What position does *Principles and Standards for School Mathematics* (NCTM 2000) take on appropriate standards, goals, and activities for preschoolers? This article is a sample of the information from chapter 4, “Standards for Grades Pre-K–2,” which has been selected and annotated by the editors. Please read the chapter for the full story. You can find it on the World Web Web at standards.nctm.org.

**The Early Years**

The early years are crucial to children’s mathematical development. Undoubtedly, mathematical development in the earliest years is important.

- The foundation for children’s mathematical development is established in the earliest years. (p. 73)
- Many mathematics concepts, at least in their intuitive beginnings, develop before school. (p. 73)

*Principles and Standards* advocates that preschoolers need to gain “a solid affective and cognitive foundation in mathematics” (p. 73).

**Nurturing Development**

Early mathematical development should be nurtured. *Principles and Standards* states clearly that adults should nourish preschoolers’ mathematical development.

- Children’s long-term success in learning and development requires high-quality experiences. . . . (p. 74)
- Whether they are cared for by family members during their preschool years or receive care from persons outside their families, all children need their innate desire for learning to be nurtured and supported. (p. 73)

*Principles and Standards* makes several suggestions about how we can support children’s mathematics learning.

**Building on Everyday Experiences**

Nurturing should build on children’s everyday experiences and informal knowledge of mathematics. Children possess an impressive informal knowledge of many mathematics concepts. Much of this knowledge is embedded in their everyday activities and not “abstracted out” as mathematics, that is, it is “premathematical.” Adults can use such implicit knowledge as a starting point for teaching mathematics ideas and skills. Preschoolers are also interested in mathematics itself.

- Children learn through exploring their world; thus, interests and everyday activities are natural vehicles for developing mathematical thinking. (p. 74)
- Mathematics learning builds on the curiosity and enthusiasm of children and grows naturally from their experiences. (p. 73)
- Before they enter school, many children possess a substantive informal knowledge of mathematics. They use mathematical ideas in everyday life and develop mathematical knowledge that can be quite complex and sophisticated. . . . (p. 73)
- Mathematical foundations are laid as playmates create streets and buildings in the sand or make playhouses with empty boxes. Mathematical ideas grow as children count steps across the room or sort collections of rocks and other treasures. They learn mathematical concepts through everyday activities: sorting (putting toys or groceries away), reasoning (comparing and building with blocks), representing (drawing to record ideas), recognizing patterns (talking about daily...
routines, repeating nursery rhymes, and reading predictable books), following directions (singing motion songs such as “Hokey Pokey”), and using spatial visualization (working puzzles). (p. 74)

We call such activities as creating streets in the sand and working puzzles premathematical tasks. These tasks form the developmental foundation of a mathematical idea that will be formed later, but they are not yet mathematics in the mind of a child. They become mathematical when they are reflected on, discussed, abstracted, and represented. For example, a teacher may ask a child to describe or draw the path that she had previously made in the sand, and the child might explain, “Here’s my drawing! See, my road was straight here and then curvy and then straight.” The teacher might extend the work with puzzles by inviting children to solve a computer puzzle in which they use slide, turn, and flip tools to move shapes into place. Using these tools will help children become aware of, differentiate among, and give names to geometric motions.

**Content Emphases**
The mathematical content should emphasize number, geometry, and patterns. The commentary on the Third International Mathematics and Science Study (TIMSS) often criticized the U.S. curriculum for covering too much and sacrificing depth, that is, being a “mile wide and an inch deep.” Principles and Standards takes the approach that sometimes “less is more” by emphasizing core topics.

- At the core of mathematics in the early years are the Number and Geometry Standards. (p. 77)
- Appropriate mathematical experiences challenge young children to explore ideas related to patterns, shapes, numbers, and space with increasing sophistication. (p. 73)
- Number activities oriented toward problem solving can be successful even with very young children and can develop not only counting and number abilities but also such reasoning abilities as classifying and ordering. . . . Recent research has confirmed that an appropriate curriculum strengthens the development of young students’ knowledge of number and geometry. . . . (p. 76)

The foundations for all mathematical understanding form during the early years. Further, to say that the majority of the mathematical concepts and skills that most people use on a daily basis are learned in the pre-K–2 years may not be an overstatement. How should these concepts and skills be taught?
The Adult Role

Adults play an important and active, if sometimes subtle, role. Although mathematics is to be taught, such teaching should be consistent with young children’s unique styles of learning.

