5. Researchers' Comments (English)

00:00:00 **Lesson length**. This lesson is about 52 minutes in duration, which is very close to the average length of Japanese lessons of 50 minutes (Roth et al., 2006, *Teaching Science in Five Countries: Results from the TIMSS 1999 Video Study* [hereafter Video Report], table 3.1).

00:00:10 **Reviewing previous content**. This lesson is a continuation from the previous lesson about the electrolysis of water. The teacher reviews previous information, then begins discussing new material at 00:03:50. Only 33% of the Japanese lessons included review, and it accounted for only three percent, on average, of lesson time (Video Report, tables 3.3 and 3.4). Developing new content accounted for 93% of lesson time (Video Report, table 3.4).

00:03:50 **Making connections**. The teacher sets up the problem for today's activity. She asks the class if it is possible to make water by putting hydrogen and oxygen together. This statement poses a question that will be answered through the collection of data. This approach to content development makes connections among data, patterns, and ideas. This approach was dominant in the Japanese lessons. Seventy-two percent of the Japanese lessons developed science content primarily through making connections, more than in all the other countries except Australia (Video Report, figure 5.5).

Inquiry/Inductive mode of development. In this particular lesson, the teacher helps students make connections through an inquiry/inductive approach where explanations are constructed from patterns in data or from experiences. The teacher sets up the problem; the students generate data, identify patterns in the data, and construct explanations for these patterns. Upon completion of the lesson, they are able to conclude that water is made from hydrogen and oxygen by using an electrolytic spark. In the Japanese data set, 57% of the lessons developed science ideas by making connections in an inquiry/inductive mode, which was significantly greater than the lessons in the Czech Republic, the Netherlands, and the United States (Video Report, figure 5.6).

00:04:55 **Making predictions**. At this point the teacher tells the students to predict whether or not oxygen and hydrogen can be combined to make water, and how this might be done. Twenty-three percent of the Japanese lessons had students making predictions related to independent practical work (Video Report, table 7.3).

00:09:25 **Teacher-student interaction**. A student privately asks the teacher to explain how a piece of equipment works and the teacher responds. This is an example of a teacher-student interaction during independent work time. On average, 22% of the science instruction time in the Japanese lessons was spent on private teacher-student interaction talk (Video Report, figure 9.2).

00:12:04 **Discussion**. The teacher stops the independent non-practical activity so that students can explain their ideas publicly. She uses questioning as a form of discussion. Only 10% of science instruction time was devoted to public discussion, less than all the other countries except the Netherlands (Video Report, figure 9.1).

00:18:16 **Whole-class practical activity**. At this point the teacher begins a whole-class practical activity where she will ignite hydrogen and oxygen with an electric spark inside an

ignition tube. She demonstrates how she will ignite the gases using a spark generator. Whole-class practical activities occurred in 77% of the Japanese lessons (Video Report, table 3.5).

00:23:30 **Canonical knowledge**. While setting up the practical demonstration to ignite oxygen and hydrogen, the teacher and students discuss canonical knowledge. For example, the teacher has students identify the colorless transparent liquid as hydrochloric acid. She also lets them know that air needs to escape before they can get 100% hydrogen. In the Japanese lessons, 44% of public talk time was devoted to canonical information (Video Report, figure 4.3).

00:34:03 **Visual representations**. The teacher instructs students to open their textbooks to page 81. She focuses their attention on the diagram on that page and draws a modification on the chalkboard. This drawing is an example of a visual representation that provides supporting explanations or descriptions of science knowledge. On average, 95% of the Japanese lessons contained visual representations (Video Report, figure 6.1).