Investigations in Number, Data, and Space®

Grade 1 Math Content[1]

Number and Operations: Whole Numbers

Counting and the Number System

Throughout first grade, students work on developing strategies for accurately counting a group of up to 50 objects. They have repeated practice with the counting sequence, both forwards and backward, and with counting and keeping track of sets of objects. They also connect the number names with the written numbers and the quantities that they represent.

5

Five

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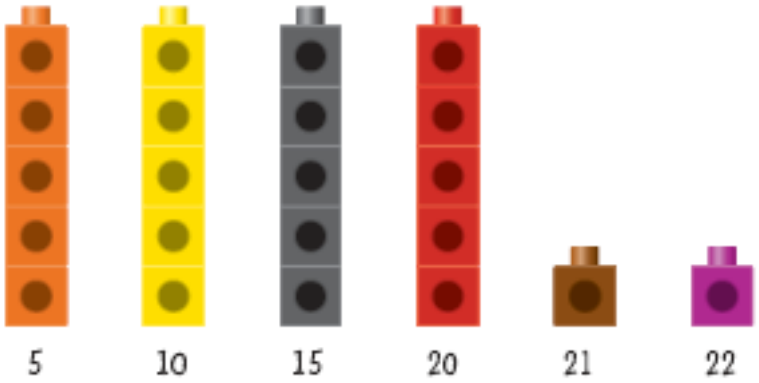
As students are developing accurate counting strategies they are also building an understanding of how the numbers in the counting sequence are related—each number is one more (or one less) than the number before (or after) it. As students build this understanding, they compare and order quantities and develop a sense of the relative size of numbers and the quantities they represent.

[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*.

Students also make sense of counting by numbers other than 1. They connect the number sequence of counting by 2s, 5s, and 10s to the quantities they represent. As they work on activities that involve multiple groups of the same amount, they build an understanding that as they say each number in the counting sequence, they are adding 2, 5 or 10 more things. This leads to more efficient and accurate counting.



Emphases

Counting and Quantity

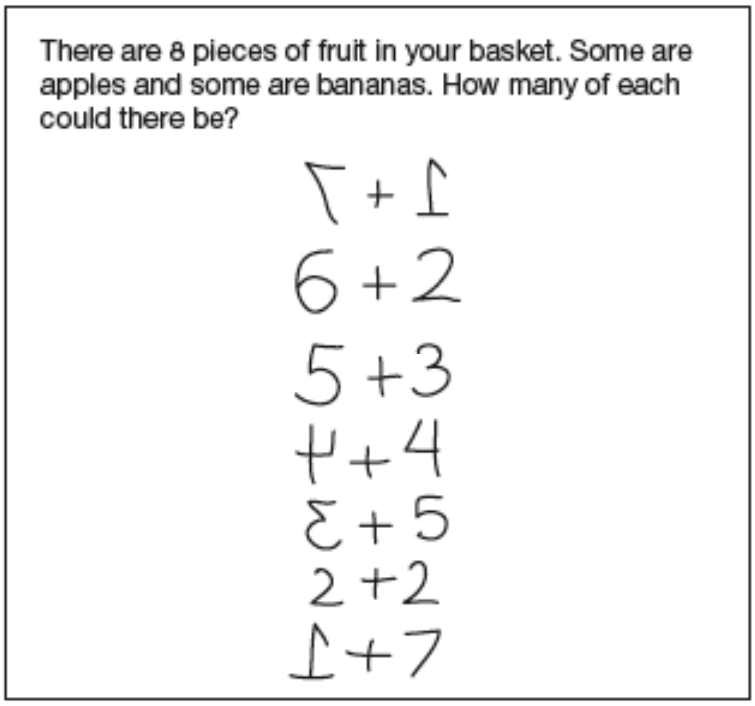
- Developing strategies for accurately counting a set of objects by ones
- Developing an understanding of the magnitude and position of numbers

