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# Math Matters: **Children's Mathematical Journeys Start Early**

## EXECUTIVE SUMMARY

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# Math Matters:

## Children's Mathematical Journeys Start Early

### EXECUTIVE SUMMARY

Mounting evidence suggests that the mathematical understandings children develop before entering elementary school are highly predictive of later academic achievement, not just in mathematics, but in other subjects as well. Moreover, children who begin school with poor math skills typically do not catch up. Those least prepared are disproportionately underrepresented minorities and from low-income families.

The conference “Pathways for Supporting Early Mathematics Learning,” held in Berkeley, California in November 2011, brought experts together to discuss how educational research, practice, and policy can be coordinated to improve the teaching of early mathematics for children ages 3 through 8. Participants also considered how preschool mathematics instruction may be meaningfully linked to a K-3 system that is based on the Common Core State Standards.

### **The Opportunity Posed by the Common Core Standards to Promote Children's Early Mathematics Learning**

Slated for implementation by 2015, the Common Core State Standards have now been adopted by 46 states as the backbone of their mathematics instruction. They will produce greater homogeneity in the early school mathematics experiences of students across the United States and provide a clear target for preparing children mathematically for school entry. The Common Core Standards represent a significant change in educational expectations for children K-12. They focus on both the sequences of mathematical *content* that children should learn and the mathematical *practices* (e.g., making sense of problems and persevering in solving them, modeling, reasoning abstractly) that students are expected to demonstrate. New assessments will emphasize problem solving, reasoning, and modeling with mathematics much more than existing assessments. Most current early mathematics instruction does not provide the rich experiences appropriate for developing such understandings, reflecting in part a lack of math-focused preparation given to the early education and elementary school teaching force. In brief, the Common Core Standards represent both an important opportunity and a significant challenge with regard to providing young children the kinds of mathematical preparation they need.

Research indicates that children begin very early to develop understanding of complex mathematical concepts (e.g., figuring out how to share a plate of cookies fairly requires foundational concepts of division). With the right supports, children can learn mathematical concepts by building on their intuitive understandings and the mathematics that they have already learned in a number of different ways, and not necessarily by following one prescribed mathematical path. The challenge for teachers, therefore, is to determine where children are with respect to their mathematical understandings, and then to provide opportunities for them to build on that existing level of knowledge. This kind of ongoing assessment and teaching requires math-related activities and conversation between teachers and children, preferably including games and tasks that children enjoy and that can expand on the experiences they may have at home (e.g., measuring for cooking; playing cards). Math activities can help children develop social-emotional skills, and if they call for articulating problem-solving and reasoning, they can facilitate language development. In other words, rich mathematical activities can contribute broadly to children's education — but skillful facilitation is required to ensure meaningful engagement and effective learning.

## Effective Classroom Practices

Research reveals that relatively little time is spent on math instruction, and that children spend very little time talking about math. Increasing the amount of children's math conversations from 2% to only 4% of the typical preschool classroom session leads to significant math gains. Moreover, increasing math instructional time can both increase math learning and promote language and literacy skills, which is particularly important for English language learners.

In the absence of clear research evidence regarding the optimal amount of time for math instruction, 30 minutes per day is a reasonable guideline, although this focused time should be supplemented with math games, integrating math into play and other activities, and taking advantage of “teachable moments” throughout the day. Rote learning or math worksheets are the least effective means of teaching math.

### Good mathematics-related instructional tasks for young children:

- are engaging
- involve important mathematical concepts
- provide access to materials to manipulate
- provide opportunities to engage in problem solving
- require some effort and persistence
- are amenable to children working collaboratively and discussing alternative solutions
- provide embedded feedback that informs children's actions
- provide an opportunity for children to observe and take pride in the fruits of their problem-solving activity.

## Need for Teacher Training

Researchers who study teaching and learning mathematics in early childhood education and the early elementary grades are scarce, and few college faculty who prepare early childhood educators have expertise in math teaching and learning. Professional

development opportunities and training are needed in early math, and teachers need ongoing support after they have begun instructing students.

## Linking Early Childhood Education and K-3

A more seamless flow between early childhood and elementary school mathematics instruction must be established to ensure the development of mathematical competencies that children need to do well in kindergarten. Key policy mechanisms for achieving this could include clear and appropriate standards for what children should learn, assessments to monitor their progress, and sufficient training and ongoing support for teachers. Standards for preschool should be coordinated with the Common Core State Standards. Like the Common Core Standards, standards for young children should emphasize students' genuine understanding of mathematical concepts, rather than simply their ability to get correct answers.

### Recommendations for Research

- Study the mechanisms underlying the key finding that early mathematical proficiency predicts not only later mathematical success but also success in other academic domains.
- Develop a deeper understanding of mathematics developmental progressions, including how they vary and can be affected by instruction.
- Locate and analyze existing longitudinal data sets that contain detailed assessments of early childhood mathematical competencies across a variety of sub-areas and that follow children into early elementary grades or beyond.
- Gather data on the effects of teacher beliefs and professional development on classroom math instruction behaviors.
- Develop and assess demonstration projects that test what young children can achieve mathematically when they are provided with culturally relevant and mathematically supportive and engaging activities.

- Develop more richly textured assessments that reveal children’s depth of understanding related to the critical math concepts in early childhood.
- Develop tools that teachers can use easily as formative assessments to tailor instruction for children.
- Ensure that summative assessments designed for program accountability are supplemented with and aligned to formative assessments – and that assessments represent the breadth of content and practices represented in the Common Core Standards.
- Develop better observational measures of teaching that can be used to assess instructional quality and improve mathematics teaching.

**Recommendations for Practice:**

- Create documents, curricula, and professional development materials that are guided by what we know about developmental progressions and are aligned with standards.
- Create problem-solving games and contexts in which children can develop mathematical knowledge and practices.
- Devote time to structured, intentional, developmentally appropriate mathematics instruction in classrooms.
- Provide in-service and practice-based professional development to help current teachers develop greater knowledge of young children’s mathematical thinking.

- Create formal and informal structures for teacher interactions with each other and with math education experts.
- Create an early childhood math teacher corps — a cadre of experts to serve as resources for early childhood educators.

**Recommendations for Policy:**

- Create a respected commission that includes math teaching and learning experts to craft preschool common core standards in mathematics which articulate with the Common Core State Standards for K-12 Mathematics.
- Create a credential and college-level programs to develop experts in early childhood math teaching and learning.
- Develop scholarships and loan forgiveness programs to attract talented people into teaching, and especially to develop expertise in math teaching at both the preschool and elementary levels.
- Increase requirements related to mathematics teaching in current preschool and elementary teacher education programs.
- Develop a national agenda in the U.S. Department of Education that focuses on the importance of early mathematics.

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The report is available at [www.earlymath.org](http://www.earlymath.org)