

LEARNING MORE BY MEASURING MORE

Building Better Evidence on Pre-K Programs by Assessing the Full Range of Children’s Skills

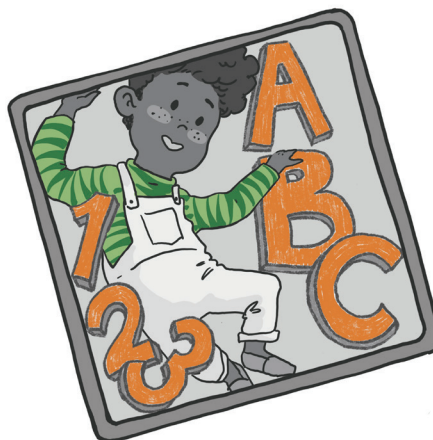
By Meghan McCormick and Shira Mattera

Decades of research on early care and education have shown that four-year-old children who enroll in prekindergarten (pre-K) programs start kindergarten scoring higher on assessments of academic skills than those who do not. A handful of long-term follow-up studies of pre-K have also found that these programs can have lasting beneficial impacts on critical outcomes into adulthood, such as educational attainment, employment, and income.¹

In the large majority of studies, however, pre-K researchers have only been able to follow students through elementary school.² This body of work has generally found that as early as kindergarten or first grade, children who did not attend pre-K perform similarly to children who did when it comes to academic skills such as letter knowledge and counting.³ This pattern—commonly described as the “fadeout” or “convergence” of pre-K effects—has led to debate about the value of large-scale investment in pre-K.⁴ This discussion has gained further traction following recent publication of a study finding that children randomly assigned to the Tennessee Universal Pre-K program performed slightly worse on tests of academic skills in sixth grade than their peers assigned to a wait-list control group.⁵ Although there are considerations about the study and program context that are important for interpreting results—such as what services the wait-listed children received in their pre-K year—the findings have raised questions for some about the value of investments in early learning programs.

Yet, when researchers are able to measure a broader range of children’s skills and competencies, there is growing evidence that the benefits of pre-K are more likely to be sustained as children move through elementary school. This brief looks at examples of additional, sometimes less frequently measured types of skills that pre-K programs may help boost in the short term and sustain over the longer term. It then presents evidence from existing studies of pre-K programs conducted by MDRC and other researchers that shows how measuring a broader set of outcomes is key to a more comprehensive understanding of the benefits of pre-K programming. The brief concludes with recommendations for ongoing investment in the creation and collection of measures that go beyond the ABCs and 123s, to better understand the lasting effects of early care and education and to strengthen future programming.

Measuring a Broader Set of Outcomes: Examples of Constrained and Unconstrained Skills



Pre-K education offers children the opportunity to learn some of their earliest academic skills, including letters, letter sounds, numbers, and shapes. Yet young children also develop a broader range of competencies during their pre-K experience that are perhaps less discussed and harder to measure. These include complex skills such as critical thinking and problem solving. Researchers have begun to think hard about the full set of skills that pre-K programs support, describing a set of competencies that range from more *constrained* skills to more *unconstrained* skills.⁶

“if a pre-K program helps children build a dynamic and growing vocabulary—a more unconstrained skill—that foundation can set the stage for lasting and continued vocabulary gains across the course of their lives.”

More *constrained skills*, such as basic letter recognition and rote counting, are directly teachable, acquired quickly with instruction, and finite, meaning they can be fully mastered within a period of time.⁷ More *unconstrained skills* are those that are acquired gradually and continue to develop throughout a person’s life; they can also be more challenging to measure.⁸ These skills include vocabulary, reading comprehension, and storytelling and oral discourse, among others. In contrast to constrained skills, unconstrained skills are often described as being limitless or not having a “ceiling.” For example, children are typically expected to learn the 26 letters of the alphabet by the end of kindergarten, and once they achieve that constrained skill, they cannot improve on their letter identification ability any further. In contrast, if a pre-K program helps children build a dynamic and growing vocabulary—a more unconstrained skill—that foundation can set the stage for lasting and continued vocabulary gains across the course of their lives.