Benchmarks

- Count a set of up to 20 objects
- Compare and order quantities up to 12
- Count a set of 40 to 50 objects
- Rote count, read, and write numbers up to 65
- Begin to use groups in meaningful ways
- Identify, read, write, and sequence numbers up to 105

Addition and Subtraction and the Number System

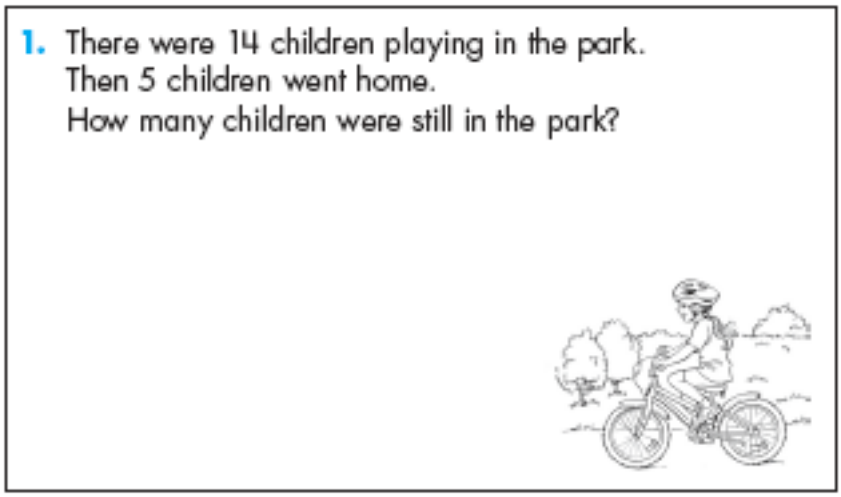
In first grade, students work with the important idea that quantities can be composed and decomposed in different ways, while the quantity remains the same. Students have repeated experiences breaking one number (a whole) into two parts, or combining two parts to form a whole. They consider the relationship between the parts, noticing, for example, that when the whole remains the same, as one part increases the other part decreases. Students work with composing and decomposing numbers to 20, and focus on the addition combinations of 10. Students are expected to develop fluency with the combinations of 10 by the end of the school year.



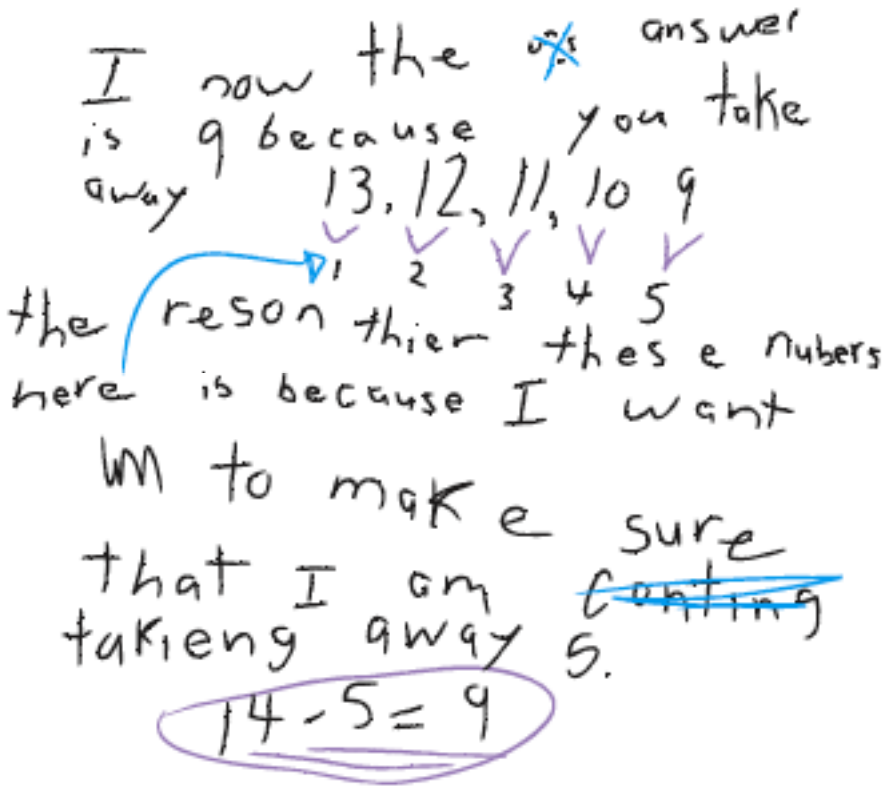
A student uses an ordered list to organize his responses to a How Many of Each? *Problem.*

