Executive Summary

LAUNCHING KINDERGARTEN MATH CLUBS

The Implementation of High 5s in New York City

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Overview

Early math has been shown to predict not only longer-term math achievement, but also future reading achievement, high school completion, and college attendance. Yet effects from early math programs often fade out as children move into more varied instructional contexts in elementary school. This fade-out suggests the need for an alignment of math instruction across the early years to support children's earlier math gains.

In 2011, the Robin Hood Foundation began a collaboration with MDRC to rigorously test an approach aimed at boosting early math skills. High 5s, a supplemental small-group math club program for children in kindergarten, was designed specifically as a follow-on to the Making Pre-K Count study, in which preschools implemented an enriched, evidence-based math curriculum (Building Blocks) supported by professional development for teachers. High 5s aligned with Building Blocks by focusing on children's developmental progression, encouraging hands-on learning, supporting student reflection about mathematical thinking, and using formative assessment (which helps teachers modify their approaches) and instruction differentiated by children's ability levels. As described in more detail in a companion report, children who were offered two years of enhanced math instruction (High 5s and Making Pre-K Count) had stronger math skills than those who had no enhanced math in pre-K or kindergarten — an impact equivalent to more than four months of growth — as well as more positive attitudes toward math. Given these encouraging findings, this report describes what was needed to implement the High 5s program successfully.

Key Findings

When the project team set out to design a math enrichment program, there were uncertainties about its feasibility: Would schools be receptive? Could an appropriate time and place to hold the clubs be identified? Would children attend regularly and be engaged? Could enough facilitators be hired at a paraprofessional level salary and retained for an entire year? With the support of a strong training and supervision model, all these issues were addressed and the High 5s program met all the benchmarks identified at the outset. Throughout the year, attendance and engagement were high, sessions were held regularly, and activities were implemented as intended by a team of committed facilitators.

All students who were part of the High 5s study also received typical math instruction in their kindergarten classrooms. Classroom instruction was found to differ in a number of ways from the instruction in High 5s: Students participating in High 5s were presented with a wider range and somewhat more advanced instructional content than was observed in classrooms, that content was delivered in a small-group format as opposed to the whole-class format in which most classroom mathematics was delivered, and facilitators engaged in more open-ended questions and more differentiation of material than was observed in classrooms.

These findings suggest that small-group enrichment may be one way to provide kindergarten instruction that is more closely aligned with the pre-K experience, which typically involves a substantial amount of small-group instruction with many hands-on learning opportunities. The math club model may help ensure that children get more individualized instruction, and its alignment with the preschool experience may be one way to help mitigate fade-out of math gains after preschool.

Preface

In 2011, MDRC entered into a collaboration with the Robin Hood Foundation to identify early childhood interventions that had the potential to change the life trajectories of New York City children experiencing poverty. The effort began with a focus on improving early math skills, an area shown to be among the most important predictors of a young child's later academic achievement. In a rigorous test, prekindergarten classrooms in New York City were provided with a high-quality, evidence-based math curriculum (Building Blocks) and ongoing teacher training and coaching over two years. The program was named Making Pre-K Count.

Though few studies of pre-K math curricula follow children over the long term, those that do often show a fade-out of math impacts as children move into elementary school. Various theories exist as to why fade-out occurs. If shifting educational contexts as children progress from preschool through high school are a factor, aligning children's instructional experiences across school years may help maintain pre-K gains. With this in mind, the study team set out to explore whether a kindergarten enrichment program that was aligned with the pre-K experience in terms of both content and pedagogy could provide a critical boost that would lead to more sustained long-term achievement gains. That initiative, a small-group math club program for kindergartners called High 5s, which was developed and piloted in 2014 and implemented in 2015, is the focus of this report.

