Spotlight on
Number Paths & Number Lines
How do students engage with number paths and number lines over time?

NUMBER PATH

What is a number path?

On a number path, numbers are arranged in order and each occupies the same amount of space. The number line pocket chart is a number path.


A number path helps students keep track as they recite the counting sequence and connect the number name to the written numeral: for example, 4 and *four* refer to the same number. It also helps them see relationships among numbers: for example, we see that 8 is 1 more than 7 because it comes immediately after 7. The number path also supports students' ability to count discrete objects because each space is a discrete object and garners exactly one count.
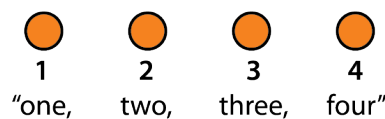
NUMBER LINE

What is a number line?

On a number line, each number marks the distance from 0. Instead of occupying space on a path, the number indicates a count of intervals from 0.
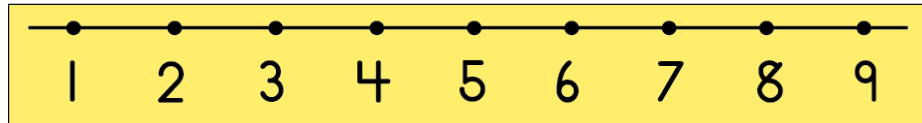

Because understanding the concept of distance from 0 involves understanding interval counting (counting intervals rather than objects) and early measurement, the number line is more useful for students after they have begun to explore ideas related to length measurement.

The number line:

- Is a continuous model.
- Can be either closed or open.
    - Closed: has beginning and end points that define the intervals.
    - Open: begins with no predetermined markings as the intervals are defined by the user.

"one,   two,   three,   four"

Discrete Counting
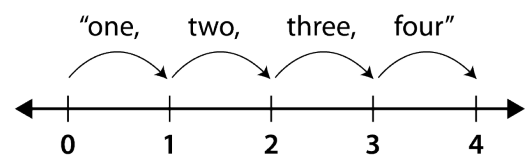
Interval counting on the number line

Kindergarten, Unit 4; With discrete counting, students count individual objects. With interval counting, students count intervals or spaces.

WHOLE NUMBERS

Counting with Number Paths

The number path supports students in learning the sequence of number names, counting with 1-to-1 correspondence and cardinality, and numeral recognition. In Pre-K through first grade, students engage primarily in discrete counting. For example, they count collections of discrete objects; similarly, they count spaces on the number path.
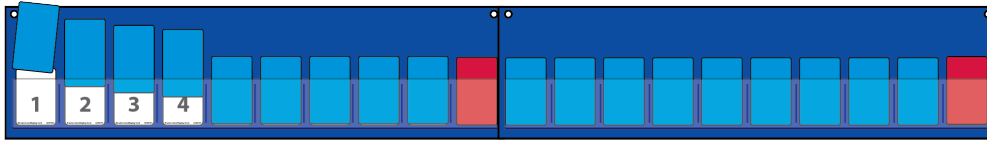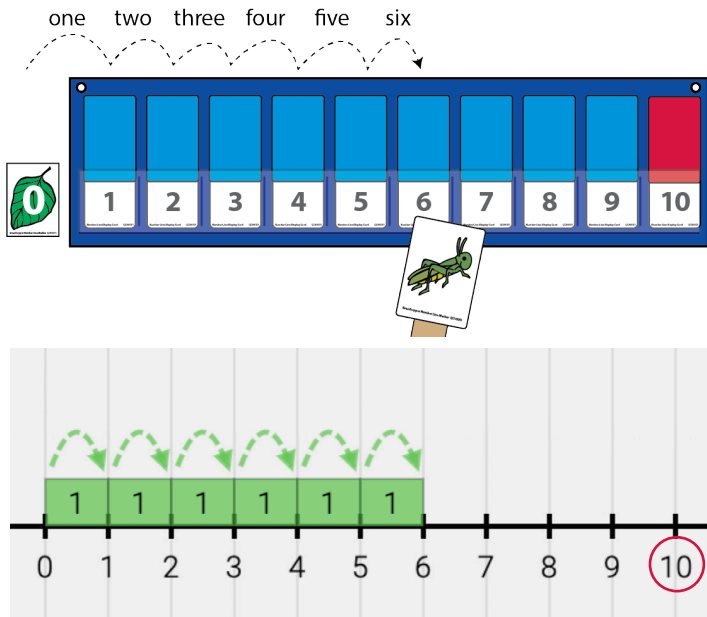

Kindergarten Number Corner introduction; The numeral cards on the number path can be added, hidden, removed and covered. The numeral cards extend to 10 in Pre-K, to 50 in K, and to 120 in Grade 1.

