COMPUTATION

SKILL: ADDING AND SUBTRACTING

Virginia Kindergarten Readiness Program

WHAT IS IT?

Once students have some understanding of how to quantify collections meaningfully (e.g., they can use the cardinality principle to understand the total number of objects in a collection) and understand verbal-based number relations (i.e., using vocabulary such as "more" to specify which of two groups has the most objects), they are ready to solve basic addition and subtraction word problems. With young children, addition and subtraction problems will most often involve small numbers and usually concrete objects that they can work with or manipulate.

Addition

Addition is the process of combining numbers (or sets of objects) to make a total. Addition can be defined in terms of counting, for example, the sum of 2+4 results from counting 4 more numbers, starting at the number 2 ("three, four, five, six").

Subtraction

Subtraction is the inverse of addition and requires children to recognize that numbers (or sets of objects) can be separated to make another number. In other words, 5 – 2 = __ means the same as 5 = 2 + __. "What is 5 – 2" is the same thing as asking, "What number added to 2 gives me 5?". Subtraction results from counting backward. For example, the difference 5 – 2 is the number that results from counting backward two numbers, starting at 5 ("four", "three"). This process is consistent with the *take away* notion of subtraction.

Key skills and concepts	Definitions
More and Less	Before students can begin solving addition and subtraction problems, they first need to recognize when a set has more, less, or the same amount, as another set.
Transformations	Once students are able to recognize transformations and identify the direction of change, they are well on their way to solving addition and subtraction problems. For example, if a student can look at two pictures, one with 5 blocks and one with 2 blocks, and say that there are now less blocks, or can even say "someone took some away"– even if she is not sure how many were taken away– she is doing some early operational thinking.
Relationship between operations and counting	Understanding that counting is just adding one to the previous number. When students are able to count objects and say how many there are, they are actually doing some basic addition. When children are taking away, they are counting backwards.
Parts and Wholes	The idea that numbers are made up of combinations of smaller numbers. When students work with putting together and taking apart sets, they start to notice how wholes can be broken up into parts. For example, they might figure out that 4 can be made up of 2 and 2, or it can be made with a 3 and a 1. Having a good sense of how different numbers can be made up of or broken into other numbers will also help students to solve addition and subtraction problems.

WHY IS IT IMPORTANT?

Early and basic arithmetic skills that children learn in preschool and kindergarten set the foundation for later more complex arithmetic and word problems.

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HOW DOES IT DEVELOP?

At this age	Children can typically:
4	• Add and subtract small numbers (up to 3+2) using objects. For example, when asked, "You have 2 chips, and get 1 more. How many in all?", students are able to count out two chips, then count 1 more, then count all 3 to arrive at the answer.
5	• Find Result: Solve addition and part-part-whole problems by direct modeling, counting-all, and using objects. • Find Result: Solve subtraction problems by separating with objects. For example, when asked, "You have 3 cupcakes and give 1 to your friend. How many do you have left?", this student will count out 3 cupcakes, then take away 1, then count the remaining two. • Find Change: Find the missing addend (2+_=5) by adding on objects and complete subtraction problems through matching objects and comparing. • Make It: Make one number into another without needing to count from "1", this is a significant advancement in a student's computation skills. For example, when adding 2+3, this student is able to hold up 2 fingers and then count 3, 4, 5, and indicate that 5 is the answer.
6	• Use counting strategies to solve addition problems, such as finger patterns or counting on. • Understand some basic part-whole concepts.

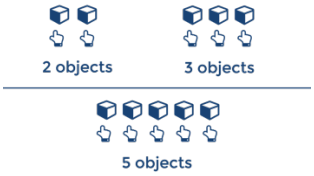
STRATEGIES TO SUPPORT DEVELOPMENT OF ADDITION AND SUBTRACTION

ADDITION

Use concrete representations.

The use of concrete objects (e.g., counters or pennies) is very helpful for students as they begin to learn to add and subtract because it helps them to imagine and better understand the problem so that they can use their counting skills to solve the problem. For example, given a set of two concrete objects and another set of three concrete objects, students are easily able to use one-to-one correspondence to count the total number of objects.

Counting all. In this strategy, learners first count sets separately, then combine sets, then count the total.



Encourage students to count individual groups first, then re-count when combining sets. For example, if students are asked to count a group of 2 objects and 3 objects, ask questions such as, "Let's count the first group. How many do you have," "Now, let's count the second group. How many do you have," and "When you put them together, how many did you have altogether?". Using this strategy, students will now count all of the objects to arrive at the answer, beginning with the number 1. Start with two groups with a small number of objects and then increase the size of the groups as students become more proficient.

Counting on.

Encourage students to "count on" from the number of objects in the first group, rather than "counting all" of the objects again once the two sets are put together. In "counting-on", the child begins counting with the number (e.g., three) representing the objects in one group and then counts-on with the number of objects in the second group. For example, when adding a group of 2 and a group of 3, the child would say, "three, four, five" and indicate that there are "five" objects all together. Counting on is a more efficient strategy because you don't need to start counting again from one. Most students will start with counting all and then move to counting on to get the same answer.

