who attended pre-k be compared with similar children who did not attend the program. The strongest research designs make apples-to-apples comparisons that ensure that any differences on the outcomes

are because of pre-k participation, not because the participants and nonparticipants were different even before the pre-k year began.

Because of the diversity of pre-k programs, settings, and participants, as well as different strengths and weaknesses of the research methods for evaluating program impacts, it can be misleading to highlight the findings of a few studies and use them to draw general conclusions about the effectiveness of state and district pre-k programs. In the sections that follow, we provide an overview of the evidence found in the full body of research on the impacts of these programs. The studies on which this overview is based include all those we have been able to identify that report any estimate of short- or long-term impacts of such programs (See Bibliography at the end of the book for the studies.)

Evidence for Impacts Shortly After Pre-K Participation

Convincing evidence shows that children attending a diverse array of state and school district pre-k programs are more ready for school at the end of their pre-k year than children who do not attend pre-k. Improvements in academic areas such as literacy and numeracy are most common; the smaller number of studies of social-emotional and self-regulatory development generally show more modest improvements in those areas.

The most frequently cited goal of state pre-k programs is enhancing "school readiness"—a concept that usually includes some mix of language, literacy, and numeracy skills; willingness to follow expected school behavior; and social-emotional capacities that enable children to take full advantage of the learning opportunities presented when they enter kindergarten. A school readiness goal does not necessarily imply that sustained effects beyond kindergarten entry are expected, though it is generally assumed that being school ready will facilitate academic progress in later grades. Research on the immediate effects of pre-k, namely outcomes at the end of the pre-k year or the beginning of the kindergarten year, has focused mainly on literacy, language, and math skills. A few studies have also examined social-emotional outcomes or classroom behavior. These studies apply a range of research methods, most of which are generally viewed as capable of producing valid estimates of effects. Despite the diversity of programs and the variety of methods, there is striking uniformity in the results. On the many academic skill outcomes measured across these studies, positive effects have been found in almost every instance. Moreover, the number of studies that have been conducted and the variety of state programs represented testify to the robustness of these findings. The effects on social-emotional skills reported in the few studies that addressed them were generally positive, but this evidence is not as robust or convincing as that for academic outcomes.

Evidence for Impacts in the Years After Pre-K Participation

Convincing evidence on the longer-term impacts of scaled-up pre-k programs on academic outcomes and school progress is sparse, precluding broad conclusions. The evidence that does exist often shows that pre-k-induced improvements in learning are detectable during elementary school, but studies also reveal null or negative longer-term impacts for some programs.

The convincing evidence showing immediate effects of so many state pre-k programs opens the door to the possibility that this early boost will lead to later benefits for the academic achievement of pre-k participants as they progress through the school years. The evidence on long-term effects of state and district pre-k programs, however, is mixed and relies on methods that vary from strong to problematic.

More than half of the studies of long-term effects have used retrospective designs to compare outcomes for children who had participated in pre-k with those for children who had not participated. Those studies have reported largely positive findings, but they fall on the weaker end of the methodological continuum. This is because they have no information about the characteristics of the children and families prior to pre-k that would help ensure that the groups were comparable, that is, that apples-to-apples comparisons were being made. As a consequence, these studies are less reliable and do not support confident conclusions about long-term impacts.

Studies that used research designs generally recognized as capable of generating valid effect estimates by conventional

methodological standards have reported more variable findings. For this group of studies, on which we based our consensus conclusion described above, positive effects favoring children who participated in the respective state pre-k programs are often reported, but so are null and even negative effects. Because most of the stronger studies focus on only one state or district pre-k program, this array of findings may stem from the specific research design used in a given locale or from differences across locales in the pre-k programs themselves, the characteristics of the children who participated, or the school experiences that followed after the pre-k year.

On balance, the available evidence about the long-term effects of state pre-k programs offers some promising potential but is not yet sufficient to support confident overall and general conclusions about long-term effects. The complexity of the pre-k puzzle requires scientists, policymakers, and practitioners to be forward looking in their attempts to build on current research and to scale up effective state pre-k programs. There is persuasive evidence from earlier small-scale programs like the Perry Preschool and Abecedarian programs that long-term impacts are possible under some circumstances. But the evidence that contemporary scaled-up state or district pre-k programs can produce such impacts is not conclusive. The path ahead must combine well-documented program innovations at the state and district level with evaluation research of broader scope and greater rigor. Exploration of the potential of pre-k at statewide scale to yield sustained benefits for participating children, while still in its infancy, is filled with promise that ways can be found to attain those benefits.

Future Innovation and Evaluation

States have displayed considerable ingenuity in designing and implementing their pre-k programs. Ongoing innovation and evaluation are needed during and after pre-k to ensure continued improvement in creating and sustaining children's learning gains. Research-practice partnerships are a promising way of achieving this goal. These kinds of efforts are needed to generate more complete and reliable evidence on effectiveness factors in pre-k and elementary school that generate long-run impacts.

