

Immediate and Long-Term Efficacy of a Kindergarten Mathematics Intervention

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Early intervention can reduce the achievement gap in mathematics

More than half of elementary school students in the United States score below proficient in mathematics in fourth grade. To address this problem, educators can provide early intervention on whole number skills (e.g., counting by ones; adding two numbers to make 10; decomposing numbers). Early intervention may be integral to children's long-term success with mathematical thinking because difficulty at school entry typically persists into later elementary grades. Persistent frustration and hardship in learning mathematics are associated with a mathematics learning disability (MLD). Students with MLD are most vulnerable to lifelong difficulty managing daily tasks that involve numbers (e.g., money management). Students with or at risk for MLD will likely benefit from intervention as early as possible to reduce adverse long-term impacts.

What is the intervention in this study?

The ROOTS intervention program is designed for educators to teach kindergarteners whole number skills. ROOTS encourages research informed teaching strategies (e.g., deliberate practice, teacher modeling) to increase the chances that struggling students will learn critical early content in mathematics. Students actively engage in lessons through frequent opportunities to respond to questions and discuss their mathematical thinking aloud. Teachers receive support on their understanding and delivery of ROOTS from an expert coach who provides training and in-class visits.

How did we do this study?

We conducted an experimental study where 290 kindergarteners identified as at-risk were randomly assigned to receive ROOTS or business-as-usual classroom instruction. Students were screened in the fall of their kindergarten year, and then follow up assessments were completed in the spring of kindergarten and halfway through first grade. In total, the experiment included 203 at-risk kindergarteners in 58 ROOTS intervention groups, 87 at-risk kindergarteners in the business-as-usual groups, and 590 kindergarteners who were not-at-risk for MLD. ROOTS was implemented by trained interventionists with small groups of kindergarteners in 20-minute sessions, five times per week over 10 weeks. Students in the ROOTS condition were part of an intervention group that had either two students or five students. There were no substantial differences in outcomes between the ROOTS group of two versus groups of five; therefore, the study results viewed all students in ROOTS together as a group to compare with students in the business-as-usual group.

Does the ROOTS intervention work?

In this study, ROOTS increased fall to spring math learning among kindergarteners at-risk for MLD. In addition, students who received ROOTS made greater learning gains than their not-at-risk peers, reducing the achievement gap. However, despite these positive short-term findings, at a six-month follow up conducted halfway through first grade, students who received ROOTS demonstrated the same outcomes as the business-as-usual control group. Like the effects of many early childhood interventions, the within year effects of ROOTS appear to fade-out in subsequent grades. This suggests further research is required to identify interventions with sustained positive impacts or examine multi-year intervention models.

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