Investigations in Number, Data, and Space®

Kindergarten Math Content [1]

Number and Operations: Whole Numbers

Counting and the Number System

A main focus in Kindergarten is counting, which is the basis for understanding the number system and for almost all the number work in the primary grades. Students hear and use the counting sequence (the number names, in order) in a variety of contexts. They have many opportunities to connect the number names with the written numbers and with the quantities they represent. They have repeated experiences counting sets of objects, and matching and making sets of a given size. As students count sets of objects and make equal sets they begin to see the importance of counting each object once and only once, and of having a system for keeping track of what has been counted and what still remains to be counted. Students engage in repeated practice with counting and develop visual images for quantities to 10.

This student used pictures, numbers and words to show that he counted 13 nuts. He drew a circle for each nut and wrote both the number and the word – '13 nts.' When he recounted his circles to check, he realized he had one too many, so he scribbled out one circle.

[1] This document applies to the 2nd edition of *Investigations* (2008, 2012). See http://investigations.terc.edu/CCSS/ for changes when implementing *Investigations and the Common Core Standards*.

As students are developing accurate counting strategies they are also building an understanding of how the numbers in the counting sequence are related: Each number is one more (or one less) than the number before (or after) it. Students develop an understanding of the concepts of greater than, fewer than, and equal to, and develop language for describing quantitative comparisons (e.g. bigger, more, smaller, fewer, less, same, equal) as they count and compare quantities.

Example: Write the names of the people in your home. Circle the name with the most letters.

Emphases

Counting and Quantity

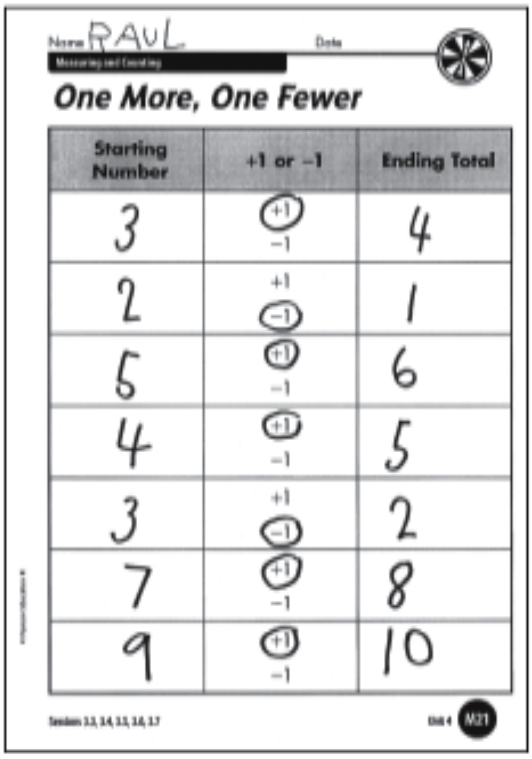
- Developing strategies for accurately counting a set of objects by ones
- Developing an understanding of the magnitude and position of numbers

Benchmarks

- Count a set of up to 10 objects
- Compare two quantities up to 10 to see which is greater
- Count a set of up to 15 objects
- Figure out what is one more or one fewer than a number
- Write the numbers up to 10
- Count a set of up to 20 objects

Addition and Subtraction and the Number System

Young students develop their understanding of the operations of addition and subtraction by having many opportunities to count, visualize, model, solve and discuss different types of problems. Many of the counting activities in Kindergarten build a bridge to the operations of addition and subtraction, as students add a small amount to a set or remove a small amount from a set and figure out, "How many now?" One of the ways students are introduced to addition and subtraction is via story problems about combining and separating. They retell the stories, act them out, and solve them, by modeling the action involved and using counting strategies. Students also play a variety of games that model the operations of addition and subtraction. They have repeated experiences joining two or more amounts, and removing an amount from a whole.



