Early Childhood Teachers Discuss the Standards

Childhood isn't a race; it's a journey. We need to think about that and give children adequate time to develop as thinkers, as knowers, as mathematicians.

—Kindergarten teacher in focus group

I have been working with a group of primary grade teachers for the past year as they have taken a close look at mathematics teaching and learning for young children. A year ago, the school district adopted a new mathematics program that focuses on reasoning and problem solving, and the teachers have already begun having in-depth discussions about the impact of such an approach on young children. (See “Teaching Young Mathematicians: The Challenges and Rewards,” by Cyndi Frakes and Kate Kline, in the February 2000 issue of Teaching Children Mathematics for one teacher’s story.) This past year, the focus group, which is made up of kindergarten teachers, decided to read and discuss selections from the Principles and Standards for School Mathematics: Discussion Draft (NCTM 1998) to reflect on the ideas in the document. Our discussions revolved around the following main themes: the strong statement about what children know before they enter kindergarten, the focus on the number strand, the importance of communication in mathematics and the unique communication issues pertaining to young children, and the necessity of offering appropriate support for parents of young children.

What Happens before Kindergarten?
The Discussion Draft contains a strong statement about what children learn and know about mathematics before they enter kindergarten. According to the Discussion Draft, young children possess well-developed informal mathematical knowledge gained from their interactions with their environment. Further, many infants, toddlers, and preschool children regularly receive education outside the home. The Discussion Draft notes that more and more children will begin kindergarten with a wider range of experiences and, perhaps, a more developed informal understanding of mathematics.

Although the teachers in our group agreed with this premise, some were disturbed by the statements of what children experience before kindergarten. One teacher commented—

I’m thinking that what they say the children should have coming in worries me. I get the impression that they want us to build upon that, and some of these children don’t have those experiences before they come into kindergarten to build upon. And if they are assuming that these children are coming in ready, that worries me.
Other teachers commented that they did not think the Discussion Draft assumed that all, or even most, children would be better prepared for kindergarten in the future. Rather, they thought that the more important point was that many children do possess a developed informal knowledge about mathematics and that teachers must work harder to tap into that knowledge and build on it.

One teacher called our attention to the Discussion Draft’s description of high-quality early childhood programs to help resolve this issue (p. 105). The document states that such programs—

- build on and extend children’s intuitive and informal mathematical knowledge;
- are grounded in current knowledge of child development;
- establish environments that encourage children to be active learners who are eager for new challenges;
- develop a strong conceptual framework that provides anchoring for skills acquisition; and
- nurture and develop children’s natural inclination to solve problems.

These recommendations made sense and fit with the teachers’ beliefs in developmentally appropriate instruction. As one teacher commented—

This is nice. This sounds very child centered rather than revolving around curriculum—just getting through the curriculum. Everything is usually so driven by that. And it focuses on developing concepts and understanding that extends children—builds upon what they know.

As we discussed the kinds of concepts or conceptual framework that were important for young children to develop, we naturally began talking about number. Understanding number and number operations is crucial for success in mathematics and certainly a central focus in the primary grades. The Discussion Draft describes number, along with geometry, as the two primary content goals in early childhood mathematics education.

The Number Strand

Two of the major goals in the number strand described in the document are (1) understanding numbers, ways of representing numbers, relationships among numbers, and number systems and (2) understanding the meaning of operations and how they relate to one another. We agreed that these goals were important and talked about the fact that young children first begin to make sense of numbers through counting. We also discussed the importance of helping children attach meaning to the counting sequences that they are able to memorize. One teacher commented that she helped students begin to develop meaning for counting sequences by focusing on numbers that are less than 10. She thought that this approach enabled children to explore relationships among numbers and begin to think about combinations that make up other numbers.

A discussion of the second major goal, understanding the meaning of operations, led to an interesting debate about which operations to consider with young children. We all agreed that the focus at the early childhood level should be on addition and subtraction. Children encounter in their everyday lives many situations that involve combining or separating two amounts, and teachers can capitalize on these situations. One teacher also noted that children encounter multiplication and division situations, as well. She described a student who wanted to figure out how many Pokémon cards were in her card collection, after having sorted them into five binder sleeves that could hold four cards each. The teacher also talked about equal-sharing situations that occur when students want to share something with others in the class, such as dividing twelve crackers among three children.

At first, the teacher thought that pursuing these kinds of problems with young children might be inappropriate. She realized, however, that if the problems were easy to model directly, then most of the children could solve them. This teacher commented—

In fact, my fourth-grade daughter has more difficulty figuring out division problems than my kindergartners. Granted, the numbers are more difficult, but she doesn’t want to think about what the problems mean. My kindergarten students seem more able to use what they know about counting and even number relationships to solve these problems.

