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Math Matters!

Children's Mathematical Journeys Start Early

What the Research Says: Early Math Skills Matter

Mounting evidence indicates that the mathematics knowledge children develop before entering elementary school is critical to later academic achievement. In a widely cited study of longitudinal data, Duncan et al. (2007) report that in a comparison of math, literacy, and social-emotional development at kindergarten entry, "early math concepts such as knowledge of numbers and ordinality were the most powerful predictors of later learning." Indeed, research consistently indicates that early mathematical proficiency is associated with later proficiency not only in mathematics, but in reading as well (see Volume 46, Issue 5, of Developmental Psychology; Eccles, 2010) and may even be linked to rates of high school graduation. Although the mechanisms underlying such associations are not yet understood, the importance of early math –– and thus of access to it for all students –– is clear.

Moreover, children who begin school with poor math skills typically do not catch up. Across the nation children who have low math scores in the fall of their kindergarten year continue to lag behind their better prepared peers through the 8th grade. Those least prepared are disproportionately children of color and from low-income families. Clearly, any serious effort to close the achievement gap needs to include, if not focus on, children before school entry.

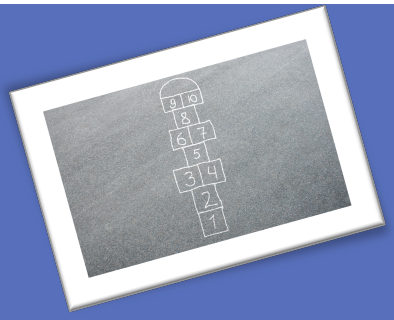
Children are inquisitive. They can learn to think mathematically and they can learn important mathematical practices (seeing patterns, persevering, explaining), in part through play and in part through playful structured learning opportunities. Early mathematical activities, such as games with an underlying mathematical structure (tic-tac-toe, Chutes and Ladders, and others) can be engaging ways for children to build mathematical habits of mind, and can help prepare them for the mathematical activities they will encounter in school. All children should be supported from the beginning in developing their innate capacity to learn math, just as they should be helped to develop their innate capacity to learn language.

Children need to have opportunities to grow mathematically and be supported in that growth.

Rich mathematical activities are engaging. They meet children where they are and offer opportunities and structures for developing deeper understandings. Rich learning environments provide feedback and scaffolding. A teacher's or caregiver's question during puzzle play, "What piece do you think might go there?" can help the child develop planning strategies as well as focus on particular features of the puzzle piece. Children's responses provide important information to the teacher about what they understand and what kind of "scaffolding" (extra support, guidance, and experiences –– not necessarily "telling") they need to master a mathematical concept, and what kinds of challenges they might profitably be given next.

Children need linguistically rich and culturally meaningful mathematical activities

Learning mathematics can and should support the development of literacy, and vice versa. Communicating effectively in and with mathematics (e.g., explaining why a certain method for sharing a set of cars is fair) contributes both to deepening mathematical understanding and to developing linguistic fluency. Mathematical activities also need to be culturally responsive, to build on the knowledge and experience that students bring with them to all formal and informal learning environments (Civil & Khan, 2001; González, Andrade, Civil, & Moll, 2001). A dress-maker showing how she cuts patterns for clothing, or children making "ojos de dios" or copying the geometric patterns in an ornamental rug links mathematics to children's lives, and makes their mathematical experiences more personally relevant.



Children profit both from math play and from structured curriculum

Mathematics concepts may be learned and conveyed through activities that children experience as play –– but mathematics learning does not automatically happen through play. Play or games can effectively reinforce and expand upon what children learn during more focused instructional times (see, e.g., Ginsburg, Lee & Boyd, 2008; Klibanoff, Levine,Huttenlocher, Vasilyeva & Hedges, 2006).

Time needs to be set aside for intentional instruction that has structure, clear math learning goals and that is sensitive to the students' current understanding. Purposeful math instruction can be done in a way that is experienced by children as playful. Dale Farran and others have found a strong association between the amount of teacher-led math instruction and gains children make in mathematics (Farran, Lipsey & Wilson, 2011). Teachers are often concerned that increasing time for math will reduce children's opportunities to develop literacy skills. But studies indicate that increasing math instructional time can both increase math learning and promote language and literacy skills. Learning is not a zero-sum game in that mathematics activities that call for discussion and explanations contribute to both mathematical understandings and to important vocabulary development. In previous research, a half hour per day of focused math instruction and activities has shown substantial benefits for children's math skill development. Thirty 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 informal "teachable moments" throughout the day.