No one thinks we have yet devised the most effective possible pre-k program. Despite evidence that pre-k can provide an effective foundation for moving children along a successful path into school and some promising, though mixed, evidence of enduring impacts, we lack the kind of specific, reliable, consistent evidence we need to move from early models to refinements and redesigns. We need to draw on the full range of evaluation methods to measure the impacts of these innovative practices and programs to develop even more effective programs. The complexity of the pre-k puzzle also requires scientists and policymakers to take care in matching evidence to real world conditions. An important part of solving the puzzle of pre-k effectiveness will be evidence on how to scale-up successful small-scale programs so that impacts, especially long-term impacts, are maintained as the program expands.

There is reason for optimism in this regard. Basing policy on evidence is becoming the coin of the realm in policymaking at both the federal and state levels. Especially at the federal level, policymakers write legislative language requiring program evaluation, sometimes even specifying the outcome measures that should be studied and stipulating that the evaluation methods should be "rigorous." It is our hope that this report contributes to the definition of rigor, directing attention to important arenas of study and enhancing the comparability of data across states so that future pre-k programs can more fully benefit from new evidence.

Our report is notable for its frank assessment of evidence and our group's struggle to develop a consensus based on studies that often produce conflicting results. We believe that conflicting evidence is what drives science forward and fuels rather than retards innovation. Conflicting evidence on enduring pre-k effects is forcing us to think harder and more clearly about what is reasonable to expect of pre-k, to deploy the best scientific tools we have at our disposal to resolve the conflicting findings, and to adapt our theories to promote understanding of practices and strategies that increase the odds of producing both short-term and long-term impacts. A host of research teams and the Institute of Education Sciences' Early Learning Network[19] are hard at work pursing these goals.

In addition to understanding the effectiveness factors that produce and sustain pre-k impacts, at least two issues

seem ripe for exploration. First, we urge evaluators and administrators to pay close attention to the instructional strategies pursued by the schools attended by children after they leave pre-k, as well as the broader characteristics of the schools and communities in which they are located. Children entering kindergarten can be arrayed along a continuum that represents their readiness to learn. Pre-k may have boosted the readiness skills of some of the children in a kindergarten class, but their classmates may begin school with fewer academic skills. We need to examine the strategies developed by local school systems to promote early-grade learning for children at all points along this continuum and to devise ways to test whether these strategies are successful. Concentrating all of a teacher's instructional efforts on children with the lowest academic skills can cause pre-k-powered gains to weaken. Fortunately, there is growing recognition among policymakers of the need to develop a coordinated early childhood-to-early elementary school approach that provides on-going charging stations for learning, thus enabling young children to retain, apply, and advance their new knowledge and skills. These efforts should be expanded.

Second, an important ingredient in the success of preschool and early elementary programs is the effectiveness of teachers in both pre-k and elementary classrooms. The field needs to know more about the characteristics of successful pre-k teachers: how they can best be recruited and trained, how they can continue to develop their skills and knowledge once they begin teaching, and how administrators can provide the kinds of support these teachers need to succeed and remain in the field.

Conclusion

Now common across the nation, pre-k programs provide a laboratory in which we can observe children learning and refine our practices and programs for future generations. We have a national platform on which to build next stage, increasingly effective, and longer lasting pre-k programs. The hard work of refining and improving these programs so that they can fully support the intellectual and social skills the nation will need in the future has just begun. Nonetheless, the scientific rationale, the uniformly positive evidence of impact on kindergarten readiness, and the nascent body of ongoing inquiry about long-term impacts lead us to conclude that continued implementation of scaled-up pre-k programs is in order as long as the implementation is accompanied by rigorous evaluation of impact. ■

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Consensus Statements

Studies of different groups of preschoolers often find greater improvement in learning at the end of the pre-k year for economically disadvantaged children and dual language learners than for more advantaged and English-proficient children.

Pre-k programs are not all equally effective. Several effectiveness factors may be at work in the most successful programs. One such factor supporting early learning is a well implemented, evidence-based curriculum. Coaching for teachers, as well as efforts to promote orderly but active classrooms, may also be helpful.

Children's early learning trajectories depend on the quality of their learning experiences not only before and during their pre-k year, but also following the pre-k year. Classroom experiences early in elementary school can serve as charging stations for sustaining and amplifying pre-k learning gains. One good bet for powering up later learning is elementary school classrooms that provide individualization and differentiation in instructional content and strategies.

Convincing evidence shows that children attending a diverse array of state and school district pre-k programs are more ready for school at the end of their pre-k year than children who do not attend pre-k. Improvements in academic areas such as literacy and numeracy are most common; the smaller number of studies of social-emotional and self-regulatory development generally show more modest improvements in those areas.

Convincing evidence on the longer-term impacts of scaled-up pre-k programs on academic outcomes and school progress is sparse, precluding broad conclusions. The evidence that does exist often shows that pre-k-induced improvements in learning are detectable during elementary school, but studies also reveal null or negative longer-term impacts for some programs.

States have displayed considerable ingenuity in designing and implementing their pre-k programs. Ongoing innovation and evaluation are needed during and after pre-k to ensure continued improvement in creating and sustaining children's learning gains. Research-practice partnerships are a promising way of achieving this goal. These kinds of efforts are needed to generate more complete and reliable evidence on effectiveness factors in pre-k and elementary school that generate long-run impacts.

[1] All authors participated in extended discussions of the evidence on pre-k impacts, the drafting of the consensus statements, and reviewing multiple drafts of the chapter. Authorship is in alphabetical order with the exception of the first four authors who were primarily responsible for the preparation of this chapter.

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