Practice Task: "Mathemagicians"

Approximately 3 days

STANDARDS FOR MATHEMATICAL CONTENT

MCC2.OA.4. Use addition to find the total number of objects arranged in rectangular arrays with up to 5 rows and up to 5 columns; write an equation to express the total as a sum of equal addend

STANDARDS FOR MATHEMATICAL PRACTICE

1. Make sense of problems and persevere in solving them.
2. Reason abstractly and quantitatively.
3. Construct viable arguments and critique the reasoning of others.
4. Model with mathematics.
5. Use appropriate tools strategically.
6. Attend to precision.
7. Look for and make use of structure.
8. Look for and express regularity in repeated reasoning.

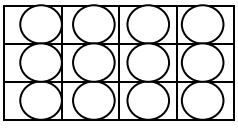
*****Mathematical Practices 1 and 6 should be evident in EVERY lesson*****

BACKGROUND KNOWLEDGE

This standard calls for students to use rectangular arrays to work with repeated addition. This is a building block for multiplication in 3rd Grade. Students should explore this concept with concrete objects (e.g., counters, bears, square tiles, etc.) as well as pictorial representations on grid paper or other drawings. Based on the commutative property of addition, students can add either the rows or the columns and still arrive at the same solution.
Example below:

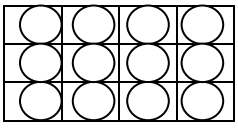
Student 1

I see 3 counters in each column and there are 4 columns. So I added: 3 + 3 + 3+ 3. That equals 12.



Student 2

I see 4 counters in each row and there are 3 rows. So I added 4 + 4 + 4. That equals 12.



ESSENTIAL QUESTIONS

- What is an array?
- What is repeated addition?

- How can rectangular arrays help us with repeated addition?
- How are arrays and repeated addition related?
- How does skip counting help us solve repeated addition problems?
- How can we use model repeated addition equation with an array?

MATERIALS

- 25 index cards (per group)
- Various manipulatives (snapcubes, counters, tiles, coins etc.)

GROUPING

Partners

TASK DESCRIPTION, DEVELOPMENT AND DISCUSSION

Part I
Begin the lesson with a review of arrays. Share the pictures of arrays created in the task "The Queen's Dilemma" and discuss the difference between a row and a column. Make sure you model the language 3 by 3. Indicate that the equation for this is 3+3+3. Ask the children this is called an array because you can make a rectangle with the number. Tell the students that now they will be the Mathemagician and will magically build all of the arrays possible for each number 1-25. Remind them to divide the numbers into an equal number of rows and an equal number of columns with nothing left over. For example,with the number 10 one can create 1 row with 10 in it, 2 rows with 5 in each row, 5 rows with 2 in each row, and 10 rows with 1 in each row. Encourage the children to look for the real magic in the numbers and discover ALL of the possibilities for their given numbers and to describe the array in all of the ways possible (repeated addition, a 5 by 2 array, etc.) **Keep in mind writing a multiplication equation is not something second grade students are required to master at this point**. The focus is on finding the total number of objects and how we can model it with both repeated addition sentences and arrays.

Part II
Allow the students to work with a partner to experiment with different arrays that the Mathemagician could create when describing numbers 1-25. Have the students use manipulatives to create their arrays. Then, encourage the students to draw their arrays on the construction paper and record the repeated addition equation next to the array. While students are working, circulate the room and ask questions from the formative assessment list. Each group of students will have one index card for each number 1-25 showing the arrays possible for that given number. You may want to consider having them create books with these index cards so that they may continue to share them after the lesson is complete.

Part III
After students have completed Part II of the task, choose several students to share their discoveries and observations with the class.

Lead a discussion about what the discovered about each number. Compare the information/data to the discoveries from the task "The Queen's Dilemma", is there any new data/information to

add to the graph? Ask questions which require them to look for patterns. Some things that they may notice are:

- 1, 2, 3, 5, 7, 11, 13, 17, 19 and 23 can only have in single file rows/columns
- 4, 9, 16 and 25 can be made into squares with equal sides
- 2,4,6,8,10,12,14, 16, 18, 20, 22, and 24 can all be divided into 2 equal rows
- 15, and 21 are odd numbers but they have more arrays than just single file rows/columns

FORMATIVE ASSESSMENT QUESTIONS

- What manipulatives are you using to help solve this problem?
- Why are you arranging the tiles in that way?
- What are some ways the Mathemagician could arrange the number 6? 10? 16? etc.
- What are some ways that she/he cannot arrange them?
- How many rows does this array have?
- How many columns does this array have?
- How can you tell the difference between rows and columns?
- What strategies are you using to help figure out ways the Mathemagician could arrange the numbers?
- Are you noticing anything about the numbers that she is or is not able to use?
- How could you use repeated addition to help you solve this problem?
- Could this number be arranged in a different way?
- How would the equation be different if this array were rotated a ¼ turn?
- How are you communicating the results you have found?
- What patterns are you noticing from your chart?
- Why are we able to make different arrays for some numbers but not others?
- Do any of the arrays you have made have the same product?

DIFFERENTIATION

Extension

- Have the students identify the arrays that are similar or that have been rotated ¼ of a turn. They are different, yet the same. Ask them to tell why.

Intervention

- Students who are having difficulty may need additional questioning with the use of manipulatives.