

Fostering Mathematical Thinking and Discourse: A Video-Centered Professional Development “Possibility”

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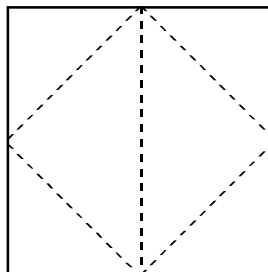
Overview

This professional development activity focuses on behaviors that teachers can employ to foster students’ mathematical thinking and discourse during a lesson. First, the professional development participants brainstorm a list of behaviors pertinent to this issue and also complete a paper folding activity that students will do in a videotaped lesson. Then the participants watch the videotaped lesson and identify instances of the behaviors on the list that they generated. The videotaped lesson contains examples of exemplary teacher behaviors that foster mathematical thinking and discourse by second grade students. Following the video the participants report on and discuss the behaviors that they identified and also on new behaviors demonstrated in the video that were not part of their original list.

Pre-View

The professional development participants first brainstorm behaviors that a teacher could employ to foster students’ mathematical thinking and discourse during a lesson. A few answers that participants give regularly are: 1) pose tasks for children to solve, 2) ask students to explain their reasoning and answers, 3) allow for sufficient think time (at least 5 seconds!) after asking a verbal question, 4) do not judge the correctness of students’ answers, (5) display genuine interest in the students ideas, and (6) have students work in pairs or small groups. Next, have the participants divide up the behaviors so that each behavior is assigned to at least two participants.

Then, have the teachers complete a paper folding activity that involves a sheet of paper approximately 8 x 8 inches square. First, have them crease the paper as shown by the dotted lines in the diagram below:



Their task is then to find as many two-dimensional shapes as they can by folding the square along one or more of the “crease lines.” This task is very interesting and challenging for the participants, especially determining whether or not they have found all of the possible shapes. The participants share their findings in a subsequent debriefing. It is especially rich to discuss the geometric properties of the resulting shapes. For example, have the participants name the polygons and the numbers of sides, parallel and perpendicular sides, congruent sides and angles. Among the 7 possible shapes there are 3 pentagons with varying numbers of parallel and congruent sides and a non-regular hexagon with 3 sets of parallel and congruent sides and 2 right angles.

View

The video, “Shapes From Squares,” starring Marco Ramirez and twenty-six 7-9 year-old students

from his bilingual classroom at the Richey Elementary School in Tucson, Arizona, is engrossing. In small groups the students eagerly search for the shapes that can be created from the creased square. The teacher masterfully engages the students in discourse related to naming the shapes and determining the numbers of sides and angles. He is particularly patient and honors students' developing understandings, and he is especially skillful in using and building on the students' terminology regarding the shapes—such as “five-a-gon and six-a-gon.” He helps them connect these shapes with similar Pattern Block shapes they have explored in previous activities. The video concludes with a class discussion in which Mr. Ramirez tapes on the chalkboard the shapes that the students created, and he has them name their shapes and identify the numbers of sides.

During the video the professional development participants note which teacher behaviors from their list were present in the lesson. Immediately following the video they meet with others assigned the same behaviors to discuss their results and to identify new behaviors that may have been present in the video lesson but not part of the original list.

Post-View

After leading an initial discussion regarding interesting lesson activities they have observed, such as the Mr. Ramirez's seamless use of both English and Spanish, have the participants name the behaviors from their list that they observed on the videotape. Many on the initial list are always present and the participants feel good about the list that they previously created. Additional teaching behaviors for fostering students' mathematical thinking and discourse are always identified, such as 1) deflecting students' questions to the teacher back to the students, 2) listening carefully and intently to students' ideas, and 3) asking for and making connections to prior lessons, to other subject areas, and to real life. Conclude the session by asking the participants to identify one or two behaviors from the final list to incorporate into their own teaching and then write a brief plan for attaining that goal. Provide opportunities for sharing these plans by participants who choose to do so.

Reflections

One of the advantages of using a video of an exemplary lesson in a regular classroom is that the viewer can see that “best practice” is possible. The video also becomes a shared activity that all participants can analyze and reflect upon. The video provides the participants with an opportunity to place themselves vicariously in the situation of the video characters and to feel what it would be like to do what those characters have done.

