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Lesson Title: 3 Squares Across
Author: Investigations Curriculum, adapted by Kate Michaud
Grade: 5th

Learning Objective:

- I can explain a rule that describes a numerical pattern
- I can write an equation that describes the relationship between two changing quantities.
- I can use letters to represent the value of one changing quantity in terms of another.

Curriculum Connection:

- This lesson is the first in a new Investigation. While students have encountered area and perimeter before, they have not worked with creating rules to find large areas and perimeters; that will be new to them.
- CCSS.MATH.CONTENT.5.OA.B.3 Generate two numerical patterns using two given rules. Identify apparent relationships between corresponding terms. Form ordered pairs consisting of corresponding terms from the two patterns, and graph the ordered pairs on a coordinate plane.

Assessment:

- Selected/Constructed Response — student work on pages 309-312 of their math workbooks will demonstrate their understanding. After the lesson, I will read through and comment on their work. Where needed, I will return work to students to try again during morning work or another math session. To show sufficient understanding, students must correctly fill in the tables for area and perimeter and offer arithmetic expressions that demonstrate a connection to a possible rule — for example, “(10x2) + 6” to find the perimeter of 10 rows of 3 squares. Their answers to the open-ended questions must also show that they can correctly explain their rule and describe numerical relationships.
- I will also be able to assess some students via Personal Communication — by making note of their conversations and responses during discussion, conferences, and at the teacher table.

Knowledge of Students:

The majority of our students are hardworking and tend to persevere through all their work, so even if this lesson presents a challenge to them, I believe they will stick with it and eventually meet the learning targets. All of our students have prior experience, in other grades, with area and perimeter. What is new (and potentially confusing) for them is finding rules to predict larger areas and perimeters.

Some of our students have low confidence in math. To support them, I can confer with several students at once by inviting them to work with me at the teacher table. Additionally, the first half of the next math lesson involves discussion of today's work, so that will be a good time to go over any confusion or misconceptions that occur during this lesson.

To support all students' understanding, I will provide all students with (and encourage) the option of using tiles and/or grid paper as they work, which I hope will make their thinking concrete.

Strategies to engage learners:

- Modeling
- Independent work
- Pair work
- Group discussion
- Use of manipulatives
- Posing purposeful questions
- Turn and Talk
- Conferring

Lesson Procedure:

- 10:10 10m math
    - Display Teacher Presentation
    - Have students write in math journals to create expressions that equal 720
    - Ask Questions
        - How do you know this expression = 720?
        - What do you know about 720 that helped you decide what #s to use?
- 10:20 Activity
    - Display p. 309 & model finding area
    - Students independently work on p. 309 & p. 310 problem #2
        - (Extension: problem #3)
        - Give tiles & grid paper
        - As students work, check in, confer, ask questions, i.e. "What happens to the total number of tiles each time you add a row?"
- 10:35 Have students tear out the pages they have been working on in their workbook & come to rug: Discussion
    - Possible questions
        - Methods for finding area? (justify w/array)
        - What happens each time add row?
        - How would the rule work with rows of 1000, 2000, 10,000?
        - What does N stand for?
    - Describe symbolic notation in basic terms, i.e. "A letter can represent any value"
    - Turn and Talk: think of a rule for finding the area with any number of rows, Share
        - What does each number/letter represent?

- 10:50 Display “3 Squares Across” perimeter worksheet & model finding perimeter
    - Ask for raised hands: What is perimeter?
    - Tell students: Here, each side = 1 cm. What is the perimeter? Arithmetic expression showing how you calculated that perimeter?
    - Add 1 row and repeat: Perimeter? Arithmetic expression?
    - Add 1 row and repeat
- Students work in pairs/trios at their own tables on p. 311-312
    - Suggest using tiles for up to at least 6 rows
    - Extension: p. 313, maybe 314
- 11:20 Transition to Literacy

If students finish easy or need more of a challenge, there is additional work (noted in Lesson Procedure as Extensions) for them. If I find that students are struggling to understand — which is quite possible once we get to the Perimeter activity — I can confer with several students at once by inviting them to work with me at the teacher table. The first half of the next math lesson involves discussion of today’s work, so that will be a good time to go over any confusion or misconceptions that occur during this lesson.

Resources Needed:

- Each student will need their math journal, workbook, & pencil
- Promethean Board
- Drawing space for 3 rows
- Pg 311 of student workbook presented
- Tiles
- 1-cm grid paper

Other adults in the room:
Anna Cloutier - observing me

Lesson Reflections:

After reading through each student’s work, I found that only five students had fully grasped the learning by the end of the lesson; the other ten had not. This is not surprising, since this is the first lesson in an investigation and a complicated concept. Finding area came easily to almost everyone, but perimeter was, as expected, a very different story. Even before reading their work, I got the sense that a number of students were struggling with the concept, because the teacher table was full of students during the work time; I found myself quickly bouncing from one pair to another, trying to clarify the concept. I will be interested to hear more of my mentor’s thoughts after this observation, but in my opinion, it was almost inevitable that most students would need more work on the difficult topic of varying perimeter, whether the lesson had been taught well or not. For this reason, it’s hard for me to use student work as evidence that I did well or not. More subjectively, I feel that I delivered the content as clearly as I was able. I was also very conscious of every student, constantly scanning the group during discussion to get an

idea of who seemed to understand and who did not. As students worked, I tried to confer with as many of them as possible in as efficient a way as possible — inviting anyone and everyone to the teacher table, spending a few seconds giving a suggestion to one pair of students before quickly moving to the next and so on, continuously circling back to each pair so as not to leave them hanging for too long.

In the rush and confusion of the lesson, I believe I failed to demonstrate finding perimeter a few times before sending students off to work. (I say “I believe” because even right after the lesson, I had already somehow forgotten whether or not I had done that.) If I were to teach this lesson again, I would definitely be sure to do that. I might also draw an array on the board as I demonstrated, or even display the tiles we use, to make the learning concrete right off the bat.

It so happened that the internet was down during this lesson, so I was unable to project the pages of the workbook that I had planned on sharing with students. (This may be why I forgot to demonstrate finding perimeter; I meant to do that with the workbook page but did not have it in the end.) This gave me a good experience in being flexible and making in-the-moment changes. I didn’t let the lack of internet phase me; instead, I used the offline drawing tool on the Promethean Board to write students’ thoughts during discussion.

Before this lesson, I took for granted that my particular class of students always excels academically. While they are indeed academically advanced, I found that even the most confident and ready students had trouble with this new and complicated concept. This lesson taught me that when starting to teach something new, students’ readiness should never be assumed. Next time, I might give a quick pre-assessment before starting a new Investigation, in order to better inform my plans.