The project faced a number of uncertainties: Would schools be receptive? Would it be possible to successfully recruit a team of facilitators to implement the program? Would scheduling and space issues stymie the effort? And if those issues were resolved, would kindergartners come regularly and be engaged in a supplemental math club? But the High 5s program met its implementation goals. Throughout the year, attendance and engagement were both high, sessions were held on a regular basis, and a team of committed facilitators delivered the activities as designed. The results show promise: As described in more detail in a companion report, students who participated in both Making Pre-K Count in pre-K and High 5s in kindergarten had stronger math skills at the end of kindergarten than students who had received no enhanced math instruction, an effect equivalent to more than four months of math learning.

This report provides detailed information about the implementation of the High 5s program: what went well, what barriers existed, and the factors that may have contributed to its success.

Gordon L. Berlin
President, MDRC

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We appreciate the ongoing support and dedication of the New York City Department of Education and the administrators, teachers, and staff of the schools that hosted High 5s clubs.

High 5s would not have been possible without the outstanding team at Bank Street College of Education. Katherine Baldwin provided exceptional leadership, direction, and input as the program director. Erica Buchanan, Nicole Cirino, Danielle Kilcullen, Connie Lafuente, and Sacha Lewis worked enthusiastically as supervisors to support and guide the facilitators in their work. Elisabeth Adduru and Scott Slavin provided invaluable administrative support. And of course, thank you to the facilitators who made High 5s happen every day with enthusiasm and a commitment to the work.

We extend a special thank you to Kristi Hanby at the University of Michigan, who played a lead role in developing and compiling the High 5s curriculum; to Doug Clements and Julie Sarama, who provided ongoing feedback, suggestions, and review of the curriculum; and to Emily Hamlin and Michael O'Keefe, who helped us pilot it.

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Most important, we thank the children, families, teachers, and schools who participated in the program. Without your commitment and dedication to High 5s, our research would not have been possible.

The Authors

Executive Summary

Early math is a strong predictor not only of longer-term math achievement, but also of later reading achievement and even high school completion and college attendance.[1] Thus, boosting children's early math skills is thought to be a way to improve long-term outcomes across a wide range of domains. Working from this notion, MDRC and the Robin Hood Foundation, one of New York City's leading antipoverty organizations, began a joint effort to rigorously test promising early childhood interventions that might make a lasting difference for children growing up in poverty. The early part of the initiative was focused on trying to boost that potential "linchpin" outcome — early math skills.

A two-pronged approach to boosting early math skills was planned. The first part, called Making Pre-K Count, provided prekindergarten classrooms in New York City with a high-quality math curriculum (Building Blocks) and ongoing teacher training and coaching over two years. Building Blocks is a 30-week, evidence-based curriculum designed to take into account and build on children's natural developmental progression in math skills; it also encourages instructional practices such as hands-on learning, student reflection about mathematical thinking, formative assessment to measure student progress and inform teaching decisions, instruction differentiated by the skill level of individual children, and a mix of small- and whole-group activities.

The second part, a math club program called High 5s, is the focus of this report. The High 5s math clubs were designed specifically as a follow-on to the larger Making Pre-K Count study and were developed using the learning trajectories research on which the Building Blocks curriculum is based. The program was intended to provide a small-group math enrichment experience that was aligned with both the content and approach of the Building Blocks curriculum, for kindergarten students who had experienced Making Pre-K Count in pre-K.

The High 5s program was developed by staff members at the University of Michigan with input from Doug Clements and Julie Sarama, the developers of the Building Blocks curriculum, and was implemented by Bank Street College of Education, which hired, trained, and supervised the club facilitators. The implementation included a number of key components:

[1]Greg J. Duncan, Chantelle J. Dowsett, Amy Claessens, Katherine Magnuson, Aletha C. Huston, Pamela Klebanov, Linda S. Pagani, Leon Feinstein, Mimi Engel, and Jeanne Brooks-Gunn, "School Readiness and Later Achievement," *Developmental Psychology* 43, no. 6 (2007): 1428-1446; Greg J. Duncan and Katherine Magnuson, "The Nature and Impact of Early Skills, Attention, and Behavior" (paper presentation, Russell Sage Foundation Conference on Social Inequality and Educational Outcomes, New York City, 2009).