Table 1 shows examples of different types of skills—split between the language/literacy and math domains—categorized as more constrained or more unconstrained.

Table 1. Examples of More Constrained and More Unconstrained Language/Literacy and Math Skills

SKILL DOMAIN	MORE CONSTRAINED	MORE UNCONSTRAINED
Language/literacy	<ul style="list-style-type: none"> • Letter identification • Phonics • Writing letters • Spelling • Knowing what sounds different letters make 	<ul style="list-style-type: none"> • Vocabulary • Reading comprehension • Oral narrative and self-expression • General knowledge about the world
Math	<ul style="list-style-type: none"> • Operations (for example, addition, subtraction, multiplication, and division) • Counting • Number recognition • Subitizing (the ability to quickly recognize a small number of items without having to count them) • Identification of shapes 	<ul style="list-style-type: none"> • Early algebraic thinking • Composing shapes • Relational thinking • Applying strategic thinking (such as using different types of counting strategies) to math problems

Learning More About Pre-K Programs by Capturing a Broader Set of Outcomes

Even when studying very different pre-K models and student populations, researchers have generally found positive associations between enrollment in a formal, classroom-based pre-K program and a wide range of constrained skills achieved by the end of the school year.⁹ But as explained above, when researchers collect information on students as they move from pre-K through the elementary school grades, a pattern often emerges in which children who did not attend pre-K quickly develop constrained skills and catch up to their peers.¹⁰ Differences that favor pre-K attendees are generally much smaller by the end of kindergarten or first grade, if detectable at all.¹¹ As a result, when looking at findings from pre-K evaluations that only measure children’s more constrained skills across time, it could be concluded that investments in early care and education do not have lasting impacts beyond kindergarten.

Yet a different conclusion about the benefits of pre-K might be drawn if those evaluations also measured a broader set of outcomes—including more unconstrained skills—over time. For example, the National Head Start Impact Study collected the same six language and literacy assessments and one math assessment in the spring of pre-K, kindergarten, and first grade for the four-year-old cohort of study participants.¹² Of those assessments, five measured more constrained skills while one measured receptive vocabulary, a more unconstrained skill that captures the ability to understand increasingly advanced sets of words. Results from that study found that the initial positive impacts of Head Start at the end of pre-K were no longer detectable in kindergarten for any of the constrained skills. However, the initial impact of Head Start on vocabulary was

sustained through the spring of first grade, indicating that there were some lasting benefits of Head Start, but only for the unconstrained skill that was measured. The small handful of studies evaluating the effects of pre-K programs through adulthood have identified a similar pattern: Although the initial impacts on early academic skills diminish quickly, there continue to be lasting benefits on a range of other outcomes that are much less frequently measured in studies of pre-K, such as educational attainment and employment.¹³

Measuring a Broader Set of Child Skills to Assess Lasting Effects More Comprehensively

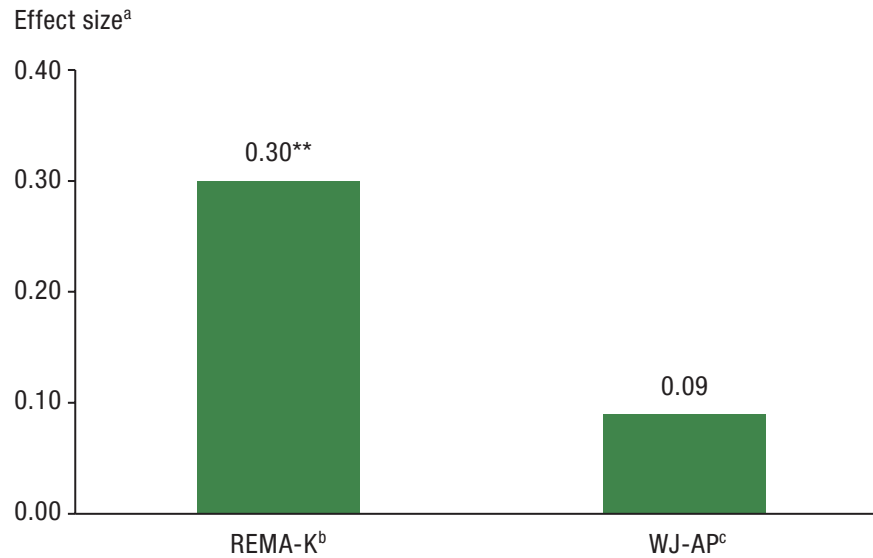
MDRC researchers have found similar results in their work. For example, MDRC conducted randomized controlled trials in two studies of early math enrichment in pre-K and kindergarten called Making Pre-K Count and High 5s.¹⁴ Making Pre-K Count provided children with an evidence-based pre-K math curriculum supported by teacher coaching and training. High 5s provided a supplemental year of math enrichment in kindergarten, including small-group math clubs before and after school or during lunch; the study of the two enhancements together estimated impacts on the language, literacy, math, and self-regulation skills of students from racially, ethnically, and socioeconomically marginalized backgrounds.

