Exploring Multiplicative Comparison, Area, Perimeter, Factors, and Multiples (Grade 4 Unit 2)
Common Misconceptions / Intervention Strategies

NC.4.0A.1, NC.4.OA.3, NC.OA.4, NC.4.MD.3

*** During this introduction to area and perimeter, the focus should be on visual models, factors, and multiples. Students should not be taught the formulas for area and perimeter at this time. The formulas will be taught in Unit 4.*

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The student may misinterpret the phrase "how many times more" as "how much more." Therefore, he will think that "four times more" means "four more" instead of "four times as much."

The student has difficulty determining if a comparison has an additive relationship or a multiplicative comparison.

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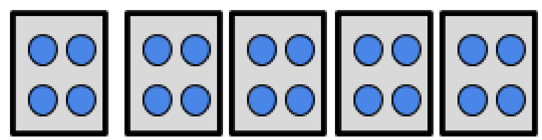
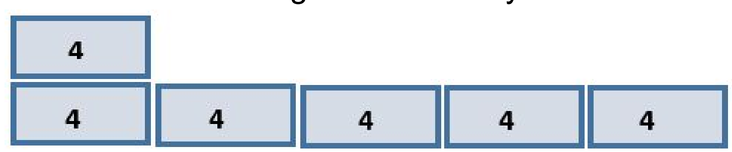
- Explain to students that they are used to interpreting multiplication expressions as situations of equal groups (ex. 5 bags of 4 candies: 5 x 4). Now they are learning to interpret multiplication expressions as multiplicative comparisons (ex. 5 times as many as 4 candies).

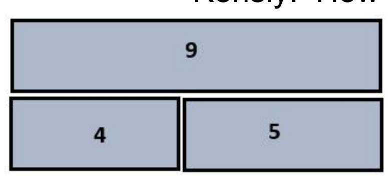
- Have students make a concrete and/or pictorial model to represent the relationships between the values in the following expressions/situations:
    - There are 5 bags with 4 candies in each bag. How many candies are there?



    - Morgan had 4 candies. Carson had 5 times as many candies as Morgan. How many candies did Carson have?



    - Kensly had 4 candies. Corbin had 5 more candies than Kensly. How many candies did Corbin have?



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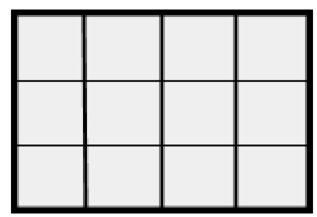
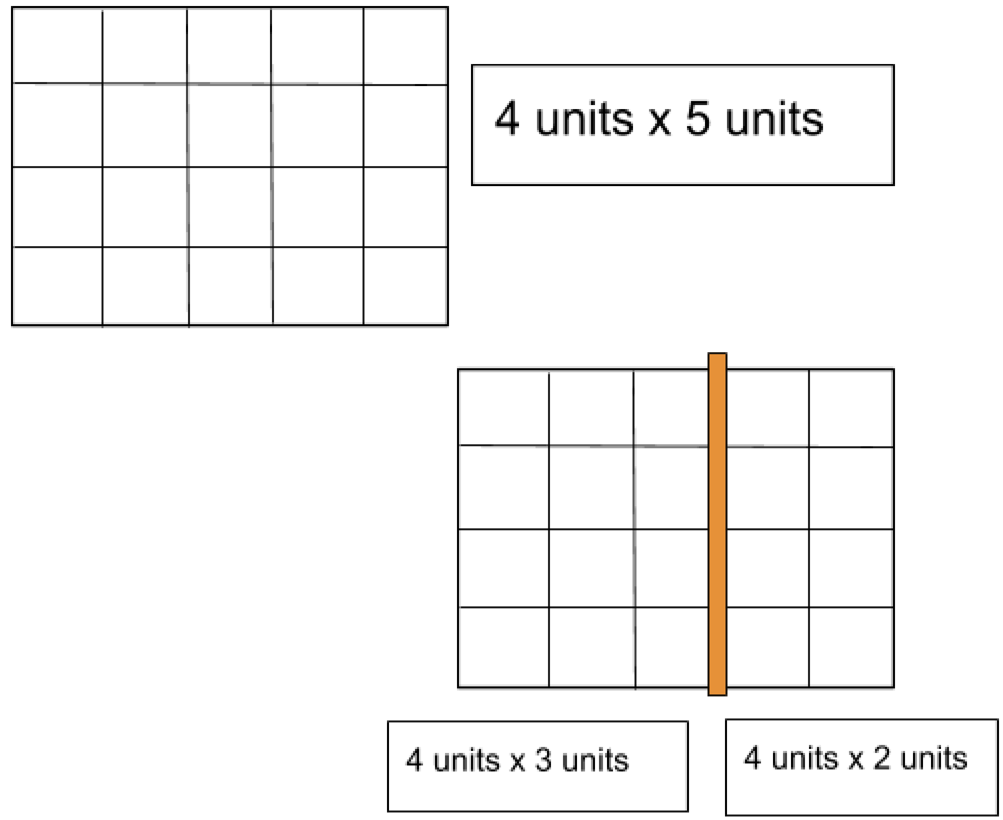
	● Sort different story problems by the type of relationship between the values: equal groups, multiplicative comparison, additive comparison. Students can draw models and/or write expressions for each story problem. (Sorting Problems Blackline Master)
The student has difficulty determining the factors of a given number or the multiples of a given number. The student confuses the terms "factor" and "multiple."	● Explore multiples of a number by relating it to skip counting. Students can sit or stand in a circle. Tell the students to **skip count by 2** around the circle twice. Have the students record the numbers that were said by listing them, marking them on a number line, or circling them on a hundred chart. Ask the following questions: "*What do the numbers said have in common? Was the number 15 said? Why or why not?"* Explain to students that skip counting can help you figure out the multiples of a number. Repeat the skip counting activity with other numbers such as **3, 4,** and **5**. ● Have students make a rectangle with 10 one-inch square tiles. Record the rectangle on one-inch graph paper *(Blackline Master in Unit 2 Lesson 5 and Unit 2 Lesson 6).* Tell students to label the dimensions (number of rows and columns) of the rectangle and write a related multiplication equation for the array. For example, a rectangle that is made of 2 rows and 5 columns would be written as 2 x 5 = 10. The numbers 2 and 5 are a factor pair of 10, and 10 is a multiple of 2 and 5. Try to build different rectangles with the 10 tiles and record the factor pairs on the graph paper.
The student has difficulty determining whether a given number is prime or composite. **A common misconception is that all odd numbers are prime.**	● Have students make rectangles with one-inch square tiles and one-inch graph paper *(Blackline Master in Unit 2 Lesson 5 and Unit 2 Lesson 6)* to prove whether a given number is prime or composite. Discuss whether a 1x5 rectangle and a 5x1 rectangle count as the same rectangle. In this case, the number 5 is prime because only one rectangle can be made using 5 tiles. The only factors of 5 are 1 and 5. Repeat the steps with the number 15 (and other numbers up to 50). The number 15 is not prime because more than one rectangle can be made using 15 tiles. Therefore, all odd numbers