- A total of 24 paraprofessional-level facilitators (mostly recent college graduates with limited formal teaching experience) administered the program to over 300 children in 24 New York City public schools during the 2015-2016 school year. The clubs typically included four children and one facilitator.
- Facilitators received substantial training on the curriculum and instructional approach before the start of the program as well as weekly coaching and supervision from the Bank Street supervisors and program director that was designed to be responsive to their individual needs.
- Clubs took place during noninstructional time (before school, after school, or during lunch). They were designed to meet three times a week for approximately 28 weeks starting in the fall of 2015, with each club session lasting approximately 30 minutes.
- Activities in the clubs were designed to move children along key mathematical learning trajectories and were delivered in a game-like format that was intended to be fun, engaging, and developmentally appropriate.

As described in more detail in a companion report, students who had two years of enhanced math instruction (both Making Pre-K Count in pre-K and High 5s in kindergarten) had stronger math skills (on the REMA-K,[2] one of two measures of math achievement in the study) at the end of kindergarten than students who had received no enhanced math instruction in either pre-K or kindergarten, an effect equivalent to 4.2 months of additional growth in math skills. Students in High 5s also had stronger math skills as measured on the REMA-K than those who had received only one year of enhanced math instruction as part of the Making Pre-K Count project, an impact equivalent to approximately 2.5 months of growth.[3]

With these positive findings as a backdrop, this report describes the High 5s program in detail, noting what was needed to implement the program with fidelity to the model. The program set out to achieve a number of goals — it was designed to build on the content of the Building Blocks curriculum; to deliver hands-on, engaging instruction in a game-like format; and to provide opportunities for both differentiated instruction and for children to delve deeply into mathematical concepts by explaining their mathematical thinking to others. Because the High 5s program was new and developed specifically for this project, and because it aimed to

[2]The Research-Based Early Math Assessment–Kindergarten (REMA-K) is a version of the full REMA. For more information on the impact measurement, see Shira K. Mattera, Robin Jacob, and Pamela A. Morris, *Strengthening Children's Math Skills with Enhanced Instruction: The Impacts of Making Pre-K Count and High 5s on Kindergarten Outcomes* (New York: MDRC, 2018).

[3]Mattera, Jacob, and Morris, *Strengthening Children's Math Skills*.

achieve an ambitious set of logistical and educational objectives, it was not clear at the outset whether High 5s could be implemented successfully.

Despite these uncertainties, the High 5s program met all the benchmarks identified for the program at the outset of the study, and with the support of a strong, ongoing training and supervision model, it was implemented with fidelity. Findings from an analysis of implementation data indicate the following:

- **Student attendance was high, with an average attendance rate of 87 percent across the year.** The majority of students attended most of their club sessions, with more than 90 percent of the students having attendance rates over 70 percent. Over 80 percent of students had attendance rates over 80 percent.
- **Club sessions were completed as scheduled and the curriculum was delivered as intended.** Ninety-two percent of scheduled sessions were completed and club observations indicated that 96 percent of the activities were implemented as intended.
- **Students spent an average of 25 minutes in each club on mathematics.** The goal was to spend at least 20 minutes of the math club on math. Students spent about 75 minutes a week on math in addition to the time they spent on math in the kindergarten classroom.
- **Facilitators created a positive instructional climate in clubs.** All facilitators met expectations for having a good rapport with students. Over 80 percent met expectations for making math learning fun and using positive strategies to manage behavior. This was true even though a number of facilitators cited managing student behavior as one of the most challenging aspects of the job.
- **Student engagement was also high (as reported by both facilitators and observers).** Engagement was rated on a scale of 1 (all students are disengaged) to 5 (all students are engaged). Average facilitator-rated engagement scores were high, with nearly all children engaged in most clubs: Ratings ranged from 4.7 to 4.9 for the different types of High 5s activities.
- While the program was generally implemented with fidelity to the model, **ensuring the highest quality of instruction — instruction that included differentiation, involved reflective questioning, and underscored the mathematical objective of the activities — was more challenging,** as it was for the kindergarten teachers in our sample, despite ongoing and high-quality training and coaching.

