

Early Math Matters: Executive Summary

Why Early Math Matters

State policies and public perception recognize how important it is that students read proficiently by the end of third grade. But no one subject is paramount, and math should not fall by the wayside during children's first years in school. While reading is critical to future academic and personal success, so are a strong foundation in numeracy and the analytic skills children learn by tackling mathematical problems. In fact, some studies show that early math skills are better predictors of students' later academic success than are early reading skills.

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Math achievement is critically important to the changing global economy. Many competencies central to the study of mathematics, including reasoning, critical thinking and problem solving, are also important 21st-century skills. These skills are vital for adults, both in daily life and in their careers. Students who have trouble earning high school-level math credits in courses like algebra likely struggle with the 21st-century skills they need to be competitive in the workforce, too. But the roots of these struggles begin well before high school.

Improving Teacher Knowledge and Practice and Reducing Math Anxiety

Experiences in early childhood with the concept of “number” — like counting objects with a parent — affect the skills children later bring to school. Unfortunately, the math experiences children have before they enter school are often not adequately nurtured in the primary grades. As a result, students may not develop strong foundational math skills, making later learning more difficult.

Aspiring teachers with strong math backgrounds tend to gravitate toward the secondary grades, where they can exclusively teach math. And educator preparation programs for elementary teachers must cover a greater variety of subject matter than programs for candidates seeking more specialized secondary credentials. As a result, **elementary teacher candidates who enter teacher preparation programs without the type and depth of mathematical knowledge they need to teach math effectively may not gain that knowledge from their programs.**

Teachers' mathematical knowledge is key to their ability to solve problems central to their work as educators — problems like choosing tools and instructional materials, making sense of and responding to students' work, and designing useful assignments. Doing these things well, even in elementary and middle grades, requires a deeper level of mathematical knowledge than some may appreciate. It also requires a *different type* of knowledge than that used by professionals in mathematics-related fields.

Researchers have found that teacher candidates in the United States have lower levels of mathematical knowledge than teachers in other countries. They tend to struggle with understanding and representing fractions, understanding the concepts of decimals and place value, and flexibly solving algebraic problems — important topics in the elementary and middle grades. If a teacher doesn't understand and can't explain why a math process works, it is unlikely that she can fully teach that process to students or troubleshoot a student's difficulties in understanding it or mistakes in applying it.

Math anxiety, a negative emotional response to mathematics tasks, can also hinder an otherwise well-prepared elementary teacher's ability to teach math effectively. Both adults and children can experience math anxiety — and in fact, studies show children may develop it from the attitudes that adults in their lives hold toward math. **Math anxiety impacts teachers' confidence and teaching practices, as well as students' academic achievement.**

Recommendations

Raising math achievement, like any other state education policy goal, will require sustained efforts and a multifaceted approach. States can consider the following recommendations.

Ensure that elementary teachers are well prepared to teach math by the time they leave educator preparation programs by:

1. Establishing course requirements for mathematical content knowledge for teaching and mathematics teaching methods.
2. Developing state math standards and competencies for prospective elementary teachers. In states where these already exist, make sure they are detailed and aligned with recommendations from an expert group.
3. Examining current state licensure exam requirements and considering whether they adequately assess the knowledge and skills elementary teachers need for the classroom.

Assist districts in identifying and accessing quality professional development opportunities that deepen elementary teachers' knowledge of math concepts and methods by:

1. Ensuring that district and school leaders are familiar with evidence-based characteristics of effective professional development.
2. Requiring districts and schools to include evaluation of teacher training opportunities when they use state funds to pay for professional development and report the evaluation results to the state.
3. Providing districts with recommendations for effective professional development opportunities that are aligned with state standards and goals.

In addition, SREB calls for more research on dyscalculia and math anxiety. To address math anxiety in the meantime, states can consider the following:

1. Carry out a public information campaign to promote a growth mindset toward math and support parents in engaging their young children in simple math-related activities.
2. Require educator preparation programs to promote a growth mindset toward math and other subjects and explicitly address math anxiety in the content knowledge and methods courses taken by teacher candidates.
3. Ensure that math professional development offered by state departments of education and local education agencies addresses the issue of math anxiety.