Providing both Making Pre-K Count and High 5s together had positive impacts through the end of kindergarten, as measured with an assessment called the Research-based Early Math Assessment–Kindergarten (REMA-K).¹⁵ This measure captured the full range of children’s more constrained *and* unconstrained math skills, including competencies like shape composition, patterning, and algebraic thinking.¹⁶ In contrast, effects on the Woodcock Johnson Applied Problems (WJ-AP) subtest—a more constrained measure of math that focuses heavily on more finite skills like counting, addition, and subtraction—were smaller in magnitude and not statistically significant at the end of kindergarten, indicating no detectable effect of math enrichment when assessing children’s skills using this measurement tool.

Figure 1 summarizes the nature of these impacts on both the REMA-K and the WJ-AP measures through the end of kindergarten. In this figure, impacts are represented using effect sizes, a standardized measure of an impact that can be used to make comparisons between measures with different metrics.



Figure 1. Impacts of Pre-K and Kindergarten Enrichment on Measures of More Constrained and More Unconstrained Math Skills in Kindergarten



SOURCE: MDRC calculations based on direct assessments of children in their kindergarten year.

NOTES: Statistical significance levels are indicated as follows: *** = 1 percent; ** = 5 percent; * = 10 percent.

^aEffect size is calculated by dividing the impact of the program (the difference between the means for the program group and the control group) by the standard deviation for the control group.

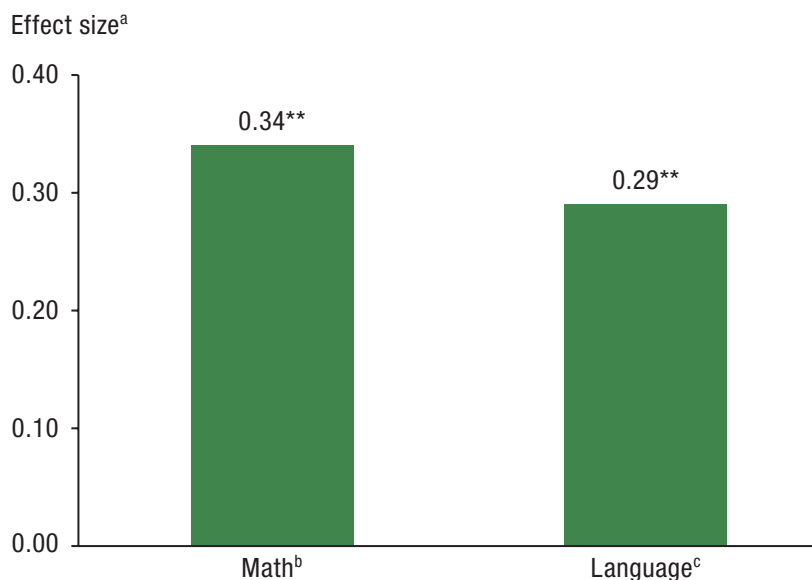
^bREMA-K = Research-based Early Math Assessment–Kindergarten.

^cWJ-AP = Woodcock Johnson Applied Problems.

