

background

Report # 109

Early Mathematics Ability

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Math Education And Early Childhood

Math Abilities Begin Early

Children begin learning skills and ideas as infants

Mathematics is a lingering concern in America's schools. U.S. school children fare poorly in studies comparing them with peers in other countries, with their scores consistently mired in the bottom third of the rankings. And socially and economically disadvantaged U.S. children perform even more poorly, on average, than their more advantaged classmates.

As educators and policymakers look for a solution, increasing attention is being focused on emphasizing math education in early childhood. And for good reason. Even as infants, children have an ability to learn important math concepts.

The implications of American children's weakness in mathematics are troubling. Recent studies suggest that children's math concepts at the time they enter school are the strongest predictors of achievement in later years – even more than their literacy skills.¹

The good news is that a growing body of research shows that effective mathematics education for children 5-years-old and younger holds great promise for improving their math performance later in school, particularly among disadvantaged children.

And there is evidence that educators and policymakers are paying more attention to such findings. For example, Head Start is strengthening its mathematics curriculum and states such as Texas and New Jersey have started new early childhood math programs.

Among the issues important to improving the performance of American children is understanding the ability of

young children to learn mathematics.

Early Mathematics Ability

More than two decades of research provides overwhelming evidence that before age 5 years, children learn real mathematical skills and ideas without adult instruction.²

Studies suggest they begin to develop everyday mathematics very early. Everyday mathematics develops in the ordinary environment and includes informal ideas of what is more and what is less, taking away, shape, size, location and pattern. Infants show some core mathematical abilities, such as being able to discriminate between two collections of objects that vary in number. And they develop basic systems for locating objects in space.

'Spontaneous Interest' In Math

Children have a spontaneous interest in mathematical ideas, according to the research. Young children have been found to spontaneously count, even up

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The content of early math education and the readiness of teachers and child care staff to teach it to young children are among the most critical issues in improving math education and children's achievement.

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to relatively large numbers. They sometimes want to know what the "largest number" is. And this interest is usually not generated by adults, who often are unaware of it.

Children's play is another area where they mathematical ideas are seen. When playing with blocks, for example, young children may spend time determining which tower is higher than another. And they often create patterns of blocks, extend the patterns, explore shapes and create symmetries.

Strengths And Weaknesses

Young children show mathematical competence and areas of incompetence.

Their competencies include being able to understand the basics of addition and subtraction.³ They spontaneously develop methods of calculating, such as counting onward from the larger number. For example, given the numbers 9 and 2, a child may count "nine, ten, eleven."⁴

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But young children often have difficulty understanding that the number of objects remains the same when the objects are simply shifted around. They may also fail to realize that an elongated or other odd-looking triangle is still a triangle with three sides to it.

A young child's thinking is both concrete and abstract. In terms of concrete thinking, they are able to see that one group of objects is more than another, and to add three toys to four toys and arrive at the sum. One way children demonstrate abstract thinking is by knowing that adding always makes more and subtracting makes less.

A Grasp Of Math Language

Language and literacy are deeply embedded in mathematics education and children begin to grasp this at an early age. From the age of 2 years, for example, they learn the language and grammar of counting, memorize the first 10 or more counting words, then the rules that make the higher numbers.

They learn other kinds of mathematical language, such as "square" and other names of shapes, and words that define quantity, such as "bigger" and "less." Some of these words, such as "more," are among their first words spoken.⁵ Some mathematical words are so pervasive that they are considered aspects of general cognitive development or intelligence and are not often thought of as belonging to mathematics.

Language is necessary to express mathematical thinking and with development children become more aware of their own thinking and begin to express it in words. These skills start to develop in children as young as 4 and 5 years and are essential to not only mathematics, but other topics as well.

But most young children find it difficult to learn the special written symbolism of mathematics, such as the

+ sign for adding and the – sign for subtracting.

Disadvantaged Children

In general, children who are socially and economically disadvantaged perform more poorly in mathematics than their more advantaged peers. However, the patterns of differences are complex.

While the performance of lower SES children on informal addition and subtraction problems is often worse than that of middle SES children, both groups use similar strategies to solve problems, such as counting on from the larger number.⁶

Disadvantaged children tend to have a more difficult time with verbal addition and subtraction, but they per-

form as well as their more advantage peers on non-verbal problems, suggesting they do not lack the basic skills or concepts of addition and subtraction. They also show few differences in everyday mathematics they use in free play.

However, disadvantaged students are more likely to be enrolled in low quality schools and other learning environments that fail to provide effective mathematics education.⁷

Whether children are disadvantaged or not, studies suggest that improving their early mathematics education rests heavily on the content of the math education they are given and the readiness of teachers and child care staff to teach them math.



references

This article was largely based on the following publications:

Ginsberg, H.P., Lee, J.S., & Boyd, J.S. (2008). Mathematics education for young children: What it is and how to promote it. *Social Policy Report*, 22(1), 3-23. www.srcd.org/index.php?option=com_docman&task=doc_download&gid=85

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⁷ Lee, V.E., & Burkham, D.T. (2002). *Inequality at the starting gate: Social background differences in achievement as children begin school*. Washington, DC: Economic Policy Institute.

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