The addition and subtraction work of first grade focuses on making sense of these operations, practicing adding and subtracting single-digit numbers, and solving addition and subtraction story problems. Many of the games and activities involve students in comparing and combining two amounts or removing one amount away from the other, which offers practice with single-digit addition and subtraction. The goal of the work with story problems is for students to learn to visualize the action of story problems and to solve the problems in ways that make sense to them.

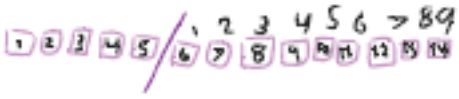
By the end of the year, it is expected that first graders will *count on* to combine two small quantities and that some students will *use a combinations they know* to solve related problems (e.g., 6 + 4 = 10 so 6 + 5 = 11). For subtraction, many students will still *show all, remove some, and count those that remain*. Others will *count back*, *count up*, or *use relationships they know* (e.g., 14 – 5 = 14 – 4 – 1)

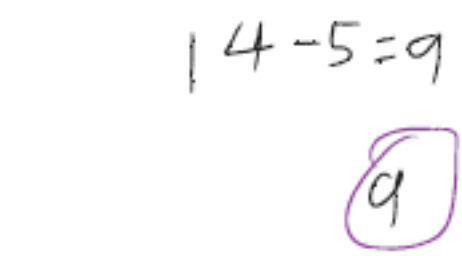


A sample subtraction problem from the Student Activity Book

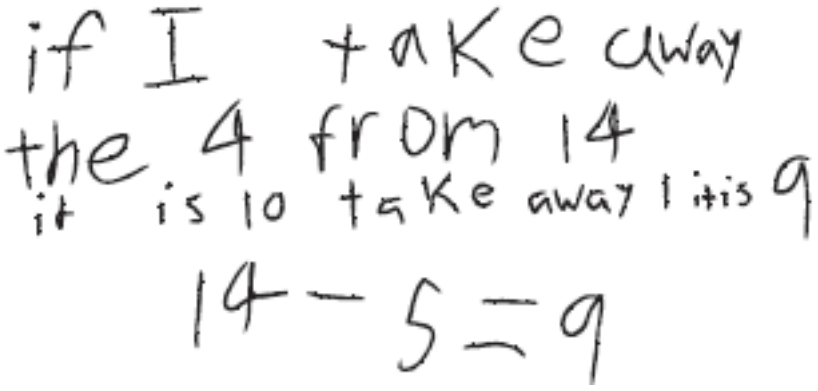


Count Back





Show all, remove or cross out some, and then count how many are left



Use a combination you know

Students use mathematical tools, such as cubes and counters, and representations, such as the number line and 100 chart, to model and solve addition and subtraction problems and to clarify and communicate their thinking. They are encouraged to represent their work on paper in ways that make sense to them. Many use a combination of pictures, words, numbers and mathematical symbols.

The Algebra Connections pages of each of the four curriculum units that focus on addition and subtraction show how students are applying the commutative property of addition as they develop strategies for solving addition problems. These pages also highlight students' application of the inverse relationship between addition and subtraction and how algebraic ideas underlie what students are doing when they create equivalent expressions in order to solve a problem (e.g., 6 + 4 = 5 + 5 and 8 + 5 = 10 + 3) or when they use addition combinations they know to solve more difficult problems (e.g., since 5 + 5 = 10, 5 + 6 must equal 10 + 1, or 11).

