Children’s mathematical abilities begin to form very early in life, several years before they first step into a kindergarten or elementary school classroom, and their exposure to simple math activities can go a long way toward determining how well they grasp mathematics later in school.

Unfortunately, these formative early childhood years also mark the beginning of a troubling knowledge gap in mathematics that is separating America’s low-income children from their more affluent peers, who generally enter school with the benefit of having more highly developed mathematical skills and a better understanding of key concepts.

The gap illustrates a trend that has debilitating consequences for low-income children.

Studies show that early deficits in mathematical knowledge have profound implications for future learning. Researchers report, for example, that children’s knowledge of mathematics in kindergarten predicts their scores on achievement tests during the elementary grades and on into high school.\(^1\)

But there is reason for optimism. The gap separating low-income and more affluent children is widely recognized and researchers are making progress in understanding its roots and are investigating effective ways of narrowing it.

For example, one of the many areas of mathematics that young children from low-income backgrounds struggle with is number sense, a key mathematical ability related to understanding numerical magnitudes. Recent studies suggest there are simple ways to promote the development of number sense during early childhood that could help low-income preschoolers sharpen their overall mathematical knowledge.

**Math Deficits Start Early**

Poor children tend to fall behind quickly

Researchers investigating the development of math knowledge and the early deficits that can jeopardize learning suggest there are simple ways to develop number sense and help children improve their overall understanding of math.

**The Troubling Gap in Math Knowledge**

In general, a child who starts out behind in learning math stays behind throughout his or her school years. Achievement test scores are one measure that provides evidence of the math achievement gap between low-income students and their more affluent peers in U.S. schools.

In western Pennsylvania, for example, a gap in math achievement between low-income students and those from more affluent families was identified by the 2003 Mayor’s Commission on Public Education as one of the challenges facing the Pittsburgh Public Schools.

According to the commission’s report, only 39 percent of all Pittsburgh Public School students in grades 5, 8 and 11 were proficient in mathematics during the 2001-2002 school year, based on Pennsylvania System of School Assessment test scores. But among low-income students, only

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29% earned test scores high enough for them to be considered proficient in math.\(^4\)

Of concern is the fact that students from low-income families account for the majority of students in the Pittsburgh Public Schools. The Pittsburgh commission’s report defined low-income students as those whose family income fell below poverty levels, as well as those with family incomes low enough to qualify for the federal free and reduced lunch program. About 60% of the students enrolled in the Pittsburgh Public Schools in 2001-2002 fell into those categories.

The same achievement test scores show that 52% of all students across Pennsylvania were proficient in math during the 2001-2002 school year cited in the Pittsburgh commission’s report.

Recent evidence suggests that Pennsylvania’s schools are also burdened by a significant gap in math knowledge that divides low-income students from their more affluent peers.

Despite general improvement in statewide academic proficiency scores during the 2007-2008 school year, for example, students who attended school in disadvantaged communities continued to struggle, accounting for 68% of those whose math and verbal scores fell “below basic,” which is the lowest category on the Pennsylvania System of School Assessment.\(^5\)

**Support Is Critical**

Research suggests that the mathematical knowledge gap reflects a difference in the learning support children receive from their parents and others.

Studies have found, for example, that middle-income parents engage in a wider range of math activities with their children and do so more frequently than do parents in low-income households.\(^6\)\(^,\)\(^7\)

And studies point out the benefits of such practices in the home. In general, researchers have found that children whose parents engage in more numerical activities generally possess greater math knowledge.

Such findings underscore the value of designing activities to improve the understanding of numbers that can be widely used among low-income preschoolers who are less likely to be exposed to adequate early math support at home.

Researchers investigating such activities have recently reported progress.

A simple board game, for instance, has shown promise in helping young children develop number sense. Not only has it helped children develop their abilities such as approximating numerical magnitudes, it is both simple and inexpensive enough that it could be widely used to help promote the development of mathematical knowledge among a wide population of young low-income children, who studies show desperately need such support.

**references**

This report is largely based on the following publications.


Children, Youth & Families background is published by the University of Pittsburgh Office of Child Development (OCD), a program of the University of Pittsburgh School of Education. These reports are based on available research and are provided as overviews of topics related to children and families.

**OCD Co-Directors:** Christina J. Groark, Ph.D.; Robert B. McCall, Ph.D.

**background writer/editor:** Jeffery Fraser; e-mail: jd.fraser@comcast.net

University of Pittsburgh Office of Child Development 400 N. Lexington Ave., Pittsburgh, PA 15208; (412) 244-5447; fax: (412) 244-5440

This report and others can be found on the Internet by visiting: http://www.education.pitt.edu/ocd/family/backgrounders.aspx