NEW MEXICO
Public Education Department

2.OA:OPERATIONS & ALGEBRAIC THINKING

Cluster Statement: C: Work with equal groups of objects to gain foundations for multiplication.

Supporting Cluster (Students should spend the large majority of their time (65-85%) on the major work of the grade/course. Supporting work and, where appropriate, additional work should be connected to and engage students in the major work of the grade.)

Standard Text	**Standard for Mathematical Practices**	**Students who demonstrate understanding can:**
2.OA.C.3 Determine whether a group of objects (up to 20) has an odd or even number of members, e.g., by pairing objects or counting them by 2s; write an equation to express an even number as a sum of two equal addends.	SMP 3: Students can construct viable arguments by proving whether a number is odd or even and critiquing the reasoning of others. SMP 4: Students can model with mathematics by using objects, drawings, numbers and/or equations to show whether a number is odd or even.	Recognize that in groups of even numbers objects will pair up evenly. Determine whether a group of objects is odd or even, using a variety of strategies. Generalize the fact that all even numbers can be formed from the addition of 2 equal addends. Count a group of objects up to 20 by 2s. Write an equation to express a given even number as a sum of two equal addends.
		Depth Of Knowledge: 1
		Bloom's Taxonomy: Understand and Apply
Standard Text	**Standard for Mathematical Practices**	**Students who demonstrate understanding can:**
2.OA.C.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.	SMP 4: Students can model with mathematics by writing an equation to go with an array. SMP 8: Students look for and express regularity in repeated reasoning by using repeated addition to begin thinking about multiplication.	Write an equation with repeated equal addends from an array. Generalize the fact that arrays can be written as repeated addition problems. Solve repeated addition problems to find the number of objects using rectangular arrays.

		Depth Of Knowledge: 1-2
		Bloom's Taxonomy: Understand and Apply
Previous Learning Connections Connect to decomposing numbers within 10 into pairs. (K.OA.3) and with addition of numbers within 20, specifically with doubles. (1.OA.6)	**Current Learning Connections** Connect to their understanding of number groupings to skip count within 1000. (2.NBT.2) and partitioning rectangles into rows and columns of same-size squares and count to find the total number of them. (2.G.2)	**Future Learning Connections** Connect to future work with understanding of odd and even to develop and apply more sophisticated mathematical arguments and proofs (MP3, MP4) and relating arrays to equal group situations. (3.OA.1)

Clarification Statement:

Second graders apply their work with doubles to the concept of odd and even numbers. Students should have ample experiences exploring the concept that if a number can be decomposed (broken apart) into two equal addends or doubles addition facts (e.g., 10 = 5 +5), then that number (10 in this case) is an even number. Students should explore this concept with concrete objects (e.g., counters, cubes, etc.) before moving towards pictorial representations such as circles or arrays.

Second graders use rectangular arrays to work with repeated addition, a building block for multiplication in third grade. A rectangular array is any arrangement of things in rows and columns, such as a rectangle of square tiles. Students explore this concept with concrete objects (e.g., counters, bears, square tiles, etc.) as well as pictorial representations on grid paper or other drawings. Due to the commutative property of multiplication, students can add either the rows or the columns and still arrive at the same solution.

Common Misconceptions

- Students may struggle with determining if a number greater than 9 is even or odd if they simply memorize a rule about digits because they won't understand whether 23 is even or odd based on the digits of 2 and 3 in the number.

Multi-Layered System of Supports (MLSS)/Suggested Instructional Strategies

Pre-Teach

Pre-teach (targeted): *What pre-teaching will prepare students to productively struggle with the mathematics for this cluster within your HQIM?*

- For example, some learners may benefit from targeted pre-teaching that uses images/resources (especially those being used the first time) when studying equal groups of objects to gain foundations for multiplication because working with equal groups of objects can be used for students to understand how these facts are derived and allows them to make those connections to multiplication.

Pre-teach (intensive): *What critical understandings will prepare students to access the mathematics for this cluster?*

- 1.OA.D.7: This standard provides a foundation for work with equal groups of objects to gain foundations for multiplication because students need the skill of adding and subtracting to understand the connection how repeated addition can represent the action of adding equal groups or rows/columns.

Core Instruction

Access

Interest: How will the learning for students provide multiple options for recruiting student interest?

- For example, learners engaging with working with equal groups of objects to gain foundations for multiplication benefit when learning experiences include ways to recruit interest such as providing novel and relevant problems to make sense of complex ideas in

creative ways because working with equal groups of objects can be used with novel and relevant problems in a way that is meaningful for students to understand how these facts are derived and allows them to make those connections to multiplication.