Emphases

Number Composition

- Representing numbers using equivalent expressions
- Composing numbers up to 20 with two addends

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

Computational Fluency

- Knowing addition combinations of 10
- Combine two small quantities

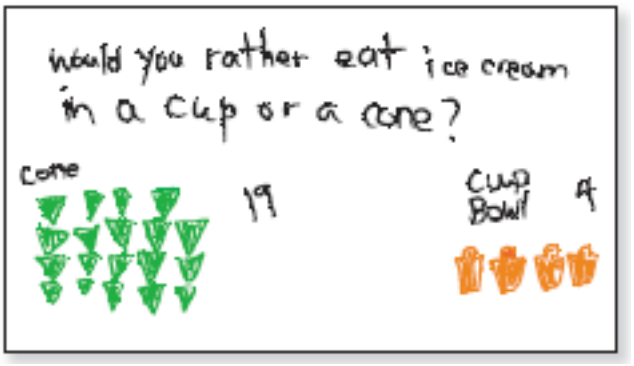
Benchmarks

- Find more than one combination of two addends for a number up to 10 (e.g., 7 is 4 and 3 and it's also 5 and 2)
- Find at least 5 two-addend combinations of 10
- Interpret (retell the action and sequence) and solve addition and subtraction story problems
- Find at least five combinations of two addends for a number up to 15
- Subtract one small quantity from another
- Represent numbers using equivalent expressions
- Combine two small quantities by at least counting on
- Demonstrate fluency with the two-addend combinations of 10

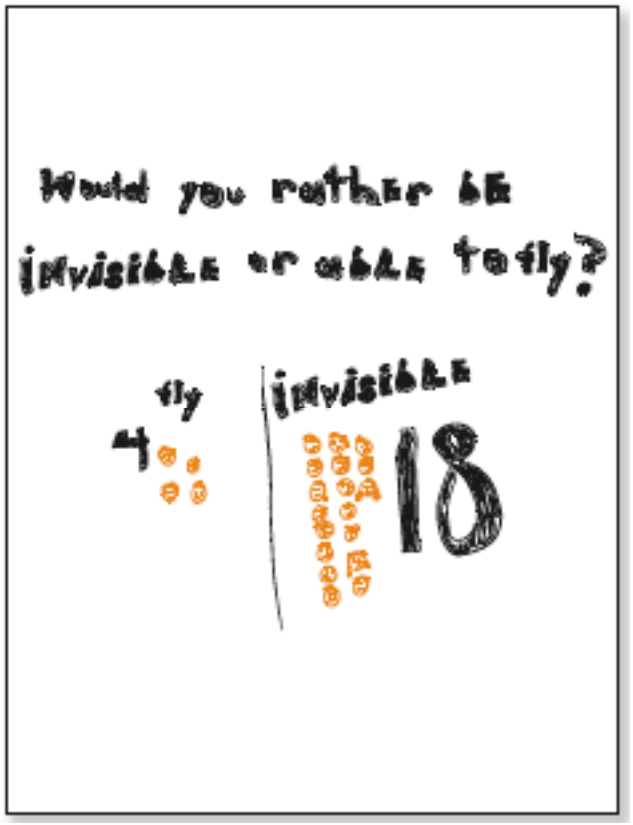
Data Analysis

In first grade, students sort groups of related objects, such as buttons, into groups, and describing what distinguishes one group from another. This early work in classification provides experience in considering only certain attributes of an object while ignoring others. Sorting a variety of sets lays the foundation for later work in classifying shapes and numbers and in working with categorical data.