- Adults support young children’s diligence and mathematical development when they direct attention to the mathematics children use in their play, challenge them to solve problems, and encourage their persistence. (p. 74)
- Adults can provide access to books and stories with numbers and patterns; to music with actions and directions such as up, down, in, and out; or to games that involve rules and taking turns. (p. 75)
- When children recognize a stop sign by focusing on the octagonal shape, adults have an opportunity to talk about different shapes in the environment. Through careful observation, conversations, and guidance, adults can help children make connections between the mathematics in familiar situations and new ones. (p. 74)

Play is often misinterpreted by those not experienced in early childhood as “just play.” As these quotes illustrate, quality play is not random recreation. Teachers structure the environment, as well as peer and adult-child interactions, to bring forth mathematical ideas. They sing songs with clear patterns and may ask children to abstract and name the pattern (e.g., ABAB). They introduce games, such as variants of war, in which the number card with the greater number of dots wins.

Balancing Activities

Various types and degrees of informal and formal experiences combine to make high-quality preschool education. A formal experience might simply involve showing children the numerals that record what they have been counting.

- High-quality learning results from formal and informal experiences during the preschool years. “Informal” does not mean unplanned or haphazard. Since the most powerful mathematics learning for preschoolers often results from their explorations with problems and materials that interest them, adults should take advantage of opportunities to monitor and influence how children spend their time. (p. 75)
- Preschool and kindergarten teachers, for example, should use naturally occurring opportunities to help students develop number concepts. . . . (p. 80)

With younger children, the more structured group activities should take a back seat to mathematical situations and problems that children find interesting. The adult should then invite and encourage children to engage in mathematical thinking in that context, for instance, counting all the crayons in the room, building a symmetrical block building, or designing a tiling with shapes by using the computer. The adult can make such activities richer mathematically by posing new problems (“What if I put these ramps on this side; how would you keep your building the same on each side?”) and talking with children about their activity.

Language Usage

Informal and formal language should be combined and connected, and both informal and formal language should be valued and encouraged.

- Children need introductions to the language and conventions of mathematics, at the same time maintaining a connection to their informal knowledge and language. They should hear mathematical language being used in meaningful contexts. For example, a parent may ask a child to get the same number of forks as spoons; or a sibling may be taller than they are, but the same sibling may be shorter than the girl next door. Young children need to learn words for comparing and for indicating position and direction at the same time they are developing an understanding of counting and number words. (p. 75)

In our previous examples, the adult might ask children to describe their symmetrical building in their own words, asking them about the two sides if necessary. She might then echo and elaborate on their description by saying, “Yes, it’s the same shape on each side [gesturing]; it’s symmetric!” She might ask them to describe how they kept it symmetric. Later, she might discuss this problem, asking students whether they know of other buildings, of pictures, and so forth, that have symmetry.

Children Needing Special Attention

Children at risk need special attention and support. All children deserve to have their mathematical development nurtured. Some children need special support; otherwise, they will be at risk for failure in school mathematics.

- Some children will need additional support so that they do not start school at a disadvantage. They should be identified with appropriate assessments that are adapted to the needs and characteristics of young children. Interviews and observations, for example, are more appropriate assessment techniques than group tests, which often do not yield complete data. (p. 75)

Research shows that differences in mathematics
achievement later on in school may be caused in part by differences in young children’s informal mathematical knowledge before they enter school. Equity is a crucial concern from the earliest years.

Technology
Computers are beneficial for young children. Principles and Standards supports the use of technology when it furthers mathematical activity and learning. This position is consistent with research.

- The mathematics program in prekindergarten through grade 2 should take advantage of technology. . . . Computers also can make powerful and unique contributions to students’ learning by providing feedback and connections between representations. (p. 77)

In conclusion, Principles and Standards states that the early childhood years are essential for the growth of mathematical thinking; that adults should support this growth; and that this support should be appropriate, balanced, and varied.

Reference

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