Lesson Study for the Effective Use of Open-Ended Problems

“Solutions to mathematics problems are either right or wrong; there is only one correct answer.” Problems set up in this format are called “closed-ended problems,” and stand in contrast to “open-ended problems,” or conditional problems in which several correct answers are possible, that is, problems where the result is, as indicated by their name, open-ended. These were initially devised for evaluating high level objectives of mathematics education about 30 years ago (Becker, Jerry P. and Shigeru Shimada, eds. The Open-Ended Approach: A New Proposal for Teaching Mathematics.1).


The three elements of Lesson Study are (1) the lesson plan (researching material), (2) lesson observation (study lesson), and (3) the feedback session. Consider, for example, a lesson in the last unit on the multiplication table in which students are asked to “find patterns in the multiplication table.” This example can be used from elementary school to high school, but the actual wording above was taken from a high school example.

To draft a lesson plan (element 1), the teacher has to try to think of as many of the possible student responses to an open-ended problem, “which has many correct solutions,” as possible. After conducting the lesson observation (element 2), it is important that the “many correct answers” be organized in the feedback session (element 3). Sharing the findings of the Lesson Study and working with people overseas on joint research projects are valuable ways in which teachers can learn from one another.

After the 9th International Congress on Mathematical Education (ICME-9) in 2000, post-ICME-9 seminars (between Japan and the USA) were held in Japan at the National Institute for Educational Research and the University of Tsukuba Attached Elementary School. The seminar focused on elementary school Lesson Study. Lesson Study events were also held at elementary, junior high, and senior high schools in 2001 (in North Carolina) and 2002 (Kanagawa Prefecture).
Closed-ended problem

Open-ended problem

Multiplication Table

Instructions:
Look closely at how this table is aligned and identify as many properties of the table as you can.
The three elements of Lesson Study

Lesson Plan

Lesson Observation

Feedback Session

Lesson Study

Japan

USA

2000  (National Institute for Educational Research, University of Tsukuba Attached Elementary School)

2001  (North Carolina High School of Science and Mathematics)

2002  (Yokohama National University)