Reference

The video, “Shapes from Squares,” is part of *Teaching Math: A Video Library, K-4*, and is part of The Annenberg/CPB Math and Science Collection. It is produced by WGBH in Boston, MA, and is available from The Annenberg/CPB Math and Science Collection, P.O. Box 2345, South Burlington, VT 05407-2345.

Contrasting Classrooms: A Video-Based Professional Development “Possibility”

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Overview

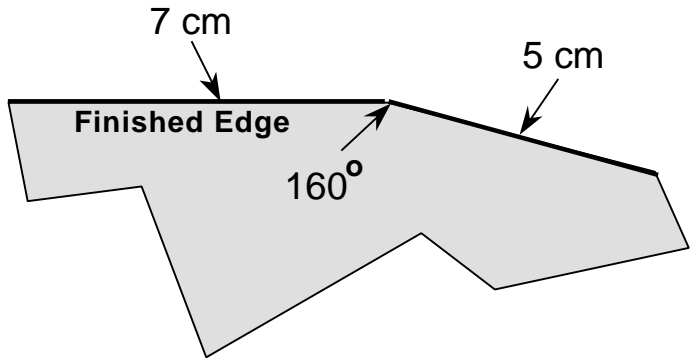
The high-school teachers in this vignette are participating in the first year of a professional development project supporting their adoption of one of the NSF-funded curriculum projects. After doing a mathematics task together and discuss the mathematics behind the task, they view two videotapes portraying classroom lessons that center around the same mathematics. The teachers discuss each of the classes and compare the two with respect to the teachers’ actions and their students’ mathematical experiences.

Pre-View

The teachers begin by working in small groups on the following problem:

The Archeologist Problem

An archeologist unearths a pottery shard, shown below:



She assumes, based on what she already knows about this culture, that this is a piece of a platter made in the shape of a regular polygon. She wishes to describe the original platter as specifically as she can. What can she say?

The facilitator asks the small groups to present their descriptions, and the reasoning behind them, to the whole group. This portion of the session concludes with teachers listing the mathematical ideas and relationships at the heart of the problem.

View and Discuss

The first tape is the U.S. Geometry segment from the TIMSS Video Study. In this tape, the teacher [insert notes from the TIMSS discussion guide here.]

The second tape portrays a teacher who is a veteran participant in this professional development project. She is teaching the lesson from the curriculum that engages students in exploration of the relationship between the number of sides of a regular polygon and the total number of degrees in the interior angles of that polygon. The students, working in groups of 3 – 4, build a table, look for patterns, make conjectures about the relationship, and are asked by the teachers to explain why that relationship might be true.

Post-View

After each tape, the facilitator asks the teachers to generate a list of “observables,” such as the physical arrangement, the number of students, what they did, what the teacher did, how long these events took. Then, the teachers generated a list of “issue questions.” Finally, the facilitator and the teachers selected two questions to discuss in more depth.

Reflections

After the post-viewing discussion of the second tape, the teachers were asked the following questions:

- How were these two classes similar? How were they different?
- How does the role of the teacher compare in the two classrooms?
- How did the teachers’ mathematical goals compare?
- How does the mathematical activity engaged in by the students in the two classes compare?

Resources

The TIMSS Video Study was a research project conducted in conjunction with the TIMSS international achievement study. Eighth-grade classrooms in three countries (The United States, Japan, and Germany) were the focus of the video study. Over 80 classrooms in each country were selected in a careful effort to create a representative sample of classrooms in those countries. (See Stigler & Hiebert, 1997) for a description of the study.) A videotape containing six classroom excerpts has been made available. The tape contains a geometry class and an algebra class from each of the three countries. A copy of the tape, titled “Eighth-Grade Mathematics Lessons: U.S., Japan, and Germany,” (\$20.00) and accompanying Moderator’s Guide (\$12.00) may be purchased from:

Superintendent of Documents
P.O. Box 371954
Pittsburgh, PA 15250-7954
(202) 512-1800
(202) 512-2550 (FAX)

The video is also included in Attaining Excellence: A TIMSS Resource Kit, available for \$76.80 (member price) from NCTM.

Reference

Stigler, J. W. & Hiebert, J. (1997). Understanding and Improving Classroom Mathematics Instruction: An Overview of the TIMSS Video Study. *Phi Delta Kappan* 79 (1), 14 – 21.