First graders create their own representations of the data they collect, organizing their data and providing an image that helps them describe what the data show. Students are also introduced to several standard forms of representation, including picture graphs, tallies, charts, and bar graphs. By discussing and comparing representations, students consider what features of a representation help communicate a clear description of the data. As student describe data, the key question they consider is: What do these data tell us about our class [or the class next door, or our siblings]? In the context of this overall question, first graders' descriptions focus on two characteristics of the data: (1) "What is the number of pieces of data in each category or at each value?" and (2) "Which category has more data?"



Would you rather eat ice cream in a cup or in a cone?



Would you rather be invisible or be able to fly?

Students carry out their own data investigation. They develop a question, collect the data, represent the data, and describe and interpret the data, which may, in turn, bring up more questions. Once data are collected, the data are represented, examined, and analyzed to find out what information the data provide about the original questions.

Emphases

Data Analysis

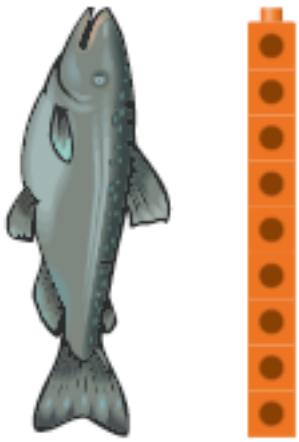
- Sorting and Classifying
- Representing Data
- Describing Data
- Designing and Carrying Out a Data Investigation

Benchmarks

- Sort a group of objects according to a given attribute
- Represent a set of data with two categories
- Interpret a variety of representations of data with two categories
- Describe a set of data including how many are in each group, which group is greater, and how many people responded to the survey

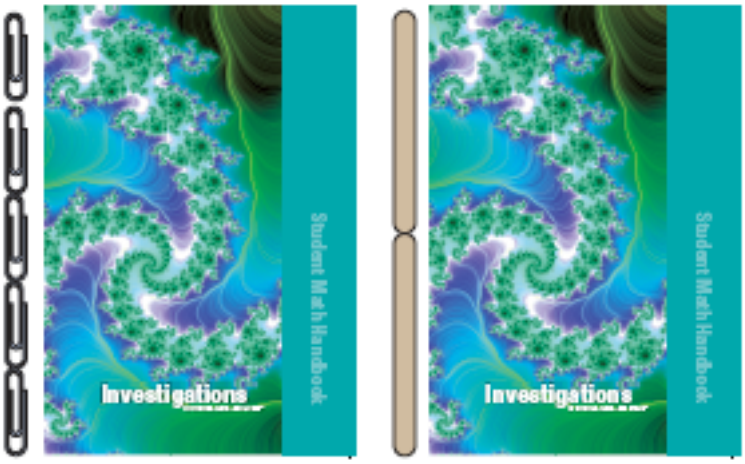
Measurement

It is important for students to develop a sense of how measurement is used--and when it is helpful--in the real world. Unit 5, *Fish Lengths and Animal Jumps,* involves students in a real context in which measuring is used, that of measuring fish to determine if they are "keepers." They measure relatively small lengths (up to 18 inches) and larger distances (up to 5-6 feet), and see that measurement is applied to both objects and distances.



knowing where to start and stop measuring, understanding how measuring tools must be lined up so that there are no gaps or overlaps, knowing which dimension to measure, measuring the shortest line from point to point, and understanding that many measurements are not reported in whole numbers. Regardless of what is measured, students learn that when one measures an

object twice--or when two different people measure it--the same results should be obtained, assuming the same measuring unit is used. Students also explore what happens when something is measured with small units versus larger units. Students begin to see that measuring an object in cubes will result in a different count than will measuring the same object in inch tiles or paper clips, but may not yet see the inverse relationship between size of unit and number of units needed to cover a distance.



