interested in exploring mathematics by developing new methods for solving problems. The teachers seem less concerned about motivating the topics in non-mathematical ways.

If one believes that mathematics is mostly a set of procedures and the goal is to help students become proficient in executing the procedures, as many U.S. teachers seem to believe, then it would be understandable also to believe that mathematics is learned best by mastering the material incrementally, piece by piece. This view of skill-learning has a long history in the U.S.[3] Procedures are learned by practicing them many times, with subsequent exercises being slightly more difficult than the exercises that preceded them. Practice should be relatively error-free, with high levels of success at each point. Confusion and frustration should be minimized; they are signs that the earlier material was not mastered. The more exercises, the more smoothly learning will proceed.

Suppose students are studying how to add and subtract fractions with unlike denominators, such as 2/3 + 4/7. These beliefs about learning would say that stu-

The TIMSS Videotape Study

By James W. Stigler and James Hiebert

THE VIDEO study that we conducted as a part of the Third International Mathematics and Science Study (TIMSS) collected samples of classroom instruction from 231 eighth-grade math classrooms in Germany, Japan, and the United States. It was the first time anyone had videotaped classroom instruction from nationally representative samples of teachers.

The study was a test run to allow us to see whether such a study would be feasible on a large scale. In the meantime, we hoped to get insight into what actually goes on inside the eighth-grade math classrooms in these three countries. It is relatively easy to gather data about classroom input by looking at curricula and textbooks and to get an idea about results from test scores. However, the classes themselves have been a black box; we have had little or no information about the process of teaching. Once coded and analyzed, the videotapes opened a new window on classroom practice. Furthermore, they revealed some fascinating national differences in a number of areas, including the following:

- The way the lessons are structured and delivered
- The kind of mathematics taught
- The kind of thinking students engage in during the lessons
- The way teachers view reform

Procedures

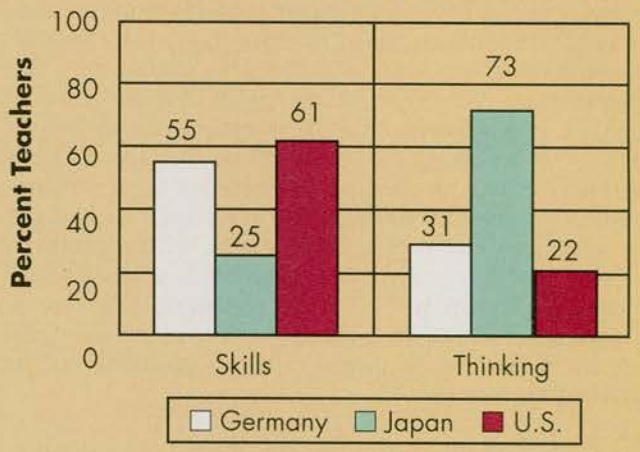
We videotaped each classroom one time, on a date convenient for the teacher. In order to discourage teachers from making special preparations for the videotaped lesson, we issued instructions telling them that our goal was to capture a typical lesson and that we wanted them to show us exactly what they would have done had we not been videotaping.

In addition to the data from the videotapes, we collected responses to a questionnaire and some supplementary materials—for example, copies of textbook pages or worksheets. The questionnaire asked teachers to describe the goal of the lesson, its place within the current sequence of lessons, how typical the lesson was, and whether teachers had used methods recommended by current reforms.

Lessons: Structure and Delivery

1. Lesson Goals

FIGURE 1



Teachers' descriptions of the lesson goal

To evaluate a classroom mathematics lesson, you must first know what the teacher was trying to accomplish. We asked teachers, on the questionnaire, to tell us what they "wanted students to learn" from the lessons we videotaped. Most of the answers fell into one of two categories:

> Skills—These answers focused on students being able to *do* something: perform a procedure, solve a specific type of problem.
>
> Thinking—These answers focused on students being able to *understand* mathematical concepts or ideas.

As the graph indicates, Japanese teachers focused on thinking and understanding; German and U.S. teachers on skills. These different goals led Japanese teachers to construct their lessons in a different way from U.S. and German teachers.

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