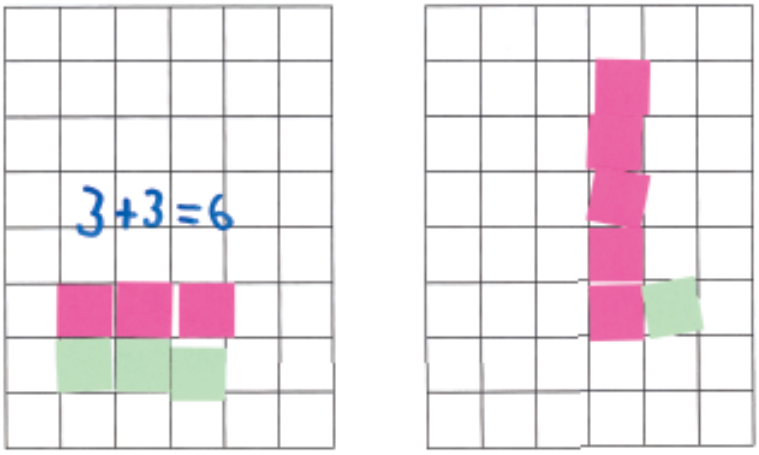
Name RAUL Date

One More, One Fewer

Starting Number	+1 or –1	Ending Total
3	(+1) –1	4
2	+1 (–1)	1
5	(+1) –1	6
4	(+1) –1	5
3	+1 (–1)	2
7	(+1) –1	8
9	(+1) –1	10

Sessions 3.3, 3.4, 3.5, 3.6, 3.7 Unit 4 M21

Later in the year students work with combinations of quantities that they can count fluently. As they find ways to arrange and describe sets of 5-10 square tiles or record combinations of two-color counters, they begin to see that numbers can be composed in different ways. They work on activities that involve seeing and describing a given quantity (e.g. 6 tiles) as made up of groups (e.g. a group of 4 and a group of 2). They are also asked to decompose quantities (e.g. 6 can be split into 4 and 2) and to find one or more combinations of a quantity (e.g. 6 can be decomposed as 6 and 0, 3 and 3, or 5 and 1.) This work lays the foundation for making meaningful sense of 4 + 2 = 6 and 6 – 4 = 2 in subsequent years.



Students show their arrangements of six tiles and indicate how they know there are six tiles in all.

Example: Record the total number of chips. Toss the chips. Record the number that are red and the number that are yellow.

Total Number: 6

Red	Yellow
2	4
5	1
3	3
3	3
4	2

Students use mathematical tools and representations to model and solve problems to clarify and communicate their thinking. Kindergartners are just beginning to learn how to represent their mathematical work on paper and are encouraged to do so in ways that make sense to them. Many use combinations of pictures, words, and numbers.

The Algebra Connections pages of the units that focus on counting, addition, and subtraction show how students develop ideas about how numbers describe the size of a set–that the number of objects in a set is fixed no matter how it is arranged and counted, and different sets may have the same number of objects. Students' observations about the constancy of the total, no matter what the order of counting a set of objects, lays the foundation for what they will later call the commutative property of addition. These pages also show how students work on ideas of combining and decomposing quantities and on understanding how addition and subtraction operate. Thus, the generalization Kindergarten students are approaching might be stated as: When adding (with the numbers they know), the resulting amount is greater than you started with. When subtracting (with the numbers they know), the resulting amount is less than you started with.

Emphases

Whole Number Operations

- Making sense of and developing strategies to solve addition and subtraction problems with small numbers
- Using manipulatives, drawings, tools and notation to show strategies and solutions

Benchmarks

- Combine two small quantities
- Figure out what is one more or one fewer than a number

Data Analysis

Sorting and classifying are central to organizing and interpreting data. Students in Kindergarten have many opportunities to identify the attributes of groups of objects, determine how the objects are the same and different and sort them into groups according to their attributes. Students apply these skills to organizing data when they sort their favorite lunch foods into categories.

Students think about how these pieces of information are the same and different in order to determine how the data might be grouped and how those groups can be defined.

Important to any data collection activity is the need to establish the group of people or objects being considered. Students begin their work on data by determining the number of students in the class and finding a way to represent this number on paper. As students collect data about themselves, they think about the one to one correspondence between the number of people and the number of pieces of data. Developing strategies for keeping track of who has responded to a survey, recording data, as well as representing this information, are important parts of the Kindergarten work.

To begin to understand the processes involved in data analysis, Kindergarteners are involved in all phases of conducting a survey: They choose and pose a question, determine how to record responses, and count and make sense of the results.

Example: Do you like  ?

Yes	No
Carmen	Dennis
Mitchell	Timothy
Mary	Sarah
Tammy	Lisa
Raul	Kiyo
Jennifer	Latoya
	Lionel
	Manuel
	Yoshio
	Beth
	Russell

Students also use some of the data they collect to solve mathematical problems connected to their classroom. For example,

"25 students are in our class. 4 are absent. How many are here?"