Build

Language and Symbols: *How will the learning for students provide alternative representations to ensure accessibility, clarity and comprehensibility for all learners? (e.g., a graph illustrating the relationship between two variables may be informative to one learner and inaccessible or puzzling to another; picture or image may carry very different meanings for learners from differing cultural or familial backgrounds)*

- For example, learners engaging with working with equal groups of objects to gain foundations for multiplication benefit when learning experiences attend to the linguistic and nonlinguistic representations of mathematics to ensure clarity can comprehensibility for all learners such as pre-teaching vocabulary and symbols, especially in ways that promote connection to the learners' experience and prior knowledge because developing a good understanding of what multiplication is and means is a prerequisite for moving onto basic multiplication facts. Students can use vocabulary and symbols to better understand that multiplication is repeated addition by making equal groups of objects with the help of pictures.

Internalize

Comprehension: *How will the learning for students support transforming accessible information into usable knowledge, knowledge that is accessible for future learning and decision-making?*

- For example, learners engaging with working with equal groups of objects to gain foundations for multiplication benefit when learning experiences attend to students by intentionally building connections to prior understandings and experiences; relating important information to the learning goals; providing a process for meaning making of new learning; and, applying learning to new contexts such as providing scaffolds that connect new information to prior knowledge (e.g., word webs, half-full concept maps) because building connections to prior understandings strengthens number sense and expands their thinking processes to see numbers in groups. These connections use prior knowledge to relate addition to multiplication.

Re-teach

Re-teach (targeted): *What formative assessment data (e.g., tasks, exit tickets, observations) will help identify content needing to be revisiting during a unit?*

- For example, students may benefit from re-engaging with content during a unit on working with equal groups of objects to gain foundations for multiplication by clarifying mathematical ideas and/or concepts through a short mini-lesson because clarifying ideas or concepts are a targeted re-engagement that can support students understanding of the relationship between operations and clarifies their distinction as they internalize the content while still maintaining the flow of the unit.

Re-teach (intensive): *What assessment data will help identify content needing to be revisited for intensive interventions?*

- For example, some students may benefit from intensive extra time during and after a unit working with equal groups of objects to gain foundations for multiplication by offering opportunities to understand and explore different strategies because offering different strategies as an intensive reteach can support students as they internalize the concept of grouping equal groups in using repeated addition for multiplication.

Extension

What type of extension will offer additional challenges to 'broaden' your student's knowledge of the mathematics developed within your HQIM?

- For example, some learners may benefit from an extension such as the opportunity to understand concepts more quickly and explore them in greater depth than other students when studying working with equal groups of objects to gain foundations for multiplication because students could extend their understanding of the relationship between multiplication to use their understanding of the properties of operations to multiply and divide.

Culturally and Linguistically Responsive Instruction:

Validate/Affirm: How can you design your mathematics classroom to intentionally and purposefully legitimize the home culture and languages of students and reverse the negative stereotypes regarding the mathematical abilities of students of marginalized cultures and languages?
Build/Bridge: How can you create connections between the cultural and linguistic behaviors of your students' home culture and language the culture and language of school mathematics to support students in creating mathematical identities as capable mathematicians that can use mathematics within school and society?

Posing Purposeful Questions: CLRI requires intentional planning around the questions posed in a mathematics classroom. It is critical to consider "who is being positioned as competent, and whose ideas are featured and privileged" within the classroom through both the types of questioning and who is being questioned. Mathematics classrooms traditionally ask short answer questions and reward students that can respond quickly and correctly. When questioning seeks to understand students' thinking by taking their ideas seriously and asking the community to build upon one another's ideas a greater sense of belonging in mathematics is created for students from marginalized cultures and languages. For example, when studying working with equal groups of objects to gain foundations for multiplication the pattern of questions within the classroom is critical because students are gaining knowledge of conceptual understanding, procedural skills, and fluencies that lead into multiplication. Students need to make that connection to the relationship between operations.

Standards Aligned Instructionally Embedded Formative Assessment Resources:
Source: http://tasks.illustrativemathematics.org/content-standards/2/OA/C/3/tasks/1418
This type of assessment question requires students to understand numbers and the patterns that make them even or odd and use the patterns to help solve problems more efficiently. You can assess if a student can write an equation for an even number using two equal addends and if equation for odd number has 2 equal addends plus 1.
You could use this task to inform and adjust instruction if necessary. This task allows you to assess students' understandings of even odd and patterns.

Relevance to families and communities:	**Cross-Curricular Connections:**
During a unit focused on Working with equal groups of objects to gain foundations for multiplication, consider options for learning from your families and communities the cultural and linguistic ways this mathematics exists outside of school to create stronger home to school connections for students, for example developing real world connections that are culturally relevant to students make more meaningful interactions for students to engage and conceptualize new ideas and vocabulary.	Art: Students can study the use of arrays and even and odd in the creation of pieces of art.