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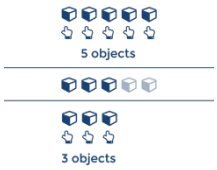
SUBTRACTION

Splitting: Count the number of items in a set, take away a number of items, count the number left over.



This is called splitting because students split the set of objects into two and then count the remaining objects.

Help students understand that subtraction is the inverse of addition and to use the "counting down" or "counting up to" strategies to solve subtraction problems.

To help children understand the concept of subtraction, show how taking away objects is simply the inverse of adding objects. For example, the difference 5 – 2 is the number that results from counting numbers backward starting at 5…5, 4, 3 (Counting Down). Asking "what is 5 minus 2" means the same as "what number added to 2 gives us 5?" (Counting Up). Understanding that subtraction is the inverse of addition takes students time and practice.

WHAT MAKES ADDITION AND SUBTRACTION EASIER OR HARDER

- The larger the numbers, the more difficult the problems. Problems with numbers larger than 10 are more difficult than problems including numbers smaller than 10.
- The type and structure of the word problem makes it easier or harder. Result unknown problems are relatively easy (3 + 5 = __), change unknown problems are harder (4 + __ = 6), and start unknown problems are the hardest (__ + 4 = 7).

THE LINGO

Counting all – Counting out the two sets of objects to be added together separately, and then combining the two sets and counting the newly combined set.

Counting down – A student would solve the problem, 4-1 by taking away 1 counter and then counting backward from 4

Counting on – In "counting on", the child begins counting with the number (e.g., three) representing the objects in one group and then counts-on with the number of objects in the second group. This strategy is more efficient than counting-all, and many students will move from counting-all to counting on.

Counting up – Students start at the lower number and then count up until they have completed the whole set, and then they see how many you counted up.

Direct Modeling – Students "act out" the situation described in the word problem. That is, they mirror the operations described using physical or concrete objects.

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Early Operational Thinking – Identifying the direction of change within a group of objects even if the exact quantity of change is incorrect. For example, being able to say "someone added something to the group" or "someone took something away from the group" is early operational thinking.

Finger Patterns – The use of fingers to help students track quantities in a problem. For example, "This dog has 2 toys but he should have 4, make it 4"; In this scenario a student would hold up 2 fingers on one hand and count up from 2 while putting up two fingers on the other hand, saying "3, 4" and recognizing the addition of 2 fingers.

Representations – Similarly to Direct Modeling, the use of concrete representations (counters or pennies) helps students to better imagine the problem so that they can use their counting skills effectively.

Splitting – Counting the number of items in a set, taking away a number of items and then counting the number left over

INTEGRATING ADDITION AND SUBTRACTION THROUGHOUT THE DAY

ROUTINES 	During routines, such as taking attendance, have students count the number of students present, and using the total number of students in your class, have them determine the number of students who are absent.
TRANSITION 	As students are lining up for outdoor time, ask them to add students together to form groups of 4 or 5.
MEALS 	When students are eating, ask them to add together and take apart groups of different foods, such as raisins. Also, encourage students to count their snacks before eating (i.e., 8 grapes), and as they eat, ask them how many grapes they have left now.
OUTDOOR TIME 	During outdoor time, go on a bug hunt! Have students make a list of the bugs they will search for. After all students have found their bugs, ask them to add their bugs together.
CENTERS 	During center or free time, have students build different sized towers with Legos and ask them how many more or less they would need for their towers to be equal. Center time is also a great opportunity to engage students in dramatic play by setting up a store with different priced items. You can give students fake pennies, and after they purchase an item, ask them how many pennies they have left.

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SAMPLE ACTIVITIES THAT SUPPORT ADDING AND SUBTRACTING

Learnzillion Addition Activities

Understand what it means to find one more
https://learnzillion.com/lesson_plans/3142
LearnZillion© 2016

Solve problems by finding one more
https://learnzillion.com/lesson_plans/3205
LearnZillion© 2016

Understand that one way to add is putting groups together
https://learnzillion.com/lesson_plans/3198
LearnZillion© 2016

Use counting to add to a group
https://learnzillion.com/lesson_plans/3203
LearnZillion© 2016

Learnzillion Subtraction Activities

Understand taking apart within 5
https://learnzillion.com/lesson_plans/2832
LearnZillion© 2016

Solve problems by taking from within 5
https://learnzillion.com/lesson_plans/3705
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Decompose within 5
https://learnzillion.com/lesson_plans/3709
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Solve problems by decomposing within 5
https://learnzillion.com/lesson_plans/3707
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MTP M/S© Activities

Snap Cube Counting
Available as PDF
MTP M/S©

Counting with Acorns
Available as PDF
MTP M/S©

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