

## **Problem Posing in Mathematics**

Spring 2004: 2 credit course

Framingham State College Division of Graduate and Continuing Education

Instructor: Jane Gorman, EDC.

Meeting Times/Dates:

2.5 hour "kick-off" workshop on 9/15/03 plus all-day workshops on the following dates:

12/5/03, 3/3/04, 5/7/04(tentative date) (Total = 24 hrs)

Requirements: Attend workshops, do 4 readings with short reflection, write 5-page paper (lesson).

### Course Description

Lesson study is a simple but powerful model of professional development commonly used in Japan. One of the main principles underlying lesson study is the idea that teachers can build expertise by developing their own research, in the form of lessons designed to address some particular teaching or learning challenge. The first year graduate credit course (Lesson Study in Mathematics) gave participants an overview of this powerful new way to study and improve teaching and build professional community. In this, the second course, participants will focus intensively on the actual posing of challenging mathematics problems and develop and test their own theories about how best to use such challenging problems in their own classrooms.

In Japan, an entire lesson is often centered on one challenging and engaging problem: the "hatsumon." International comparison studies (TIMSS) brought to light how much more challenging these problems were than what was typical in US classrooms. Many reform curricula in the U.S. emphasize use of "investigations" in this same spirit. The central text of this course is a collaborative effort of American and Japanese educators, with a focus on one type of "hatsumon" that is open to multiple solutions and methods.

In this course, teachers will deepen their lesson study work by reading about problem posing (from American and Japanese authors) and by designing a research lesson based on what they have learned. In their final paper, they will present this research lesson, and give a rationale for how the central problem in the lesson is expected to develop student understanding of the topic.

### Readings:

*Aspects of Mathematics Teacher Education in Japan: Focusing on Teachers' Roles*, Yoshinori Shimizu, *Journal of Mathematics Teacher Education*, v2: 1999. In this article, the parts of a lesson and the teacher's role in each phase of the lesson is described, as practiced in many Japanese classrooms. The term "hatsumon" is explained.

Reflection question: The Japanese education community has built up, over the years, a common vocabulary to describe different aspects of a typical lesson, and of the teacher's roles and activities. Comment on how Shimizu's model relates to your own lessons, or your own views on teaching. If your model is quite different, describe the differences in structure or teacher role. If your model is quite similar, add to his descriptions from your own experience.

*Problem Posing.* The Making Math web site ([www2.edc.org/makingmath/](http://www2.edc.org/makingmath/)) is built on the premise that research in mathematics is something people can do at all levels - by continually posing new problems that emerge from the mathematics they are exploring.

Have some fun working on one of the research problems at the site. (If appropriate, you might also give the problem to your students to work on.) Also read the essay on problem posing in the site's teacher resource center.

([www2.edc.org/makingmath/handbook/Teacher/ProblemPosing.asp](http://www2.edc.org/makingmath/handbook/Teacher/ProblemPosing.asp)). Reflect on what the value of this kind of mathematical investigation might be for yourself or for your students.

*Habits of Mind, An Organizing Principle for Mathematics Curriculum*, Al Cuoco, E.Paul Goldenberg, June Mark, Education Development Center, Inc. This is a seminal and thought-provoking essay on teaching and learning mathematics authored by June Mark (of our project staff) along with two EDC colleagues. Are we teaching mathematics as a set of procedures or as a way of thinking, or perhaps both? What kind of habits of mind do our students need in order to learn and do math?

Reflection question: Select one (or more) of the "habits of mind" described in the article that you think is particularly important in understanding mathematics, reflect on how this habit might be learned by students. What kinds of problems might you pose that encourage development of this habit?

*The Open-Ended Approach, A New Proposal for Teaching Mathematics*, Becker and Shimada, NCTM, 1997. Introductory chapters present a philosophy about the value of posing open-ended questions in math class and techniques for creating open lessons. The text also includes research lessons (prepared by Japanese teachers) that explore this open approach.

Reflection question: According to the first TIMSS video study, 10 years ago most American math classrooms had very few open-ended questions posed. The typical lesson consisted of teacher explanation followed by student practice, and most questions posed called for short right-wrong answers. Reflect and write on one or more of these questions: How does teacher explanation fit into the open-ended approach? What do you personally see as the biggest benefit(s) and negative(s) of this approach? Where is your teaching headed with regard to use of open-ended questions? What questions about problem posing are you most interested in exploring at the present time?

Final Paper: due 6/30/04 (5 pages plus lesson plan)

Inspired by the direction of your own research interests and by your readings on problem posing in mathematics, prepare a research lesson for a class you teach. Write a rationale statement that explains your research question, your goals for student understanding, and how the problem(s) posed in the lesson is expected to further this understanding. Data on and reflections about the actual teaching of the lesson should be included as well as a brief description of the students and classroom context.

Grading: Final paper 50%, reading reflections 30%, participation in workshops 20%.