> Kindergarten:
> Major focus in Bridges and Number Corner
>
> Grade 1 Units 1–4 and 7; embedded in every month of Number Corner

Counting & Operating with Closed Number Lines

As a bridge to interval counting, in Kindergarten, a "0" marker is placed to the left of the chart. Students make hops starting at 0 and count one hop each time they move to 1, 2, 3 and so on. This is the beginning of their work with interval counting. Students also explore how they can use forward and backward hops to represent addition and subtraction.

> Grade 1 Unit 4: Major focus
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> Grade 2 Units 1 and 4–5
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> Grade 3 Unit 2; Number Corner Oct.
>
> Grade 4 Units 3 and 7; Number Corner Sep.–Nov., Jan.–Mar, and May
>
> Grade 5 Number Corner Dec. and Apr.

During NC January, kindergarteners model the hops of Hap, the grasshopper.
Work on the number path connects and leads to work on the number line.

In first grade, students add and subtract using a closed number line. They begin with increments of 1 and, later, increments of 10, to represent and solve addition and subtraction problems involving multiples of 10 within 100.
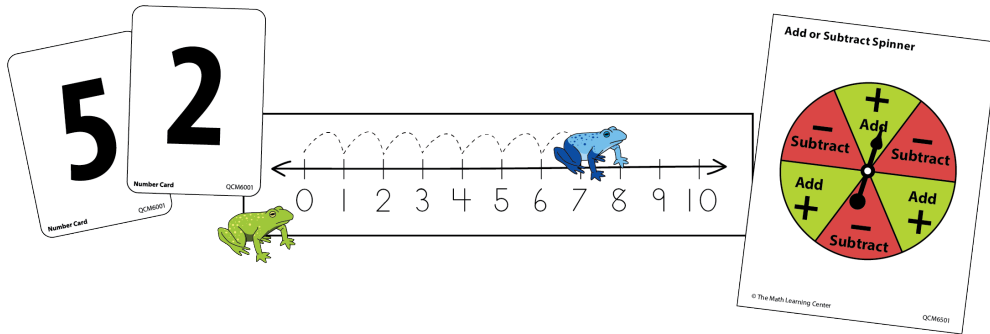
In Unit 4, first graders play The Frog Jump Game solving addition and subtraction story problems within 10 (e.g., 5 + 2 = 7).

Number Relationships & Operating on the Open Number Line

In the primary grades, students focus on closed number lines, but they have some opportunities to use open number lines as well. In Grade 1, for example, students use number cards on a string to explore open number lines. This activity opens the door for conversations about relative magnitude, estimation, and number relationships (e.g., 6 is the same distance from 8 as 10 is from 8).

Where should we hang the empty box?
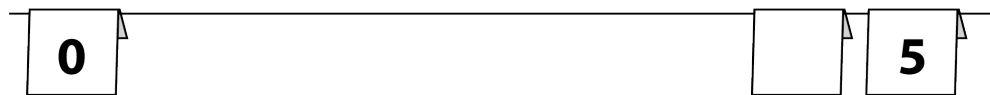
What number belongs in the empty box? How do you know?
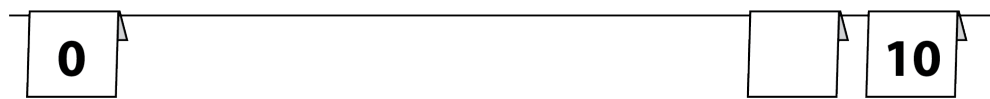
Now what number belongs in the empty box? How do you know?

