Improving Teacher Quality Program

Mathematics Within: Algebraic Processes and Its Connections to Geometry

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

Emily Nitti Macias and Nancy Zuber

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.

Before entering fourth grade, students will have had previous experience with perimeter and area. Before this, Lesson 2 exercises will be completed:
1) Vocabulary terms of *perimeter, area*, and *square unit* will be reviewed. These terms will be entered in to the Learning Log. An introduction to square unit will be provided; e.g., one yard square, one 12- inch ruler square, one 1 cm square, one paper clip square.

2) Geoboards will be provided for each student to outline a square or rectangle with a rubber band. Colored rubber bands will mark the internal squares. The student will measure the shape's perimeter and area. The geometric shape will be drawn on dot paper and, its perimeter and area will be recorded on the dot paper. This process will be repeated 6-8 times.
Extension: 2 or more Geoboards will be placed together to form a larger square or rectangle.

2. What is the purpose of this lesson?

The student will develop an understanding of the relationship between perimeter and area.

- Given a set number of blocks, if the number of exposed sides is reduced in a shape, it will decrease the perimeter of an area.
- The largest perimeter of a set area will have the least number of sides touching (2 or 1).
- When the area is increased by 1, the largest perimeter will increase by 2.

E.g.,

Area	Largest Perimeter
1	4
2	6
3	8
4	

3. What do you anticipate taking place?

Using cm blocks, students will form a geometric shape with an area of 1. They will record the shape on graph paper and label its corresponding perimeter. While keeping the area constant (maintaining the same number of blocks), the students will rearrange the blocks to increase and/or decrease the perimeter. Record the smallest and largest perimeter for each set area on graph paper and on a table. Increase the area by 1 and repeat the activity 8 times.

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

The teacher will observe students using cm blocks to form square or rectangular shapes. The students will draw each geometric shape on graph paper and label its perimeter and area. The students will record the smallest and largest perimeter for each set area on a table.

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

- The students will look at their drawings and compare the shape of the smallest perimeter for each set area. In their Learning Log, they will draw the shape that represents a commonality among the smallest perimeter for each area. (The smallest perimeter measurement will form a square or rectangle by reducing the number of exposed sides).

- The students will look at their drawings and compare the shape of the largest perimeter for each set area. In their Learning Log, they will express the commonality among the largest perimeter shapes; e.g., 1 or 2 sides will be touching within the shape. The length of the base is longer than the base of the shape with the smallest perimeter or the height of the shape is higher than the height of the shape of the smallest perimeter shape.

- Given 5 (1cm) blocks in a row, students will be asked to increase the perimeter of the shape by 2. The students will record this geometric shape in their Learning Log and explain their reasoning why the perimeter increases by 2 when the area is increased by 1: By adding 1 block, one adds 3 exposed sides to the perimeter. But when the block is placed along side the end block of the first shape, it covers up 1 exposed block. Therefore, 3 –1 = an increase in perimeter by 2.

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Participant Name(s): Emily Nitti-Macias and Nancy Zuber

Broad Topic: Geometry **Subtopic:** Area and Perimeter

Grade level: 4 **Time Frame:** 30 minutes

Aim: Students will develop an understanding of relationships between area and perimeter.

Specific Objective(s):

- Given a set number of blocks, if the number of exposed sides is reduced in a shape, it will decrease the perimeter.
- The largest perimeter of a set area will have the least number of sides touching.
- When the area is increased by 1, the largest perimeter will increase by two.

e.g.

Area	Largest Perimeter
1	4
2	6
3	8

Materials/Supplies:

- graph paper
- small cm blocks or "ones" base ten blocks (see pp.5-7)
- 25 copies of perimeter and area table (see p. 8)

Lesson:

- **Introduction**
  - Review previous lessons on area and perimeter. Have students restate definitions and or examples of area, perimeter and square unit.
  - Pose questions and discuss "How are area and perimeter similar?" and "How are area and perimeter different from each other?"
  - Let students know that you will be exploring how area and perimeter affect each other (or what kinds of relationships they have).
- **Body**
  - Each student will receive graph paper, a perimeter and area table (p. 8), and one block. As a class we will discuss the area and perimeter of the one block and fill the information and drawing in on the table and graph paper. We will continue to work together for the area of at least areas two and three to start seeing some more possibilities.
  - Students will then work in partners or small groups, continuing to search for different shapes for areas four through eight drawing them on graph paper, and recording largest and smallest perimeter on the table.
  - While students are working in small groups and later in large group discussion, these questions should be posed:

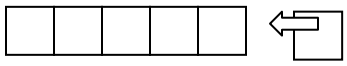
1. Identify the shape with the smallest perimeter for each set area. What is similar about these shapes?
2. Identify the shapes with the largest perimeter.
   What is the same about all these shapes?
   Does the length or height seem to be longer or shorter than the smallest perimeter?
   How many sides are touching another square?
3. What pattern do you see on the table for the largest perimeters? (Are the numbers increasing or decreasing?)
   Why do we see this pattern?
   Can you predict the next largest perimeter?

- **Close**
  - The students will look at their drawing and compare the shape of the smallest perimeter for each set area. In their Learning Logs they will draw the shape that represents a commonality among the smallest perimeter for each area. (The smallest perimeter measurement will form a square or rectangle by reducing the number of exposed sides.)

  - The students will look at their drawings and compare the shape of the largest perimeter for each set area. In their Learning Logs, they will express the commonality among the largest perimeter shapes, (The more sides exposed for each block, the larger the perimeter will be.)

  - Given five 1cm blocks, in a row, students will be asked to increase the perimeter of the shape by two. The students will record this in their Learning Logs and explain their reasoning of why the perimeter increases by two when the area increases by one. (By adding one block, 3 sides are added to the perimeter, but the other side now covers a previously exposed edge.

  - Therefore 3 -1 is an increase in perimeter by 2.



- **Application/assessment**

  Assessments can be made from the observations of partner and small group work. Teachers can look at the graphs, table, and Learning Log. Students also can share with the class their explanations of why the perimeter increases by two when the area increases by one.

- **Extensions**

1. Plot the data on a graph to see in another way how the perimeter and area are increasing.

2. Use set perimeters and explore what the largest area and smallest area are for each. Instead of using blocks use flat toothpicks on top of graph paper in which the length of one side is the same as a toothpick.

3. Change the length of one side of a square to one half. How does that affect the area and perimeter? Now you can see odd numbers in perimeter too!