Emphases

Linear Measurement:

- Understanding length
- Using linear units
- Measuring with standard units

Benchmarks

- Demonstrate measuring techniques when measuring a distance with nonstandard or standard units. These techniques include starting at the beginning, ending at the end, leaving no gaps or overlaps, measuring in a straight line, and keeping track of the number of units
- Know at least one way of describing a measurement that falls between two whole numbers
- Understand that the same results should be obtained when the same object is measured twice, or when two different people measure the same object (using the same unit)
- Understand that measuring with different-sized units will result in different numbers

Patterns, Functions, and Change

Students begin their work on patterns in first grade by creating, describing, extending, and making predictions about repeating patterns. By building or acting out these patterns and thinking through how the pattern continues, students analyze the regularities of the pattern to determine what comes next or what will come several steps ahead in the pattern. Students analyze the structure of a repeating pattern by identifying the *unit* of the pattern—the part of the

pattern that repeats over and over. By focusing on the unit of the repeating pattern, students shift their focus from seeing that "red follows yellow and yellow follows red" to how the repeating pattern is constructed of an iterated red-yellow unit. This focus allows students to analyze more complex patterns.

Students also compare patterns and begin to notice how patterns are the same. For example, a red, yellow, red, yellow pattern and a green, blue, green, blue pattern have the same structure.

Students then work with number sequences associated with repeating patterns. Associating the counting numbers with this pattern allows new kinds of questions about the pattern, such as the following: "What color will the 17th square be?" "Is the 20th square black?" Numbering the elements of a repeating pattern provides another way to describe that pattern.

Students also consider situations that have a constant increase. They investigate three different contexts— collecting pennies in a jar, making Staircase Towers from connecting cubes, and making repeating patterns with pattern blocks. In each situation, a sequence of numbers is generated by the situation.

Example: I have one penny in a jar, and each day I add three more pennies.

Comparison across contexts helps students focus on how the same start number and the same amount of constant increase can create the same number sequence in different situations.

Emphases

Repeating Patterns

- Constructing, describing, and extending repeating patterns

- Identifying the unit of a repeating pattern

Number Sequences

- Constructing, describing, and extending number sequences with constant increments generated by various contexts

Benchmarks

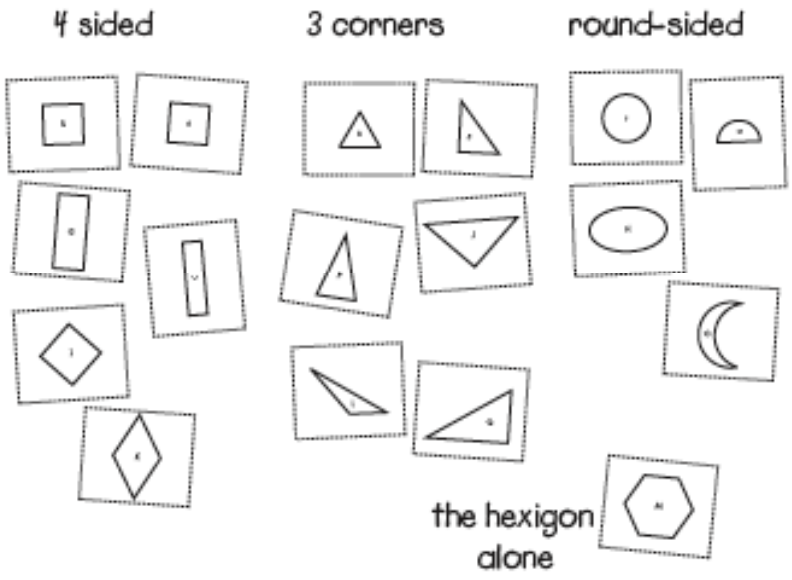
- Construct, describe, and extend a repeating pattern with the structure AB, ABC, AAB, or ABB
- Identify the unit of a repeating pattern for patterns with the structure AB or ABC
- Describe how various AB or ABC patterns are alike (e.g., how is a red-blue pattern like a yellow-green pattern?)
- Determine what comes several steps beyond the visible part of an AB, ABC, AAB, or ABB repeating pattern
- Construct, extend, and describe a pattern that has a constant increase for the sequences 1, 3, 5, …; 2, 4, 6, …; 1, 4, 7, …; 2, 5, 8, …; and 3, 6, 9, … through counting and building

Geometry

The emphasis of geometry work in 1st grade is on careful observation, description and comparison of two-dimensional (2-D) and three-dimensional (3-D) geometric shapes.