Emphases

Data Analysis

- Representing Data
- Sorting and Classifying
- Carrying Out a Data Investigation

Benchmarks

- Represent a set of data
- Use data to solve a problem
- Sort a set of objects according to their attributes

Measurement

In Kindergarten, students are introduced to length and linear measurement through measuring by direct comparison. As they compare objects to determine the longest object, they discuss and make sense of important aspects of accurate measurement such as choosing which dimension to measure.

Students begin to think about the different dimensions of objects.

They also become comfortable with, and use language to describe length—long, short, wide, tall, high (and the comparative forms –longer, wider, etc). Later in the year students use multiple nonstandard units (e.g., craft sticks or cubes) to quantify length: "How many craft sticks long is this desk? the path from the window to the door?" "How many cubes long is my shoe? this pencil?" As they measure lengths around their classroom, students think about what happens if the units are (or are not) laid straight or if there are (or are not) gaps or overlaps between them.

Students begin to think about measuring accurately

Emphases

Linear Measurement

- Understanding length and using linear units

Benchmarks

- Decide which of two objects is longer
- Measure the length of an object by lining up multiple units

Patterns, Functions, and Change

Kindergarten students construct, describe, extend, and determine what comes next in repeating patterns. To identify and construct repeating patterns, students must be able to identify the attributes of the objects in the pattern. Therefore students first work on sorting objects by their attributes, before they begin constructing their own patterns. Students encounter patterns with two (AB, AAB, ABB) or three (ABC) elements. As students construct and describe many different patterns, they become more familiar with the structure of patterns, are able to identify what comes next in a pattern, and can begin to think about how two patterns are similar and different.

Example: What is the same about these cube trains? What is different?

After having many opportunities to construct their own patterns and extend patterns made by others, students begin to analyze the structure of a repeating pattern by identifying the *unit* of the pattern—the part of the pattern that repeats over and over.

Example: What is the repeating unit of this pattern?

Emphases

Data Analysis

- Sorting and Classifying

Repeating Patterns

- Constructing, describing, and extending repeating patterns
- Identifying the unit of a repeating pattern

Benchmarks

- Copy, construct, and extend simple patterns, such as AB and ABC
- Begin to identify the unit of a repeating pattern

Geometry

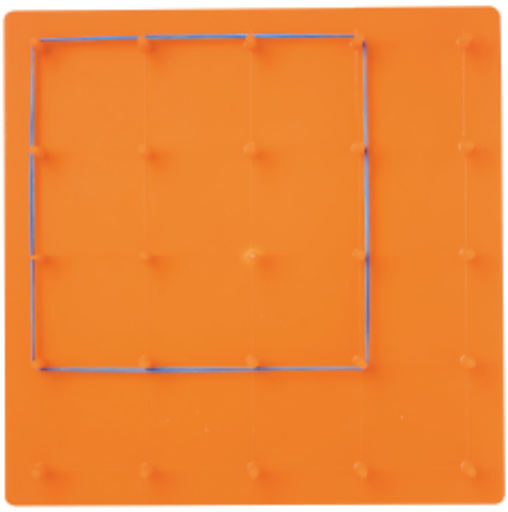
The geometry work in Kindergarten builds on students' firsthand knowledge of shapes to further develop their spatial sense and deepen their understanding of the two-and three-dimensional

world in which they live. As students identify the different shapes that make up the world, they are encouraged to use their own words to describe both 2-D and 3-D shapes. In this way, they form images of familiar shapes through associating them with familiar objects.

Students explore the geometric idea that shapes can be combined or subdivided to make other shapes. For example, they investigate how 3-D shapes can be combined to form a particular rectangular prism.

By putting shapes together and taking shapes apart, students deepen their understanding of the attributes of shapes and how shapes are related.

Students also construct 2-D and 3-D shapes with clay and on Geoboards. As they construct shapes they form mental images of the shapes and think about the attributes of particular shapes.



The *Shapes* software is introduced as a tool for extending and deepening this work. This tool is designed for K-2 students to explore how different shapes can be combined to form other shapes,

experiment with different sorts of geometric transformations (rotations, translation, reflection), make patterns, and investigate symmetry.

Emphases

Features of Shapes

- Composing and decomposing 2-D and 3-D shapes
- Describing, identifying, comparing, and sorting 2-D and 3-D shapes

Benchmarks

- Describe the overall size, shape, function, and/or features of familiar 2-D and 3-D shapes
- Construct 2-D and 3-D shapes
- Make 2-D and 3-D shapes by combining shapes