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Anticipating Children's Thinking: A Japanese Approach to Instruction

by Tad Watanabe

Results from the Third International Mathematics and Science Study (TIMSS) suggested that the nature of mathematics teaching in Japan is different from that commonly seen in the United States. Although the TIMSS focused on the eighth-grade level, other studies suggest that a similar difference also exists at the elementary school level. My recent seven-month visit to Japan, which included observations of more than 50 lessons, seems to confirm this difference. For example, Japanese lessons often focus on a single fundamental problem. Also, students' solutions are shared and analyzed critically, and teachers often appear to stand aside during the class discussion. I would like to discuss one factor that may contribute to the difference in performance between Japanese students and students in the United States. That factor is teachers' anticipation of students' thinking.



I first noticed the importance of anticipating children's thinking for mathematics teachers in Japan when a university mathematics educator showed me a videotape of an exemplary mathematics teacher. When I asked him why he thought that the teacher was exemplary, he told me that the teacher was able to accurately anticipate how his students would respond to the problems that he posed to the class. For him, the teacher's ability to anticipate students' thinking was an important indicator of good mathematics teaching. In observing lessons and talking with Japanese teachers, it became clear that other Japanese teachers shared this perspective.

The anticipation of children's thinking plays an important role before, during, and after the lesson. For example, in an introductory lesson on division with fractions, a fourth-grade teacher posed the following four division problems and asked the students to find the answers by using what they had already learned:

$$3/5 \div 1/5, 2/5 \div 3/4, 1 \div 2/5, 2 \div 1/4$$

After the students thought about these problems for some time, he asked the students to tell him which problems they could solve most easily. Many students responded that they knew that the answer to the first one was 3 and that the answer to the last one was 8. Then the teacher began the whole class discussion by posing the problem $2 \div 1/4$. After the lesson, the teacher explained that he chose to begin the class discussion with this problem because the goal of the lesson was for students to think about computation strategies. He knew that most, if not all, students solved $3/5 \div 1/5$ by using the quotitive meaning of division (How many $1/5$'s are in $3/5$?). However, he believed that starting the discussion with $2 \div 1/4$ would be more beneficial because he anticipated that his students would use various strategies to find the answer. He could then also ask his students how various strategies used for $2 \div 1/4$ could be used with $3/5 \div 1/5$, and vice versa, keeping the focus on computation strategies. Thus, by anticipating his students' thinking, he was able to not only select appropriate problems but also orchestrate a more productive class discussion. Moreover, during the class discussion, he could afford to stand aside because he anticipated where the discussion would lead and when he would need to assume a guiding role.

This is just one example of how anticipating children's thinking plays an important role in Japanese teachers' teaching of mathematics. However, as we look at the mathematics education practices of Japan, we must remember that we should never transplant those practices to North America just because the Japanese do it. Rather, we must critically analyze what Japanese teachers do and why they do it. Only after we agree that the practice is sound and effective should we consider adopting it in our own practices. So, is anticipating children's thinking a sound teaching practice?

Principles and Standards for School Mathematics (Reston, Va.: NCTM, 2000) states,

Effective mathematics teaching requires a serious commitment to the development of students' understanding of mathematics. Because students learn by connecting new ideas to prior knowledge, teachers must understand what their students already know. Effective teachers know how to ask questions and plan lessons that reveal students' prior knowledge; they can then design experiences and lessons that respond to, and build on, this knowledge. (p. 18)

This perspective is consistent with the previously described Japanese approach. The Japanese approach to anticipating students' thinking requires understanding what students already know and represents an effective tool for knowing what questions to ask, how to ask them, and how to design appropriate learning experiences.

Teachers often express their concern about classroom management. Usually what they mean by "classroom management" is behavioral management. However, managing students' learning is just as important as having control over classroom behavior. Anticipating students' thinking in planning, implementing, and reflecting on lessons may help teachers manage students' learning. Perhaps professional development programs should consider how to assist teachers more in developing their ability to anticipate students' thinking. We can learn this lesson by comparing mathematics education in Japan with mathematics education in the United States.

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