Cluster 2: Building a Conceptual Understanding of Addition and Subtraction

Duration: 3-4 weeks

Content Standards:
This list includes standards addressed in this cluster, but not necessarily mastered, since all standards are benchmarks for the end of the year. Note strikethroughs and recommendations in the Important Considerations section for more information.

NC.1.OA.1
Represent and solve addition and subtraction word problems, within 20, with unknowns, by using objects, drawings, ~~and equations with a symbol for the unknown number to represent the problem~~, when solving:

- Add to/Take from-Change Unknown
- Put together/Take Apart-Addend Unknown
- ~~Compare-Difference Unknown~~

NC.1.OA.3
Apply the commutative and associative properties as strategies for solving addition problems.
NC.1.OA.6
Add and subtract, within 20, using strategies such as:

- Counting on
- Making ten
- Decomposing a number leading to a ten
- Using the relationship between addition and subtraction
- Using a number line
- Creating equivalent but simpler or known sums

NC.1.OA.7
Apply understanding of the equal sign to determine if equations involving addition and subtraction are true.
NC.1.OA.9
Demonstrate fluency with addition and subtraction within 10.

Mathematical Practices:
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.

What is the mathematics?

- In this cluster, students work on the concept of addition and subtraction within 20 and focus on building fluency within 10. Mastery of facts is not expected at this point in the year.
- Word problems serve as the context within which students develop an understanding of the meaning of the operations of addition and subtraction. Children best gain understanding through carefully crafted experiences where students use their own prior knowledge to solve problems rather than following a demonstrated procedure.
- In this cluster, students use concrete objects and drawings in real world contexts or to solve problems. Though these experiences students begin to understand situations in which we add and subtract. They use the language of *more, less*, and *the same as* to describe

different situations including those where a quantity is increased or decreased.

- At this time students are introduced to two problem types: add to/take from and put together/take apart (part-part-whole). Compare-Difference Unknown problems are not taught at this time. This concept will be taught in Cluster 3. Students solve problems using objects and drawings.
    - Add to/take from problems involve actions that increase or decrease a quantity. In Kindergarten, students solved add to/take from problems where the result was unknown. This year students focus on change unknown problems.
        - Add to- Change unknown- There were 3 bears having a picnic. Some more bears came to join. Now there are 5 bears at the picnic. How many bears came to join the picnic?
        - Take From- Change unknown - 5 bears were having a picnic. Some bears left the picnic. Now there are 3 bears at the picnic. How many bears left the picnic?
    - Put together/ take apart problems do not involve an action. These problems can be thought of as two parts that make a whole. In Kindergarten students worked to solve put together/take apart problems where the total was known. In1st grade they also work to solve problems in which the whole and one part are known, and the other part is unknown (ex. A vase is filled with 7 flowers. Three flowers are red and the rest are yellow. How many yellow flowers are in the vase?)
- Students continue to develop number sense by focusing on relationships between numbers (ex. doubles, doubles +/- 1, benchmarks of five and ten). They solve addition and subtraction problems with multiple strategies and representations.
- The strategies below are the ways students typically solve addition and subtraction problems as they develop over time, gradually moving away from counting to using number relationships and finally towards mastery. Memorization of these specific strategies should not be the focus but rather students should be given the opportunity to choose strategies as they reason through problems. This can be supported through the use of classroom discussions in which teachers carefully sequence the sharing of student work to promote the use of different strategies and to support students in learning how to choose an efficient problem-solving method.
    - Counting on- ex. Students begin with a quantity and then count on from there to find the sum. 7+3 can thought of as 7, 8, 9, 10 (student often raise one finger as they count). After many experiences with counting on, children begin to realize it is most efficient to start at the larger addend when using this strategy.
    - Making ten-

      7 + 6 = __

      3 3

    - 10 + 3 = 13
    - Decomposing a number leading to a ten-

      12 - 4 = __

      2 2

      10 - 2 = 8
    - Using the relationship between addition and subtraction- ex. Knowing 7 + 8 = 15, a student also knows 15 - 8 = 7
    - Using a number line to make jumps by ones or by groups
    - Creating equivalent but simpler or known sums- ex. Adding 8 +9 by using the known

doubles fact 8+8 = 16 and adding 1 (8+8 + 1) = 17

- Students use the associative and commutative property as strategies to add and subtract.
    - The commutative property of addition states that the order of the addends does not change the sum. For example: If a child knows 4+7 =11 then they also know that 7+4=11. Knowledge of this property cuts in half the number of facts that students must master in order to be fluent with single digit addition and subtraction.
    - The associative property of addition states that the grouping of 3 or more addends does not affect the sum. While students are not being given 3 addends at this time, this property is utilized when students decompose to make addition easier. For example: To solve 9 + 7 a child might decompose the 7 into 6 and 1 to make a 10. 9+7 = 9+(1+6) = (9+1)+6. These standards introduce the concept of equality *with* concrete objects and drawings but *without* using symbolic notation (=, < and >). Instead students use the language of *more, less,* and *the same value as* to describe their work.
- As students work with addition and subtraction they are moving towards becoming fluent with their math facts. In order for students to be fluent in addition and subtraction they must be able to access basic facts flexibly, accurately, efficiently and appropriately. Reasoning strategies should be at the center of basic fact instruction rather than a focus on the memorization of facts. In fact, memorization can foster inflexible thinking, ultimately working against fluency as children may continue to count by ones for sums and differences rather than internalizing number relationships that will be used throughout the grades.

Important Considerations:

- Start with number ranges within 10 and move on to within 20 as students are ready. When introducing a new problem type or problem context, consider lowering the numbers so students can engage more fully in thinking about the structure of the problem and then increase the number size.
- The consistent and accurate use of symbols to write number sentences is not expected until mid-year though students were exposed to symbols for the first time at the end of kindergarten. Students will naturally build on their knowledge of symbols for addition, subtraction, and equals to write number sentences, but the primary goal is for students to develop a deep, intuitive understanding of number relationships. It is particularly important for students to see symbols as ways to record these relationships and view the equal sign as meaning “has the same value.” As they internalize the relationships they are learning through language (ex. 4 and 3 is 7; 3 is more than 2) and seeing symbols modeled in connection with other representations they gradually take on symbol use as another way to represent those relationships.
- When students feel their strategies are valued, this can foster positive attitudes, making math more interesting and enjoyable while increasing their understanding of the concepts.
- Providing students with experiences with number relationships such as more/less, doubles, near doubles, making fives, and making tens will help them develop fact fluency.