Learning About Length: Lining Up Units

Kindergarten and Grade 1 students begin to develop an understanding about length as a stable, measurable dimension as they compare lengths directly and indirectly. They learn to identify measurable attributes of an object and develop an understanding of longer than/shorter than/equal to. These foundational experiences develop their understanding of what length is and how it can be described. As they place multiple units end to end and then count them, they begin to understand length as a continuous interval that can be quantified.

Students in your class may vary quite a bit in how accurately and consistently they measure the lengths of things. Some do not carefully line up the units (e.g., sticks, cubes, inch tiles) end to end when they use them to measure, instead either overlapping the units or leaving spaces between them. Others measure with a single unit by running it along a given length as they count "1, 2, 3, 4, . . ." without paying much attention to whether each successive placement begins where the previous one ended. These *mistakes* are probably not just carelessness or sloppiness; instead, these students are still figuring out what measuring is about.

Rather than simply tell students to carefully line up units along the length of an object, encourage discussion among students about the different ways they are measuring:

Some people said that this book was 10 cubes long, some said 9, and some said 11. Who would like to show how you measured this book? [William] lined up 10 cubes like this. Do you think that's alright? Could it be 11 cubes? Here's a tower of 11 cubes. Could that work? Why or why not?

At times, show students some inaccurate ways of measuring to help them think through and articulate their own ideas. For example, place three cubes with big gaps along the edge of a book: one at one edge of the book, one in the middle, and one lined up with the other edge. Tell students that you measured this book and that it is 3 cubes long. Ask them whether that seems right and, if not, what you should do to get a better measurement. As students discuss and compare ways of measuring, they will gradually develop a sense of what length is and how to measure it accurately.

Using numbers to measure length is different from using numbers to count a discrete quantity. When students count objects, each successive counting number refers to one object. But to use numbers to measure length, students have to develop the sense of a continuous interval. One unit does not refer to one object but to an interval of length. For example, 1 refers to an interval of length from 0 to 1.

This is a new and difficult idea. It is important that students develop this idea through many experiences with units that they can place repeatedly along a length and count (such as craft sticks, connecting cubes, or inch tiles) so that they physically experience what length is, and develop a sense of how it extends from one point to another, and how two lengths might be compared.

Because many students have seen people using rulers or yardsticks to measure objects, they may be interested in using such tools. You can make rulers available, but, in the early grades, students usually see the numbers on a ruler simply as marks to read without understanding just how a ruler is used to quantify length. For example, some students align the end of an object with the 1, rather than with the end of the ruler. Others use the ruler backward, reporting a length of ten inches when it is actually two.

Students sometimes think that one measuring unit is equivalent to another; for example, they will find that an object is six cubes long and report the length as six inches. They may also think that when one object is longer than another, it must be one more unit long. For example, a student who was four feet tall compared herself with a classmate. He was a few inches taller, so she said, "So he's five feet tall."

As students' understanding of measurement develops in Grades K–1, they begin to formulate ideas about the need for standard units of measure. The understanding they develop through many experiences of using nonstandard units will become the basis for understanding the use of standard measuring tools. The need for a standard measuring tool is among the topics students investigate in Grade 2.