



## Surprising Research Findings

### Surprise 1: There is predictive power in early mathematics

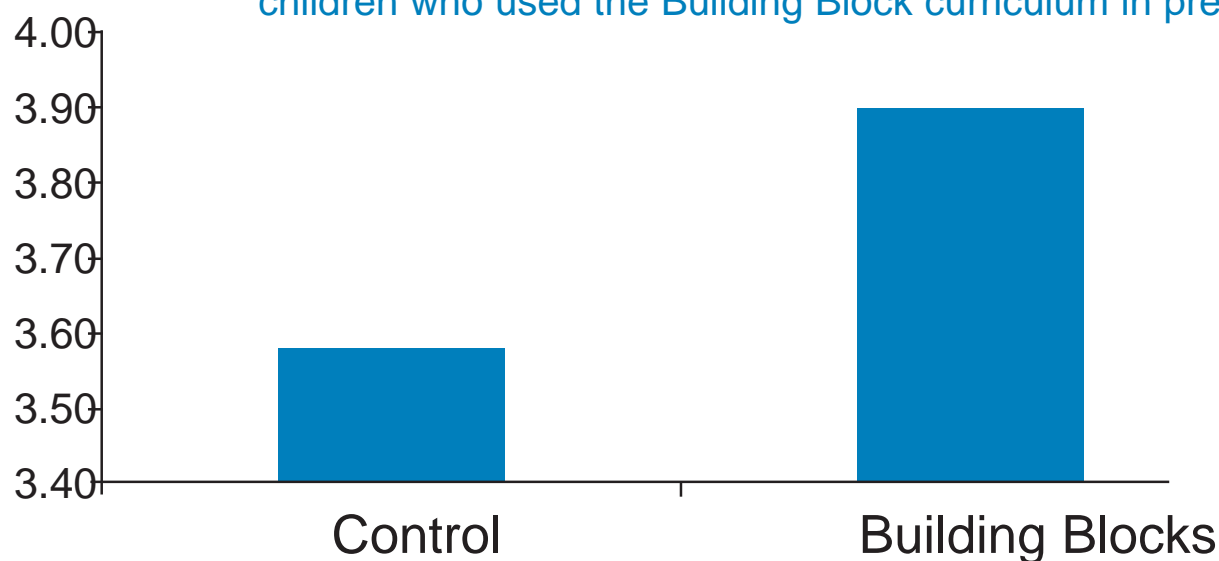
Mathematical thinking is cognitively foundational and children's early knowledge of math strongly predicts their later success in math. More surprising is that preschool

### Surprise 5: We know a lot

A lot is known about how children think about and learn math, and teachers can use learning trajectories to synthesize this knowledge into effective interventions for children.

There are books and research available to districts that detail the learning trajectories that can help underlie scientific approaches to standards, assessment, curricula,

Figure 3: Expressive oral language scores at the beginning of kindergarten children who used the Building Block curriculum in preschool.



Source: Sarama, A. Lange, D.H. Clements, and C.B. Wolfe, "The Impacts of an Early Childhood Curriculum on Early Literacy and Mathematics Skills," *Early Childhood Research Quarterly*, 27(2), 2012, pp. 149-160, doi: 10.1016/j.ecresq.2011.12.002.

## Policy Implications and Recommendations

### The Importance of High-Quality Curriculum and Instruction

The quality of mathematics education varies across settings but is generally disappointing, especially in the earliest years. For example, 60% of 3-year-olds had no mathematical experience of any kind across 180 observations<sup>21</sup>. Even if a program adapts an ostensibly "complete" curriculum, mathematics is often inadequate, with the most commonly used engendering no more math instruction than a control group<sup>22</sup>.

It is little surprise, then, that evaluations show little or no learning of mathematics in these schools<sup>23</sup>. As an example, observations of Opening the World of Learning (OWL), which includes mathematics in its curriculum, found that out of a 360-minute school day, only 58 seconds

were devoted to mathematics. Most children made no gains in math skills, and some lost mathematics competence over the school year<sup>24</sup>. Teachers often believe that they are "doing mathematics" when they provide puzzles, blocks, and songs. Even when they teach mathematics, that content is usually not the main focus, but is "embedded" in a fine-motor or reading activity<sup>25</sup>. Unfortunately, evidence suggests such an approach is ineffective<sup>26</sup>. To ensure a program is truly effective, policymakers and school leaders must prioritize investing in high-quality math curricula and instruction that meet the needs of all students.

### Qualified Instructors

Teacher certification for pre-K through 3rd-grade teachers should emphasize both knowledge of the subject (specifically, a profound knowledge of the math taught in early and elementary years) and strengths in pedagogy. It is only recently that some states are requiring teachers to be evaluated on fluency in literacy instruction. What we now know is that math instruction is far more effective coming from a specialist who understands both the subject matter and the most effective ways in which young children learn math. A successful program will be one that ensures that early math instructors specialize in these areas. One solution may be for a school to designate a teacher in each grade who is responsible for teaching only math to all students.

**58%** Percent of adults who cannot compute a 10% tip

**71%** Percent who cannot compute the interest paid on a loan

**78%** Percent who cannot compute miles per gallon on a trip

Source: W. Phillips, *Chance Favors the Prepared Mind: Mathematics Indicators for Comparing States* (Washington, DC: National Center for Education Statistics, 2007).

## Seamless Learning Trajectories

The most common argument offered for limiting investments in preschool is that the gains made are soon lost as a child matriculates through the early primary grades. The losses primarily signify a siloed approach to education, where each grade level and teacher holds different expectations for students, creating a learning trajectory that is not seamless. Therefore, in order for students to benefit from math instruction in the early years, primary grade teachers must build on early math interventions and engage students in more interesting, challenging, and substantial math lessons as students progress through competency levels. If there are follow-through interventions in kindergarten and the primary grades, students maintain their preschool advantage. This effect is highlighted by the 0.54Tj Okigu Twy itinusons

## Endnotes

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