

Teaching Is a System

ALTHOUGH VIDEOTAPES are a rich source of information, they provide only glimpses of the full activity of teaching. We have found images of teaching in each country, and we have constructed indicators that measure the features of classroom lessons in each country. These images and indicators provide only partial views of teaching, however. It is as if we are seeing the peaks of mountain ranges poking above the surface of the water. The videotapes provide views of these mountaintop islands, but still hidden, underneath the surface, are the mountain ranges.

We discovered that mountain ranges lay beneath the surface as we asked ourselves why the indicators revealed certain differences among the countries. Consider the following simple indicator. Many mathematics teachers in the United States use an overhead projector, whereas almost all teachers in Japan prefer the chalkboard.' Some would say this is a trivial difference and not worth worrying about. But when we look more closely at this superficial difference we see that it points to a deeper, more significant difference in the way teaching is conducted.

When we look again at teachers using overhead projectors

and chalkboards, we begin to see that teachers in the two countries do not just use different visual devices, they use them in different ways. Most teachers in the United States use visual devices to focus students' attention. They use both overhead projectors and chalkboards to display information in written or graphic form while they are describing it orally. As they finish each part of their oral presentation, they often erase that part of the written material and move to the next item. Whether they use overhead projectors or chalkboards, they use these visual aids to keep students' attention directed toward the information of the moment. This observation is not a new revelation. Many preservice teacher-training programs offer advice on using overhead projectors in just this way. Readers who have participated in such teacher training might remember being told to cover up all the items on the transparency except the one being presented, then to move the cover down to the next item, and so on. When finished presenting the last item, the teacher is told to turn off the projector so as to reclaim students' attention.

Japanese teachers use visual aids for a very different purpose: to provide a record of the problems and solution methods and principles that are discussed during the lesson. The first item of information in the lesson is placed at the far left of the chalkboard; the next item, whether presented by a student or the teacher, is written next to it; and so on. The record builds, left to right, as the lesson proceeds. Many Japanese teachers finish the lesson with a full chalkboard, showing a complete record of the lesson.

The fact that U.S. teachers frequently use overhead projectors and Japanese teachers use only chalkboards indicates much more than a whimsical preference in visual aids. Given how these aids are employed in each culture, we can now see

that Japanese teachers would *not* use overhead projectors, whereas U.S. teachers would use either one but probably would find overhead projectors more effective. Visual aids function very differently in these two different systems of teaching.

And here is the significant truth about teaching that this simple-seeming indicator reveals: teaching is a *system*. It is not a loose mixture of individual features thrown together by the teacher. It works more like a machine, with the parts operating together and reinforcing one another, driving the vehicle forward. In the U.S. machine, or system, there is a slot for a visual aid that helps focus students' attention. The overhead projector serves this purpose as well as, or better than, the chalkboard, so it is easy to see why many teachers have shifted to the overhead. In the Japanese system, there is no such slot. Instead, there is a slot for presenting a cumulative record of the day's lesson. The overhead projector does not function in this way, so Japanese teachers do not use it; they continue to use the chalkboard.²

If teaching is a system, then each feature, by itself, doesn't say much about the kind of teaching that is going on. What is important is how the features fit together to form a whole. How does one feature connect with the next one? How does an activity near the end of the lesson link back with one at the beginning? This is a very different way to think about teaching. It means that individual features make sense only in terms of how they relate with others that surround them. It means that most individual features, by themselves, are not good or bad. Their value depends on how they connect with others and fit into the lesson.

One lesson we described briefly in Chapter 3 began with pure memorization. The teacher asked students to recite three properties they had learned already about parallelograms, such as "opposite sides are parallel and of equal length." Individual