American children. Among the top one hundred first graders in mathematics, there were only fifteen American children. And only one American child appeared among the top one hundred fifth graders. The highest-scoring American classroom obtained an average score lower than that of the lowest-scoring Japanese classroom and of all but one of the twenty classrooms in Taipei. In whatever way we looked at the data, the poor performance of American children was evident.

These data are startling, but no more so than the results of a study that involved 40 first- and 40 fifth-grade classrooms in the metropolitan area of Chicago—a very representative sample of the city and the suburbs of Cook County—and twenty-two classes in each of these grades in metropolitan Beijing (China). In this study, children were given a battery of mathematics tasks that included diverse problems, such as estimating the distance between a tree and a hidden treasure on a map, deciding who won a race on the basis of data in a graph, trying to explain subtraction to visiting Martians, or calculating the sum of nineteen and forty-five. There was no area in which the American children were competitive with those from China. The Chinese children's superiority appeared in complex tasks involving the application of knowledge as well as in the routines of computation. When fifth graders were asked, for example, how many members of a stamp club with twenty-four members collected only foreign stamps if five-sixths of the members did so, 59 percent of Beijing children, but only 9 percent of the Chicago children produced the correct answer. On a computation test, only 2.2 percent of the Chinese fifth graders scored at or below the mean for their American counterparts. All of the twenty Chicago area schools had average scores on the fifth-grade geometry test that were below those of the Beijing schools. The results from all these tasks paint a bleak picture of American children's competencies in mathematics.[2]

The poor performance of American students compels us to try to understand the reasons why. We have written extensively elsewhere about the cultural differences in attitudes toward learning and toward the importance of effort vs. innate ability and about the substantially greater amounts of time Japanese and Chinese students devote to academic activities in general and to the study of math in particular.[3] Important as these factors are, they do not tell the whole story. For that we have to take a close look inside the classrooms of Japan, China, and the United States to see how mathematics is actually taught in the three cultures.

## Lessons Not Lectures

If we were asked briefly to characterize classes in Japan and China, we would say that they consist of coherent lessons that are presented in a thoughtful, relaxed, and nonauthoritarian manner. Teachers frequently rely on students as sources of information. Lessons are oriented toward problem solving rather than rote mastery of facts and procedures and utilize many different types of representational materials. The role assumed by the teacher is that of knowledgeable guide, rather than that of prime dispenser of information and arbiter of what is correct. There is frequent verbal interaction in the classroom as the teacher attempts to stimulate students to produce, explain, and evaluate solutions to problems. These characteristics contradict stereotypes held by most Westerners about Asian teaching practices. Lessons are not rote; they are not filled with drill. Teachers do not spend large amounts of time lecturing but attempt to lead the children in productive interactions and discussions. And the children are not the passive automata depicted in Western descriptions but active participants in the learning process.

We begin by discussing what we mean by the coherence of a lesson. One way to think of a lesson is by using the analog of a story. A good story is highly organized; it has a beginning, a middle, and an end; and it follows a protagonist who meets challenges and resolves problems that arise along the way. Above all, a good story engages the reader's interest in a series of interconnected events, which are best understood in the context of the events that precede and follow it.

Such a concept of a lesson guides the organization of instruction in Asia. The curricula are defined in terms of coherent lessons, each carefully designed to fill a forty- to fifty-minute class period with sustained attention to the development of some concept or skill. Like a good story, the lesson has an introduction, a conclusion, and a consistent theme.

We can illustrate what we are talking about with this account of a fifth-grade Japanese mathematics class:

> The teacher walks in carrying a large paper bag full of clinking glass. Entering the classroom with a large paper bag is highly unusual, and by the time she has placed the bag on her desk the students are regarding her with rapt attention. What's in the bag? She begins to pull items out of the bag, placing them, one-by-one, on her desk. She removes a pitcher and a vase. A beer bottle evokes laughter and surprise. She soon has six containers lined up on her desk. The children continue to watch intently, glancing back and forth at each other as they seek to understand the purpose of this display.
>
> The teacher, looking thoughtfully at the containers, poses a question: "I wonder which one would hold the most water?" Hands go up, and the teacher calls on different students to give their