

IMPROVING TEACHER QUALITY PROGRAM

Mathematics Within: Algebraic Processes and Its Connections to Geometry

Page 1 & 2 – Pre-planning: Teacher Lesson Plan

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Context of the lesson:

- 1. To help me understand the context of the lesson, please explain where this lesson occurs within a unit or series of lessons. Describe what led up to this lesson and what will follow.**

This lesson is the second lesson in a unit on exploring fractions as part of area model. In the previous lesson the students worked with dividing “crazy cakes,” or shapes that were not symmetrical, in half so that two people could receive a fair share. Since the shapes were not symmetric, the students had to look for pieces of the cake that were equal in size and then cut and paste the pieces to prove that the two halves were equal. Following this lesson, the students will do similar explorations of $\frac{1}{4}$'s, $\frac{1}{8}$'s and $\frac{1}{16}$'s. We will also explore whether or not we can use Geoboards to illustrate $\frac{1}{3}$'s and $\frac{1}{5}$'s, etc. References:

Investigations in Number, Data, Space –Dale Seymour Publications;
Investigations 1, Sessions 2-4; Different Shapes, Equal Pieces, (pp. 4-8).

- 2. What is the purpose of this lesson?**

The purpose of this lesson is to develop the understanding that halves must have equal areas and that halves don't necessarily have to be congruent shapes. A final purpose is for students to be able to justify (orally or in writing) whether or not a particular division of an area results in two equal halves.

- 3. What do you anticipate taking place?**

During this activity, students will

Day 1

- use the Geoboard and rubber bands to illustrate $\frac{1}{2}$ divisions of the total area
- share and justify the divisions that they make
- find as many different halves as they can with the Geoboards
- record the halves that they've identified on a recording sheet
- describe the strategies they used to determine that the two halves were equal
- write an entry in their learning logs describing what makes equal halves and record their strategies for finding them

Day 2

- make a graph paper model of division I've chosen from their recording sheet
- use a scissors to cut apart the division to prove that the two halves have equal areas
- explain their reasoning to the class

Following this activity, given an illustration the students will

- decide if the Geoboard has been divided into halves
- write a proof that the Geoboard has been divided into halves
- extend this knowledge to $\frac{1}{4}$ pieces and record their reasoning
- identify whether or not 2 incongruent shapes are equal in area and record their reasoning

4. What strategies or techniques will you use to monitor learning?

During this activity, I will monitor learning by

- observing the individual and group work
- asking students to defend their divisions
- questioning to determine the strategies that students are using to visualize halves
- challenging students who seem ready to find halves that are not congruent

5. How will you know if students have achieved the objective(s)?

- During the exploration I will check to see that students are making correct divisions on the Geoboards and ask them to verbalize the reasoning behind their divisions.
- At the end of day one, students will hand in their recording sheets (Dot Paper Squares) and learning logs. I will check illustrations and writing for understanding of equal area halves and halves that are equal but not congruent.
- At the end of day two I will check their proofs to assess whether or not they can identify a half and write a proof that a Geoboard division produced two halves. I will also check to determine whether they can extend this knowledge.

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Participant Names: Jeannie Ness and Justin Bushard

Broad Topic: Fractions

Subtopic: Halves

Grade level: 4

Time: 30 minutes

Aim: Understanding that halves of a whole must be exactly equal in size.

Specific Objective(s):

- Halves don't have to be congruent.
- Halves must have equal area.

Materials/Supplies:

- Geoboards, rubber bands – one board per student.
- Student sheets 2 and 3 (*Investigations*, pp. 62-3)
- Overheads of Student Sheets 1, 2 and 3 (*Investigations*, pp. 61-3)
- Graph Paper
- Scissors
- Markers

References: (text/handouts, etc)

- *Investigations in Number, Data, Space* –Dale Seymour Publications
Investigations 1, Sessions 2-4; Different Shapes, Equal Pieces, (pp. 4-8)

Two Lesson Sessions

- **Introduction**
 - Learning log: Record their thoughts about “What is a half?”
 - Review yesterday’s “Crazy Cakes” lesson (Student Sheet 1, *Investigations*, p. 61). Use the overhead of student sheet 1 to discuss the methods they used to get equal halves.
- **Body**

Introduce the students to Geoboards. Give them a short exploration time with the Geoboards. Students should be looking for simple halves.

 - Teacher can walk around the room looking for simple halves. Ask three students to walk up to the overhead and share with the class what they think a simple half would look like and verbally tell the class how they figured it out.
 - Introduce the students to Dot-Paper Squares (Student Sheet 2, *Investigations*, p. 62). Show them how it has the same area as a Geoboard.
 - Allow the students to explore and record on their Dot-Paper Squares Sheet for about five minutes.
 - Have them discuss their findings with a neighbor.

- Incorporate more exploration time.
- Walk around the room and select congruent and incongruent halves to be shared on the overhead by students.
- The students will mark their halves on the overhead and share their thoughts and strategies with the class.
 - * Look for two specific ways to figure out halves on the Geoboard:
 1. Cut and paste visually
 2. Connecting the squares
- Learning log entry: “How has your thinking about halves changed?”
- Collect Student Sheet 2—Dot Paper Squares.

(End of day one)

Day 2 Lesson

Teacher will select one example of halves from yesterday’s Student Sheet 2 for each student.

- Students will prove that the halves are equal by duplicating the selected half on graph paper and coloring one half red and the other half blue. Then they can cut along the dividing line to prove to us that the two halves are equal. (We are leaving this open to student interpretation to encourage divergent thinking).
- Students will share their proofs with the class.

• **Close**

Literacy Check: Student Sheet 3 (*Investigations*, p.63)—Proving Fractional Parts

- Students will write proofs for the given examples using illustrations to help explain their proofs.

• **Application/assessment**

Observational –

- Check student examples during exploration.
- Ask students to verbalize their reasoning and strategies.

Paper/Pencil Assessment -

- Check the Dot-Paper-Square illustrations.
- Check learning logs for increased understanding.
- Check final proofs—Proving Fractional Parts.

• **Extensions**

- Create $\frac{1}{4}^{\text{th}}$ and $\frac{1}{8}^{\text{th}}$ displays in the classroom.
- Math Keys computer program has Geoboards.
- Good background for the topic of area.