The research team then [continued to examine](#) children’s outcomes as they moved through elementary school, using state standardized test scores to measure students’ English/Language Arts and math skills through the end of third grade.¹⁷ These standardized tests—which aim to capture skills like vocabulary, reading comprehension, algebraic thinking, and problem solving—arguably measure a more unconstrained and broader set of skills within each of these learning domains. As illustrated in Figure 2, the research team detected sizeable, sustained impacts of two years of early math enrichment through third grade on both English/Language Arts and math standardized test scores. Interestingly, the early math enrichment also had a sustained, meaningful effect on children’s chronic absenteeism, a nonacademic outcome that is not often measured when examining the impacts of pre-K programs but is an important indicator of later school success.¹⁸ There were also lasting impacts of Making Pre-K Count on children’s executive functioning skills—an outcome also less frequently measured in typical pre-K assessments—through the end of kindergarten for those students who had enrolled in pre-K in community-based organizations (as opposed to public schools).

Taken together, these findings illustrate that measuring a broader set of outcomes helped provide a more comprehensive understanding of the benefits of math enrichment for children’s learning and development. Examining *only* a narrow, more constrained outcome might have led to the conclusion that math enrichment in pre-K and kindergarten did not make a difference for children at all. Adding in a broader and richer set of

Figure 2. Long-Term Impacts of Pre-K and Kindergarten Math Enrichment on Measures of More Unconstrained Math and Language Skills in Third Grade



SOURCE: MDRC calculations based on administrative records from the New York City Department of Education, via the Research Alliance for New York City Schools.

NOTES: Statistical significance levels are indicated as follows: *** = 1 percent; ** = 5 percent; * = 10 percent.

^aEffect size was calculated by dividing the impact of the program (the difference between the means for the program group and the control group) by the standard deviation for the control group.

^bMath was measured using the citywide standardized z-score for the state third-grade math test.

^cLanguage was measured using the citywide standardized z-score for the state third-grade English language arts test.

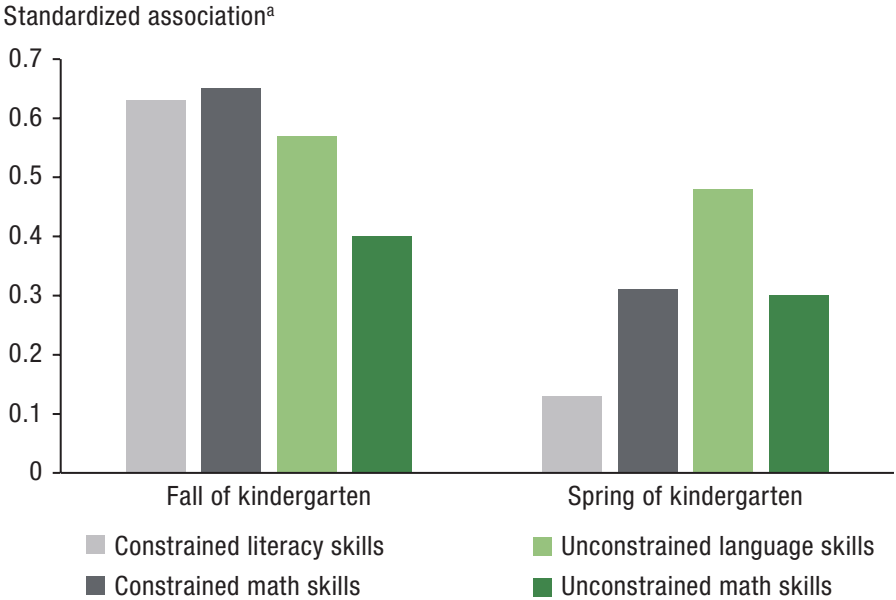
outcomes suggests that math enrichment may have had deeper, wider, and more lasting effects across a range of outcomes and provides important evidence to policymakers about how and for whom math enrichment may be strengthened.

