

RESEARCH ABSTRACT

Patricia O'Hara, M. S., Diane Demarest, M.Ed., and Harriet Shaklee, Ph.D.
University of Idaho Extension, Boise, Idaho

EARLY MATH SKILLS - BUILDING BLOCKS FOR IDAHO'S FUTURE

America's economic growth is fueled by continuing innovation in science and technology. A key challenge is to educate a new generation with the math and science skills needed for today's economy.

Over 20 years of research shows that children build number and math skills from a very early age. Even young infants note when an item is added or subtracted from a small set, showing simple understanding of quantity. Children between 2 and 3 years begin to solve non-verbal calculations and by three to four years of age children show several math skills, including enumeration, number relations, counting, informal addition, subtraction and division (Ginsberg, Klein, & Starkey, 1998). Further evidence shows that children who are strong in prekindergarten math skills such as these are more advanced in math achievement in the 10th grade (Stevenson & Newman, 1986).

Evidence is consistent in showing that Asian children have stronger math skills than their American peers. Research shows parallel differences in early math activities, with Chinese and Taiwanese 3-5 year olds spending more free play time in mathematical activities than their American peers, and showing higher levels of complexity in their math play (Ginsberg, Lin, Ness and Seo, 2003; Lin & Ness, 2000).

Before school age, children's opportunities for development of number sense and mathematical understanding may be largely overlooked. A study of everyday math activities of American preschoolers found that most children were rarely involved in explicit mathematics activities either in lesson or in play. The same study showed parents and teachers frequently engaged with children in literacy activities, perhaps reflecting a cultural emphasis on reading. This evidence shows little attention in American homes and preschools to early math, resulting in "striking disparities in what children know and can do, evident well before they enter kindergarten" (National Academy of Sciences, 2003).



Play: A child's laboratory for exploration

Beginning at birth, children construct knowledge through their senses and their experiences. Through play, children develop an ever-growing understanding of the world around them. Children learn essential math skills through play such as counting, equality, addition and subtraction, planning, patterns, classification, volume and area, and measurement. Children's informal understanding of these concepts provides the foundation on which formal mathematics is built. According to the National Association for the Education of Young Children and the National Council of Teachers of Mathematics, "Play does not guarantee mathematical development, but it offers rich possibilities (2002)."

Parents and teachers can facilitate learning by offering infants, toddlers, and preschoolers opportunities and materials to promote their construction of mathematical thinking. Block-building provides a natural context for development of early math concepts, such as number, quantity, measuring, symmetry and pattern as well as comparisons such as more or less. In fact, research shows that early block play is related to later math competence. Observations of preschool children's block play were unrelated to 3rd and 5th grade math skill. However, early block play and later math performance were related in junior high and high school, when youth were grappling with more advanced math concepts. The researchers found a significant relationship between preschool block performance and number of

math courses taken, number of honors courses, mathematics grades achieved, and math test scores. Even when controlling for IQ and gender, preschool block performance still showed a relationship to later math performance (Wolfgang, Stannard & Jones, 2001).

Block construction offers an opportunity for wonder and exploration and engages all areas of development. What happens if I put the big block on the smaller one – will it balance or will it fall down? Can I make a bridge? What can I use for a car to drive on my block “road?”

As a child moves about a pile of blocks, he or she uses small and large motor skills to navigate. Problem solving and planning is involved as children choose the blocks to use to reach their goal. Children engage their imagination as they use a long rectangle to symbolize a telephone, then line blocks up to form a road. When children build with a friend, they plan and communicate with each other, practicing sharing, persuading, compromising, taking roles. Jointly, they create a new reality and together they can enjoy the power of knocking their creation down.

“I sat at the little Kindergarten tabletop... and played with the cube, the sphere, and the triangle...I soon became susceptible to constructive patterns evolving in everything I saw. I learned to ‘see’ and when I did, I did not care to draw casual incidentals of nature. I wanted to design.”

Frank Lloyd Wright, 1957

Invest Early: A logical conclusion and wise strategy

Research in child development shows elementary math competencies beginning in the earliest years of life, and that children strong in early math skills excel in later math learning. This evidence suggests that those concerned about the preparation of today’s work force for employment in technology sectors would do well to consider the role of the early years in later success.

Considerable research shows the economic value of an early investment in education for children (Rolnick and Grunewald, 2003). The return on early investment is academic success from the day children walk through the school door. Children who enter school with early math competencies are ready to build on those skills through the formal classroom experience. Such children experience the success in school that will enable further study as scientists, mathematicians, architects, and engineers.

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