Grade 1, Unit 4. The first number line, with 0 as the only number marked, remains an open number line. In the second number line, the placement of a second number, 5, makes it a closed number line as it now has a fixed interval. On the third number line, the 5 is replaced with a 10. The bottom two number lines invite conversations about open and closed number lines. As students make decisions about interval size and value, they consider how their choices impact the position of other numbers and relative magnitude.
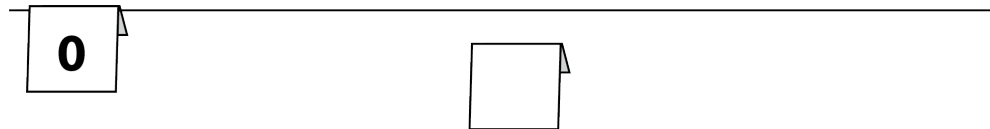
Grade 1 Unit 8: Major focus

Grade 2 Units 2–3 and 7; embedded in every month of Number Corner

Grade 3 Units 1–4 and 7; embedded in every month of Number Corner

Grade 4 Units 1 and 3–4; Number Corner Nov.–Dec.

Grade 5 Units 2–3 and 5; Number Corner Sep.–Apr.

In Grade 2, students begin using the open number line to represent different strategies for adding and subtracting. The flexibility of the open number line invites them to add and subtract using friendly numbers, including multiples of 10 and 100. To solve 56 + 14, for example, students might decompose the 14 to make 10 and 4. On the number line, they model their thinking by showing jumps of 10 and 4 to get to 70.

Grade 2 Unit 3 Overview

Students might notice that they could also add 4 to get to the friendly number 60, and then add 10, enlisting the commutative property of addition.

FRACTIONS & DECIMALS

Extending the Number Line to Fractions & Decimals

In third grade, students represent fractions on a number line by partitioning a unit on the number line into equal parts that can be counted as intervals (e.g., ¼, ²⁄₄, ¾, ⁴⁄₄). They begin to understand that fractions are numbers as they count unit fractions and see relationships between fractions and whole numbers on the number line.

Grade 3 Units 4 and 7; Number Corner Jan.–May

Grade 4 Units 3 and 6; Number Corner Jan.–May

Grade 5 Units 2 and 5; Number Corner Sep., Dec., Mar., and Apr.

In Grade 3 November Number Corner, students model unit fractions on a number line by partitioning a unit into equal parts that can be counted as intervals. They use both repeated addition and multiplication to determine the sum of multiple same-sized unit fractions

Third and fourth graders also use number lines as a way to understand multiplication, modeling multiplication as repeated addition and looking for patterns and relationships that emerge.

In Grade 4 NC (September Computational Fluency), students count by each single-digit number to identify multiples of each number within 100. Over time, students notice patterns among common multiples and factors.

In fourth grade, students use the number line to compare and order fractions and decimals, reasoning about the relationships between rational numbers. For example, to place 0.50, students reason that 0.50 is the same as ½, and ½ is exactly between 0 and 1.

| 0 | 0.50 | 1 | 2 |

In Unit 3 (M4–S3), fourth graders place number cards on a string to compare and order rational numbers.

In fifth grade, the double number line is used to model multiplying fractions by whole numbers as well as adding and subtracting fractions with unlike denominators. The double number line also supports students in scaling up unit fractions (e.g., ⅕) to find non-unit fractions of whole numbers (e.g., ⅗ of 35).

The double number line is a major focus in Bridges Grade 5 Unit 2.
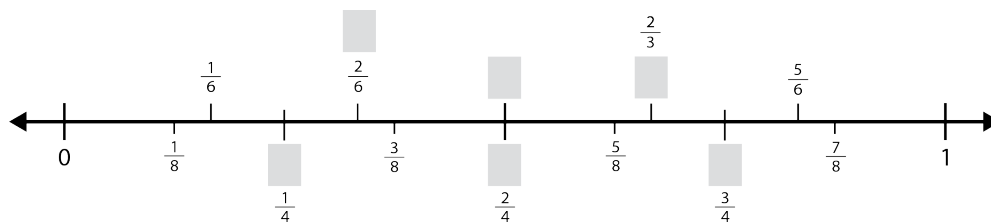
In Grade 4, Unit 7 (M1-S3), fourth graders labeled equivalent fractions on a number line.