Students describe 2-D shapes, sort them and compare them, and they think about questions like the following: What makes a triangle a triangle? How are triangles different from squares?

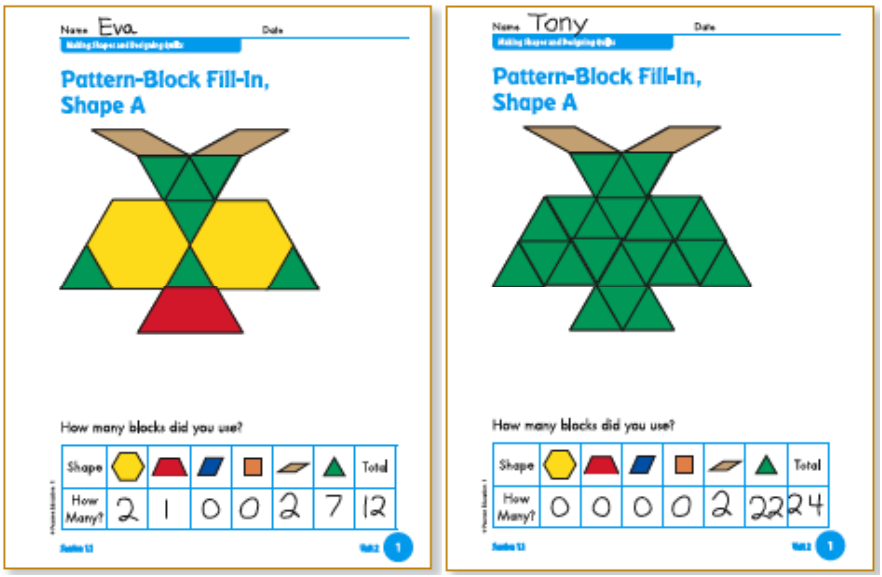
Developing visual images of shapes as well as drawing 2-D shapes are ways that students come to know the important features of shapes. When they sort 2-D shapes, they make groups of shapes that "go together," which requires them to look for similarities and differences among the attributes of different shapes.



One pair's sort of Shape Cards

Students look for 3-D shapes in their own environment and they work with 3-D shapes (whose faces are familiar 2-D shapes) such as Geoblocks, manufactured boxes, and boxes made by students.

Students also learn about geometric relationships by composing and decomposing shapes. As they fill in the same shape outline with pattern blocks in different ways, they break apart or combine shapes in order to change how the shape is filled. When using the geoblocks, students notice, for example, that two cubes can be put together to make a rectangular prism and that two triangular prisms can be put together to make a cube.



Eva and Tony's student work of SAB 1, Pattern Block Fill-In, Shape A

Students investigate the relationship between 3-D shapes and 2-D representations of those shapes. By matching 3-D objects to outlines of their faces, to pictures, and to drawings of other students, they identify shapes by looking carefully at some parts of the shape and then visualizing what the whole shape looks like. Moving back and forth between 3-D objects and their 2-D representations helps students describe and compare the characteristics of common 3-D shapes.

A student draws a 2-D representation of his 3-D building.

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 shapes
- Describing, identifying, and comparing 2-D and 3-D shapes
- Exploring the relationships between 2-D and 3-D shapes

Benchmarks

- Fill a given region in different ways with a variety of shapes
- Use geometric language to describe and identify important features of familiar 2-D shapes
- Identify and describe triangles
- Describe and sort 2-D shapes
- Compose and decompose shapes
- Attend to features of 3-D shapes, such as overall size and shape, the number and shape of faces, and the number of corners
- Match a 2-D representation to a 3-D shape or structure