Teacher Guide to Clarification

**2.OA.4**

**Work with equal groups of objects to gain foundations for multiplication**

2.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 addends.

**Use Rectangular Arrays to Work with Repeated Addition & Write an Equation to Express the Total as a Sum**

This standard is building conceptual knowledge for multiplication. Students will learn how to find the total number of objects organized in rectangular arrays and use repeated addition.

A rectangular array is an arrangement of objects in horizontal rows and vertical columns. Arrays can be made out of any number of objects that can be put into rows and columns. All rows contain the same number of items and all columns contain an equal number of items. Have students use objects to build all the arrays possible with no more than 25 objects. Their arrays should have up to 5 rows and up to 5 columns. Ask students to draw the arrays on grid paper and write two different equations under the arrays: one showing the total as a sum by rows and the other showing the total as a sum by columns. Both equations will show the total as a sum of equal addends.

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|  |  |  |  | It is important for students to have the correct rectangular array and matching addition equation |
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The equation by rows: 20 = 5 + 5 + 5 +5

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The equation by columns: 20 = 4 + 4 + 4 + 4 + 4

Build on knowledge of composing and decomposing numbers to investigate arrays with up to 5 rows and up to 5 columns in different orientations. For example, form an array with 3 rows and 4 objects in each row.

Represent the total number of objects with equations showing a sum of equal addends two different ways: by rows, 12 = 4 + 4 + 4; by columns, 12 = 3 + 3 + 3 + 3. Show that by rotating the array 90° to form 4 rows with 3 objects in each row. **Have students discuss this statement and explain their reasoning: The two arrays are different and yet the same.**

**2.OA.4** 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:

Find the total number of objects below. (Students use concrete objects to show, solve and explain)



Students may arrange any set of objects into a rectangular array. Objects can be cubes, buttons, counters, etc. Objects do not have to be square to make an array. *Geoboards* can also be used to demonstrate rectangular arrays. Students then write equations that represent the total as the sum of equal addends as shown below.



Kansas Association of Teachers of Mathematics (KATM) Flipbooks. Questions or to send feedback: melisa@ksu.edu. Retrieved from: <http://katm.org/wp/wp-content/uploads/flipbooks/2FlipBookedited.pdf>

**Coherence and Connections: Need to Know**

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| Below Grade Level | At Grade Level  | Above Grade Level |
| 1.OA.7 | **2.OA.4** | 3.OA.1 |

**Examples of Opportunities for Connections among Standards, Clusters or Domains**

Work with nickels (2.MD.C.8) and with telling time to the nearest five minutes on analog clocks (2.MD.C.7) should be taken together with counting by 5s (2.NBT.A.2) as contexts for gaining familiarity with groups of 5 (2.OA.C.4). Recognizing time by seeing the minute hand at 3 and *knowing* that is 15 minutes; recognizing three nickels as 15¢; and seeing the 15-ness of a 3-by-5 rectangular array held in any position at all (including with neither base horizontal) will prepare for understanding, in grade 3, what the new operation of multiplication means.

**Examples of Linking Supporting Clusters to the Major Work of the Grade**

* When students work with time and money (cluster 2.MD.C), their work with dollars, dimes and pennies should support their understanding and skill in place value (2.NBT). Their work with nickels, with telling time to the nearest five minutes on analog clocks, with counting by 5s (2.NBT.A.2), and with arrays of five rows and/or five columns (cluster 2.OA.C) should be taken together.

*PARCC Draft Model Content Frameworks: Mathematics Grades K-2* (2013, December).
 Retrieved May 10, 2014, from <http://parcconline.org/sites/parcc/files/PARCCMCFMathematicsNovember2012V3_FINAL_0.pdf>

**Levels in problem representation and solution**

Multiplication and division problem representations and solution methods can be considered as falling within three levels related to the levels for addition and subtraction (see Appendix). Level 1 is making and counting all of the quantities involved in a multiplication or division. As before, the quantities can be represented by objects or with a diagram, but a diagram affords reflection and sharing when it is drawn on the board and explained by a student. The Grade 2 standards 2.OA.3 and 2.OA.4 are at this level but set the stage for Level 2. Standard 2.OA.3 relates doubles additions up to 20 to the concept of odd and even numbers and to counting by 2s (the easiest count-by in Level 2) by pairing and counting by 2s the things in each addend. 2.OA.4 focuses on using addition to find the total number of objects arranged in rectangular arrays (up to 5 by 5).



Level 2 is repeated counting on by a given number, such as for 3: 3*;* 6*;* 9*;* 12*;* 15*;* 18*;* 21*;* 24*;* 27*;* 30. The count-bys give the running total. The number of 3s said is tracked with fingers or a visual or physical (e.g., head bobs) pattern. For 8x 3, you know the number of 3s and count by 3 until you reach 8 of them. For 24÷3, you count by 3 until you hear 24, then look at your tracking method to see how many

3s you have. Because listening for 24 is easier than monitoring the tracking method for 8 3s to stop at 8, dividing can be easier than multiplying.

Common Core Standards Writing Team. (2013, September 19). *Progressions for the Common
 Core State Standards in Mathematics(draft). K-5 Counting and Cardinality and
 Operations and Algebraic Thinking.* Tucson, AZ: Institute for Mathematics and
 Educations, University of Arizona.

**Classroom Resources**

Have Daily Discussion and use the Power Point to practice Repeated Addition with a Rectangular Array and the matching equation.

**HOT Questions**

1. I have a pile of marbles. Arrange these marbles into an array of rows and columns, then write a repeated addition equation to find the total amount.

2. Given the picture below, choose the 2 correct addition equations.

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a. 4 + 4 + 4 + 4 + 4 = 20

b. 20 = 5 + 5 + 5 + 5 + 5

c. 5 + 5 + 5 + 5 = 20

d. 20 = 4 + 4 + 4 + 4

3. Write two different addition expressions to describe the number of colors.

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4. I have a total of 36 books to arrange on shelves. What are two possible ways I can arrange the 36 books onto shelves. Draw your 2 pictures below and write an addition equation to represent both pictures.

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**Additional Resources**

Building Arrays – Center Activity
<http://www.k-5mathteachingresources.com/support-files/building-arrays.pdf>

Making Arrays – Center Activity
<http://www.k-5mathteachingresources.com/support-files/makingarraysr.pdf>

Real World Making Arrays- Multi-Step Problem – Enrichment <http://www.insidemathematics.org/assets/problems-of-the-month/diminishing%20return.pdf>

Howard County Assessing 2.OA.4 – Free printable Assessment Tasks
[https://grade2commoncoremath.wikispaces.hcpss.org/Assessing+2.OA.4](https://grade2commoncoremath.wikispaces.hcpss.org/Assessing%2B2.OA.4)