- **Overall, the logistics of the program proved to be the most challenging aspect of running the clubs.** The most common logistical challenges included finding an appropriate time and place to meet, escorting children to and from clubs, and having facilitators who traveled from school to school.

All students who were part of the High 5s study also received typical math instruction in their kindergarten classrooms. To better understand the potential value that the High 5s program added, kindergarten classrooms were observed to understand the nature of the mathematics instruction students were receiving and how it compared with the instruction students were receiving in High 5s clubs. Instruction in kindergarten classrooms was found to differ in a number of ways from the instruction in High 5s:

- **The High 5s program presented a wider range and somewhat more advanced instructional content than was observed in kindergarten classrooms.** Classroom teachers were, for the most part, following the district's Common Core-aligned kindergarten math curriculum, which focused on numbers and operations for a majority of the year. Geometry, measurement, and patterning activities were included throughout the year in High 5s.

- **Content in the High 5s clubs was delivered in a small-group, hands-on format, while small-group instruction in the kindergarten classroom tended to be limited.** By design, the High 5s clubs were small groups, and all the High 5s activities involved the use of hands-on manipulatives. In the kindergarten classrooms, small-group activities accounted for around 5 percent of the activities observed, and about two-thirds of the activities observed in kindergarten classrooms involved only workbooks or no materials at all.

- **Observations indicated that High 5s facilitators asked more open-ended questions and engaged in more differentiation of material than was observed in kindergarten classrooms.**

Overall, despite uncertainty in the planning phases about the viability of a math club model like High 5s, the program was implemented well, with high attendance rates and strong student engagement. Staff members with a variety of backgrounds and experiences but limited formal teaching experience were able to deliver a wide range of math content with adequate instructional quality. The program had a robust, statistically significant impact on one of two measures of math achievement.

- Findings from this study suggest that small-group enrichment may be one way to provide kindergarten instruction that is more closely aligned with the

pre-K experience, which typically involves a substantial amount of small-group instruction with many hands-on learning opportunities.

- The small-group experiences that a math club model offers can also help ensure that children get more individualized instruction and do not "fall through the cracks."
- It is worth considering whether experiences that are more closely aligned with the preschool experience and that emphasize differentiated instruction may help mitigate the fade-out often associated with high-quality preschool experiences.

The positive impacts of the High 5s program demonstrated in this study suggest that further research is needed to examine whether and how it works in different contexts. For example, is the program effective in scenarios in which children come into kindergarten with a variety of different pre-K math experiences? Would it be effective if schools used in-house staff members to deliver the clubs, or could it be done without the level of training and supervision that facilitators were provided in the model that was tested? At the same time, future research is needed to parse how the different components of the program work and for whom.

Other MDRC Publications on Making Pre-K Count and High 5s

Strengthening Children's Math Skills with Enhanced Instruction
The Impacts of Making Pre-K Count and High 5s on Kindergarten Outcomes
2018. Shira K. Mattera, Robin Jacob, Pamela A. Morris

Counting on Early Math Skills
Preliminary Kindergarten Impacts of the Making Pre-K Count and High 5s Programs
2017. Shira Mattera, Pamela Morris

Making Pre-K Count
Improving Math Instruction in New York City
2016. Pamela A. Morris, Shira K. Mattera, Michelle F. Maier

NOTE: All the publications listed above are available for free download at www.mdrc.org.

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MDRC is a nonprofit, nonpartisan social and education policy research organization dedicated to learning what works to improve the well-being of low-income people. Through its research and the active communication of its findings, MDRC seeks to enhance the effectiveness of social and education policies and programs.

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