Once students found solutions, the teacher also thought that having them share their strategies with classmates solidifies children’s understanding of the operations. She mentioned that children naturally used such terms as “putting together” for addition and “taking apart” for subtraction when they explained what they did to solve problems. They were also beginning to develop notions of equal groups for multiplication and division.

Communication in Mathematics

The Discussion Draft (p. 140) notes that mathematics programs “should use communication to
foster understanding of mathematics.” The teachers agreed that requiring children to communicate their ideas using pictures, words, and symbols enhanced their understanding of mathematics, but many also struggled to find effective ways to put these forms of communication into practice with young children. As one teacher said—

Right now, at the beginning of the year, we’re trying to do discussions and things like that, and it’s really hard because the kids shrug their shoulders or they say something that’s way off. And they get onto the subject of their cat or whatever.

The teacher went on to say that with perseverance as the year goes on, however, students do improve in their abilities to focus on a particular topic, express themselves clearly, and listen to the ideas of others. The teachers shared a number of instructional techniques that are effective in encouraging and developing communication in mathematics, including these:

- Encourage students to use a combination of concrete objects, pictures, words, and symbols to communicate their ideas.
- Ask students to make conjectures about “what might happen if . . . ” situations. Return to those conjectures after students have investigated a problem to discuss which ideas still hold true.
- Have students describe the strategies they used to reach their solutions, as they share solutions with the class.
- Allow other students to ask questions of each student who shares his or her solution and method.
- Ask one student to rephrase or repeat another student’s explanation.

We also discussed the importance and difficulty of asking good questions that are engaging and eliciting conversation. One teacher described a particular episode that took place in her classroom when the students were discussing patterns. The students were working in pairs to create a pattern using multilink cubes. One pair of students created a train with a repeating pattern of green-yellow-yellow. Students had nine cubes linked together, and the teacher asked them what came next. The teacher described the episode as follows:

They’ve done the pattern, but they couldn’t tell me what comes next. And then I had to stop and think, “Okay. Now what do I say?” So then I have them start from the beginning and say a color as they point to each cube. And then they can tell me what comes next. But then I wondered if they were just repeating this string of words and not really recognizing their pattern. So with the next pair of students, I was prepared. I thought about what I could ask to get them to think about their pattern. I asked them, “Can you describe your pattern to me?” I was amazed at how differently students responded to this question. They talked about what the repeating unit was, how many pieces they needed to see in their pattern to figure out what the unit was, and how it was different from the pattern their partner had made.

We in the group realized that wondering about children’s knowledge led to better questioning. One teacher’s helpful reminder was to ask herself the following question (from Richardson [1997]) before she asked students a question: “Do I already know what I want the answer to be, or am I really curious about what this child is thinking?”

Supporting Parents

Although much of what the group discussed revolved around what teachers can do in school, we also voiced concern about supporting parents and suggesting activities that they can do with their children at home. As the Discussion Draft states, “Quality experiences for children are most likely to occur in environments that are rich in language, encourage children’s thinking, value children’s uniqueness, and nurture children’s explorations” (pp. 103–4). This statement obviously applies to both home and school environments. We talked about the fact that both parents and teachers of young children are naturally inclined to try to help by doing things for children or by simplifying tasks so that they are easily accomplished. In addition, we recognized the difficulty of asking good questions that encourage children to think in school, let alone in more informal situations at home.

We asked ourselves, “How can teachers support parents to take advantage of at-home learning opportunities that promote thinking?” One teacher expressed frustration with the idea of sending letters to parents containing examples of good, thought-provoking questions that they might ask their children about mathematics. She thought that the parents who read the letters were usually not the ones she most wanted to reach. We agreed that a more effective approach was to use open house or family math nights to provide opportunities for parents to experience mathematics in the same way as their children experienced it in school. Many teachers found that parents better understand the value of asking their children to think when they themselves are required to investigate a mathematical problem, make conjectures, listen to others’ ideas, and respond to thought-provoking questions from a teacher.

Conclusion

Reflecting on the Discussion Draft led to thoughtful and substantive conversations about mathemat-
ics teaching and learning. The Discussion Draft served as a vehicle for our focus group to talk about issues, such as supporting parents, that had concerned us for some time and to share ideas for solutions. The group discussions resulted in helpful suggestions for thinking about communication in mathematics and helped to solidify our beliefs about effective practice. Now that the final version of Principles and Standards for School Mathematics is available, I encourage others to meet with colleagues to discuss the document and work toward developing a shared vision of the teaching of early childhood mathematics.

References

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