One common function of language is in defining terms and stating rules for performing mathematical operations. A second, broader function is the use of language as a means of connecting mathematical operations to the real world and of integrating what children know about mathematics. We find that American elementary school teachers are more prone to use language to define terms and state rules than are Asian teachers, who, in their efforts to make mathematics meaningful, use language to clarify different aspects of mathematics and to integrate what children know about mathematics with the demands of real-world problems. Here is an example of what we mean by a class in which the teacher defines terms and states rules:

> An American teacher announces that the lesson today concerns fractions. Fractions are defined and she names the numerator and denominator. "What do we call this?" she then asks. "And this?" After assuring herself that the children understand the meaning of the terms, she spends the rest of the lesson teaching them to apply the rules for forming fractions.

Asian teachers tend to reverse the procedure. They focus initially on interpreting and relating a real-world problem to the quantification that is necessary for a mathematical solution and then to define terms and state rules. In the following example, a third-grade teacher in Japan was also teaching a lesson that introduced the notation system for fractions.

> The lesson began with the teacher posing the question of how many liters of juice (colored water) were contained in a large beaker. "More than one liter," answered one child. "One and a half liters," answered another. After several children had made guesses, the teacher suggested that they pour the juice into some one-liter beakers and see. Horizontal lines on each beaker divided it into thirds. The juice filled one beaker and part of a second. The teacher pointed out that the water came up to the first line on the second beaker—only one of the three parts was full. The procedure was repeated with a second set of beakers to illustrate the concept of one-half. After stating that there had been one and one-out-of-three liters of juice in the first big beaker and one and one-out-of-two liters in the second, the teacher wrote the fractions on the board. He continued the lesson by asking the children how to represent two parts out of three, two parts out of five, and so forth. Near the end of the period he mentioned the term "fraction" for the first time and attached names to the numerator and the denominator. He ended the lesson by summarizing how fractions can be used to represent the parts of a whole.

In the second example, the concept of fractions emerged from a meaningful experience; in the first, it was introduced initially as an abstract concept. The terms and operations in the second example flowed naturally from the teacher's questions and discussion; in the first, language was used primarily for defining and summarizing rules. Mathematics ultimately requires abstract representation, but young children understand such representation more readily if it is derived from meaningful experience than if it results from learning definitions and rules.

Asian teachers generally are more likely than American teachers to engage their students, even very young ones, in the discussion of mathematical concepts. The kind of verbal discussion we find in American classrooms is more short-answer in nature, oriented, for example, toward clarifying the correct way to implement a computational procedure.

Teachers ask questions for different reasons in the United States and in Japan. In the United States, the purpose of a question is to get an answer. In Japan, teachers pose questions to stimulate thought. A Japanese teacher considers a question to be a poor one if it elicits an immediate answer, for this indicates that students were not challenged to think. One teacher we interviewed told us of discussions she had with her fellow teachers on how to improve teaching practices. "What do you talk about?" we wondered. "A great deal of time," she reported, "is spent talking about questions we can pose to the class—which wordings work best to get students involved in thinking and discussing the material. One good question can keep a whole class going for a long time; a bad one produces little more than a simple answer."

In one memorable example recorded by our observers, a Japanese first-grade teacher began her class by posing the question to one of her students: "Would you explain the difference between what we learned in yesterday's lesson and what you came across in preparing for today's lesson?" The young student thought for a long time, but then answered the question intelligently, a performance that undoubtedly enhanced his understanding of both lessons.

Concrete Representations

Every elementary school student in Sendai possesses a "Math Set," a box of colorful, well-designed materials for teaching mathematical concepts: tiles, clock,