	are *not* prime.
	
	• Engage students in discussions about the following questions:
	  ○ *Do you think that all odd numbers are prime numbers?*
	  ○ *Can you find examples that prove all odd numbers are not prime numbers?*
	  ○ *Choose several odd numbers less than 50. Which ones are prime and which ones are composite?*

The student may not understand that rectangles with the same area may have different perimeters and that rectangles with the same perimeter may have different areas.	• Measure and cut a piece of yarn or string a specified length (i.e., 12 inches). Use the piece to make several closed figures. Discuss with students that the length of the yarn/string (perimeter) does not change even though the shape has. • Use square grid paper to draw multiple rectangles with the same area *(Blackline Master in Unit 2 Lesson 5 and Unit 2 Lesson 6).* Record the area. Then find the perimeter of each shape. Ask: *"What do you notice about the different shapes?"* • Use square grid paper to draw multiple rectangles with the same perimeter. *(Blackline Master in Unit 2 Lesson 5 and Unit 2 Lesson 6).* Record the perimeter. Then find the area of each shape. Ask: *"What do you notice about the different shapes?"* • Cut out paper rectangles or use index cards that are about 3 inches by 5 inches. Each pair of students needs six rectangles. They will fold and cut the rectangles on the diagonal which will make two identical triangles. Then they will rearrange the triangles into different shapes making sure that only sides of the same length are matched up. Have pairs of students find all of the triangles and quadrilaterals that can be made in this way. They should glue the triangles on paper to record each shape. Engage the students in a discussion about the size and shape of the different figures. Ask: "*Is one shape larger than the other ones? How do you know? Did one shape take more paper to make or did they use the same amount of paper?"* Guide students to conclude that all of the figures

	have the same area even though each figure is a different shape (Van de Walle). • Students will work in pairs for this activity. Each group will need three sets of paper rectangles: Set A - 2 in. x 9 in. and 3 in. x 6 in.; Set B - 1 in. x 10 in. and 3 in. x 5 in.; Set C - 3 in. x 8 in. and 4 in. x 5 in. The students may cut or fold the rectangles in any way in order to determine which rectangle in each pair has the greater area or if the two are the same size (Van de Walle).
The student may have difficulty finding the missing dimension (unknown factor) of a figure.	• Use square tiles or grid paper to make the figure having the specified width and area. Then use the constructed figure to determine the unknown length. Area = 12 square units Length = 4 units  Width= W units • Encourage students to connect their everyday experiences and intuitive understanding of area and perimeter to what they learn in the mathematics classroom. Wherever possible, measurement examples should be related to real life examples, such as playing fields, yards, fencing, room layouts, tiling a room, and swimming pools.
The student may have difficulty using the distributive property to decompose a rectangle.	• Pair students and give each group color square tiles and rulers. The first student will use the tiles to build an array *(i.e., 4 units x 5 units = 20 square units)*. The second student will use the ruler to make one vertical or horizontal separation in the array, creating 2 smaller arrays *(4 units x 3 units = 12 square units and 4 units x 2 units = 8*

square units). Both students will determine and record the dimensions of each smaller array. They will add up the products to determine if the final product (composed of 2 partial products) matches the original array.



Resources:

Rutherford, Kitty and Schulz, Denise: NC Department of Public Instruction . “Common Mathematical Misconceptions”

Van de Walle, John. *Teaching Student-Centered Mathematics (Volume 2) - Grades 3-5*

“Fourth Grade Instructional Framework” - North Carolina Collaborative for Mathematics Learning (nc2ml.org)

Tools4NCTeachers website. Grade 4 Cluster 2.