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Report # 110

Teacher Readiness & Math Education

April 2009

Math Education And Early Childhood

Early Math Education Weak

More effective teaching in early childhood needed

The number of children enrolled in some type of early education program – preschool, childcare centers, Head Start and kindergarten – has markedly increased in the United States. From 1970 to 2005, enrollment of children ages 3 and 4 years rose from 20 percent to 54 percent. With so many children enrolled who are capable of learning mathematics, the questions of whether they are being taught math and being taught effectively become important.

Unfortunately, studies suggest their teachers are not well prepared to teach math, the content is narrow and the overall quality of math instruction in early childhood education settings is lacking.

Student achievement in mathematics is a lingering concern in America's schools with U.S. school children faring poorly when compared to children in other countries and disadvantaged children doing more poorly in math than their more advantaged classmates.

The good news is that the means for effectively teaching early mathematics are available, including research-based curricula. Research also provides policymakers and educators with insight into how programs can be implemented to promote the learning of mathematics subject matter and ways of thinking.

The National Council of Teachers of Mathematics and other professional organizations argue that young children should be taught the “big ideas” of mathematics, such as number, shape and space, measurement and pattern. For example, understanding number goes beyond saying a few counting words and involves reasoning about

number, making inferences and developing a mental number line. Children also need to be aware of mathematics strategies and be able to verbalize them.

In preschool, however, teachers often use a narrow range of mathematical content. For example, their focus is typically limited to the names of common shapes and small counting numbers, which do little to encourage processes such as estimation.¹

Important Components

Effective early math education has several key components. They include:

- **Environment.** A classroom should contain a rich variety of materials, such as blocks, dress-up area and puzzles. Teachers need to support activities that develop math skills.
- **Play.** Play provides opportunities to explore and take part in fairly sophisticated mathematical activities, especially block play.
- **Teachable moment.** This requires

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teachers to observe children's play and other activities to identify a situation they can exploit to promote mathematical learning.

- **Projects.** These include teacher-guided explorations of complex topics, such as working with children to create a map. Such projects involve mathematical ideas, including space, measurement and perspective, and help children learn that making sense of real-life problems can be fun.
- **Curriculum.** Organized curriculum is essential to early childhood mathematics education. An effective curriculum offers planned activities for teaching math and assumes math is interesting and exciting on its own and does not need to be sugar coated or integrated with other activities to appeal to young children.
- **Teaching.** Leading professional organizations stress that in high-quality

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math education for children 3 to 6 years old, teachers need to practice deliberate and planned instruction to introduce math concepts, methods and language.

Teacher Qualifications

There is consensus among policy-makers and professional leaders that a four-year undergraduate degree with specialization in early childhood education is the minimum standard for early childhood teachers. But in the 2005-2006 school year, only 18 of 38 states that fund preschool required lead teachers to have a four-year degree.

What is more important is whether a degree provides teachers with the knowledge and skills to effectively teach math to young children. Studies suggest that an undergraduate degree – even one in early childhood education – is not a good predictor of the quality of instruction children find in the classroom or of their academic outcomes.²

And one common shortcoming among postgraduate programs is the inability to adequately prepare early childhood education majors to teach domain-specific knowledge to young children, particularly mathematics.³

Beliefs And Attitudes

Studies suggest preschool teachers, in general, give the social, emotional and physical domains of their classroom higher priority than intellectual and academic activities. They tend to believe acquiring basic literacy and mathematical knowledge and skills is less important than children's need to be healthy and socially and emotionally competent.⁴ However, the greater the school's poverty level, the more likely teachers are to identify academic skills as a problem they need to address.

Teaching Practice

The low priority preschool teach-

ers give to teaching mathematics tends to manifest itself in their classroom practices. Their classrooms typically are found to be socially positive, but instructionally passive. They also spend much less time teaching math than teaching literacy,⁵ with one study finding that only 15 percent of class time is typically devoted to mathematics. Similar practices have also been found in kindergarten classrooms.⁶

The quality of mathematics instruction has also been found to be troubling.

One study, for example, found that in two preschool programs with a reputation for high quality, mathematics was not a prominent topic of discussion and, when discussed, the conversation lasted less than one minute and usually focused on very basic concepts, such as age, number recognition and the names of shapes.

Policy Implications

Research clearly suggests that improving teacher training and support is an urgent need. Other areas of improvement that have been identified include the need for federal, state and local education authorities to promote early childhood mathematics curricula, including efforts to develop new, evidence based curricula. And greater support is needed for research in areas such as how to enrich teacher knowledge of early mathematics education and effective teaching practices.

Work in such areas is essential if child care, preschool and kindergarten programs are to exploit the findings of researchers who report that children, from an early age, have the potential and desire to learn mathematics.



references

This article was largely based on the following publications:

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² Early, D.M., Maxwell, K.L., Burchinal, M., Alva, S., Bender, R.H., Bryant, D., et al. (2007). Teachers' education, classroom quality, and young children's academic skills: Results from seven studies of preschool programs. *Child Development*, 78(2), 558-550.

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⁶ Graham, T.A., Nash, C., & Paul, K. (1997). Young children's exposure to mathematics: The child care context. *Early Childhood Education Journal*, 25(1), 31-38.

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