A similar pattern of findings emerged in recent research conducted by MDRC, the Boston Public Schools (BPS), Department of Early Childhood, the University of Michigan, and the Harvard Graduate School of Education. The research team examined associations between enrollment in the nationally recognized, high-quality BPS pre-K program for four-year-olds and children’s skills through the spring of kindergarten. Students in the study came from a diverse range of racial, ethnic, socioeconomic, and linguistic backgrounds. The study revealed that positive associations between enrollment in the BPS pre-K program and some unconstrained language and math skills—measured using the Peabody Picture Vocabulary Test of receptive language and the REMA math assessment—were more likely to be sustained through the end of kindergarten compared with other constrained literacy and math skills, measured using the Dynamic Indicators of Basic Early Literacy Skills (DIBELS) and WJ-AP assessments, respectively.¹⁹

Figure 3 illustrates this pattern of results. As shown, the magnitude of the associations between enrollment in BPS pre-K and children’s outcomes in the fall and spring of kindergarten stayed fairly consistent for unconstrained skills, while the strength of the associations between enrollment in BPS pre-K and more constrained skills declined more substantially. The ultimate conclusion of this work, and the next steps for how to bolster pre-K programming in BPS, would have been different had the team not been able to collect a broader and richer set of assessments to measure indicators of early learning and development.

This pattern also extends to studies happening in a more diverse group of settings and populations. For example, research teams from the national Early Learning Network—funded by the Institute of Education Sciences and including MDRC, the University of Virginia, the University of North Carolina–Chapel Hill, Ohio State University, and the University of Nebraska–Lincoln—have all found similar sets of results. Across a range of pre-K programs and localities—including urban, suburban, and more rural contexts—the research teams found that the benefits of pre-K were more likely to be sustained through the end of kindergarten for unconstrained skills like vocabulary and executive functioning, compared with constrained skills such as numeracy and letter word identification.²⁰ As the field continues to explore the importance of measuring a broader and richer set of skills, it will be important to continue to expand the kinds of localities, pre-K settings, student and teacher populations, and program types that are studied.

Figure 3. Summary of Standardized Associations Between Enrollment in Boston Public School’s Pre-K Program and Children’s Skills, Fall and Spring of Kindergarten



SOURCE: MDRC calculations using data reported on in McCormick, Weiland, Hsueh, Pralica, Weissman, Moffett, Snow, and Sachs (2021).

NOTE: ^aStandardized association is the difference between BPS Pre-K attenders and non-attenders in standard deviations.

Where Do We Go from Here? Future Directions for Assessing a Broader Set of Skills

This brief demonstrates the importance of measuring a broad range of children’s outcomes and skills to learn about the real effects of pre-K programs on learning and development over time. Capturing unconstrained skills may also help identify longer-term sustained effects of pre-K programs for children from historically marginalized backgrounds. For example, more unconstrained skills such as storytelling and oral discourse may be more broadly culturally relevant to and target the strengths of children from a wider range of backgrounds and experiences.²¹ There may be other skills and competencies that are important to measure but have not typically been the focus of research in early care and education. Future assessments that capture such skills may be better able to predict longer-term outcomes and help schools and districts understand how early interventions support key domains of development over time.

However, measuring children’s skills in a valid, reliable, nuanced, and comprehensive way can be time- and resource-intensive and difficult to accomplish on a large scale. For example, the majority of widely used assessments for young children do tend to measure constrained skills because they are fairly simple to administer. These types of assessments have a clear right or wrong answer that teachers can quickly and reliably score. And, because the measures are widely used and studied, scores can easily be compared with other samples and with national norms. In comparison, measures that capture a broader set of skills—like critical thinking, problem solving, and others that have not yet been defined—can take more time to complete and may require more intensive training to be used reliably and validly. Although substantial additional work is needed in this area, advances in technology may provide an opportunity to measure a wider and more complex set of skills and outcomes on a large scale.

Measuring skills beyond the ABCs and 123s is critical for improving the field’s ability to use data to inform instruction, understand the full range of effects of programs, enhance program quality, and promote more equitable opportunities and outcomes for children.

As investments in publicly funded pre-K expand, policymakers and localities are increasingly looking to use assessments of children’s skills to understand whether programs effectively support learning and development. Recent research examining constrained and unconstrained skills points to the value of expanding the types of skills measured to understand more fully the effects of pre-K on children over time. Measuring skills beyond the ABCs and 123s is critical for improving the field’s ability to use data to inform instruction, understand the full range of effects of programs, enhance program quality, and promote more equitable opportunities and outcomes for children. ■

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