LESSON PLAN – Reason about the area of a plane figure by comparing the size of unit squares

Subject/Topic/Unit: Math/Area/Healthy Living

Grade Level: Third Grade

I. Main Ideas/Conceptual Understanding/Goals

Area is an expression of how much surface is covered. Both the size of the square unit and the number of units are needed to measure the area of a figure.

II. Specific Objectives

Students will be able to reason about the area of a plane figure by comparing the size of the unit squares.

CCSS.MATH.CONTENT.3.MD.C.5
Recognize area as an attribute of plane figures and understand concepts of area measurement.

CCSS.MATH.CONTENT.3.MD.C.6
Measure areas by counting unit squares (square cm, square m, square in, square ft, and improvised units).

CCSS.MATH.PRACTICE.2. Reason abstractly and quantitatively.

CCSS.MATH.PRACTICE.3. Construct viable arguments and critique the reasoning of others.

Vocabulary: compare, inequality, area, square unit (unit square), square centimeter, square inch, square foot, square meter

III. Procedures

A. Introduction/Motivation

Lesson Overview: This lesson builds on learners’ understanding unit squares as the standard measurement for area. In the task, learners will compare the area of figures constructed from unit squares with different sized units. Learners’ ability to reason abstractly and quantitatively will be enhances as they develop an understanding that the number of square units needed to cover a figure depends on the size of the square unit. This understanding lays the foundation for learners’ conceptual understanding of area as it relates to multiplication and addition. More specifically, learners’ understanding that when they arrange square units in an array, they can use multiplication to find the number of squares.
Warm-up:

The teacher should have the warm-up power point slide displayed for the learners to see at the beginning of the class. The teacher should provide each learner with a Student Worksheet for this lesson. In the warm-up students are required to recognize the importance of the unit in finding the area of a figure. During the debriefing of the warm-up the teacher should show students a model of a square inch, square foot, square meter, and square centimeter. These models should aid in the in students investigation of the questions in this lesson.

Warm-up question:

Joe and Kendra are cousins who attend different schools.

Joe states, “The area of my playground is 2,500!”

Kendra replies, “No way! My playground has a larger area than your playground and the area of my playground is 1,524.”

Is there any way that both Joe’s and Kendra’s statements could be correct?

How do units impact area?

Guiding questions:

How is it possible for 1,524 to be greater than 2,500?

What units on the numbers would make the inequality true?

What is something that has an area of about 1 square centimeter? 1 square inch? 1 square foot? 1 square meter?
B. Study/Learning

Main Task:

The teacher should have the main task power point slide displayed for the learners to see after the warm-up. After presenting the question the teacher can pass out square centimeter, inch, Foot, and meter grid and/or template for modeling to aid in students’ exploration of the problems. Prior to the main task the teacher should show students the power point slides with images of 1 serving size for grains, vegetables, fruits, and protein. The teacher should ask the learners to estimate the area of each portion of food as well as the best choice of unit for measuring each portion of food. After the learners make their conjectures, the teacher should reveal the actual estimations for the area of each portion of food and the units used. The teacher should circulate around the room asking learners the guiding questions during the main task. The learners should be able to construct viable arguments to support why their sis reasonable. The learners should be able to precisely communicate the number of unit squares that fit into each garden. Learners can work on the main task either individually or in small groups. Once the teacher notices that most learners have solved the task, the teacher should draw the classes’ attention to the front of the room for a whole-class debriefing discussion.

*Portion Sizes*

Grain = 1 slice of bread

Vegetable = 4 spears of asparagus or 12 baby carrots

Fruit = 1 handful of grapes or 1 medium orange or apple

Meat = 1 palm of meat

What square unit would be ideal for finding the area?

What do you think the area of each portion size is?
Main task question:
Complete the inequalities. Show how you know they are true.

| 50 square centimeters  | ___ | 15 square inches  |
| 40 square inches       | ___ | 1 square foot     |
| 18 square centimeters  | ___ | 2 square inches   |
| 30 square inches       | ___ | ___ square centimeters |
| ___ square inches      | ___ | 45 square centimeters |

Guiding Questions:

What do the numbers in the problem represent?
What is the relationship between the quantities?
What strategies or tools might help you?
Have you tried making an estimate?
What is something that has an area of about 50 square centimeters? (Use with any measurement.)
How can you prove which measurement is larger?
How does the shape you arrange the squares in affect the area?
What ways can you check if the area of your rectangle is accurate?

Common Misconceptions/Errors:

Students interpret the number without considering the size of the units.
Students compare the length (one-dimension) instead of area (two-dimensions).
Possible Solution Paths:

Learners may use square tiles to construct rectangles based on the given measurements and compare the size of the figures. Learners may draw rectangles on grid paper using the appropriate number of square units and compare the size of the figures. Learners may identify the relationship among the square units (e.g., 1 square inch = about 6.5 square centimeters or 1 square foot = 144 square centimeters). Learners may reason about that relationship to compare the size of the figures.

C. Culmination

Task Debrief: Once the teacher notices that most learners have solved the task, the teacher should draw the classes' attention to the front of the room for a whole-class debriefing discussion. The teacher should use the task debrief to facilitate classroom discussion about the task and as an opportunity for learners to share their different approaches to the task. The teacher should pose the same guiding questions used while circulating during the task. The learners should be able to construct viable arguments to support why their sis reasonable. The learners should be able to precisely communicate the number of triangles that fit into each waffle shape.

Closing Questions: Ask students to write their answers to the closing questions on their worksheets.

1. Order the following units from least to greatest: 1 square foot, 1 square inch, 1 square meter, 1 square centimeter.
2. How can 2 square inches be larger than 6 square centimeters?
3. How can you prove which has a larger area?
4. How do a rectangle's length and width help determine the area?

Indicators of understanding: The learner understands that area is an expression of how much surface is covered. The learner understands that the standard unit of measurement of area is square units. The learner understands that specific square units have different sizes. The learner understands that to determine the size of a figure both the number of units and the size of the unit must be considered. The learner understands that length is only one dimension of area.

Big Idea: After the task debrief the teacher should ask learners what they think the most important mathematical concepts that the learned in the lesson were. The teacher should guide the learners to summarize the big idea of the lesson to that area is a measurement of how much surface is covered and area is commonly measured in square units. Also, both the size of the square unit and the number of units are needed to measure the area of a figure.
D. Follow-up

Ticket of the Door:

Order from least to greatest:
200 square centimeters, 20 square feet, 40 square inches, 1 square meter

Student Practice Sheet: There are three levels of practice sheets for the learners. Practice Sheet A is intended for learners who do not fully understand the big idea(s) of the lesson, Practice Sheet B is intended for learners who showed understanding but would benefit from added practice, and Practice Sheet C is intended for learners who displayed strong understanding of the big idea(s) and are ready to develop a deeper understanding.

IV. Materials/Resources

- Interactive whiteboard or computer with projector
- square centimeter, inch, foot, and meter grid and/or template for modeling
- Lesson Plan power point
- Student Worksheets (1 per student)
- Practice Sheets (A, B, and C)

V. Evaluation related to objectives

- Warm-up question
- Main task question
- Task Debrief questions
- Closing questions
- Big idea summary
- Ticket out the door
- Practice sheets (A, B, and C)