Place Value

In Grade 3, students solidify their understanding of the base-ten number system as they learn to use and understand numbers in the 100s and 1,000s. The base-ten number system is a "place value" system. Any numeral such as 2 can represent different values, depending on where it appears in a written number. The numeral 2 can represent 2 ones, 2 tens, 2 hundreds, 2 thousands, and so forth. Understanding our place value system requires coordinating the way we write the numerals that represent a particular number (e.g., 217) and the way we name numbers in words (e.g., two hundred seventeen), with how those symbols represent quantities.

The Base-Ten Number System

In this unit, students focus on how numbers are composed and how the written numerals relate to the quantity they represent. This is not simply a matter of saying that 217 "has 2 hundreds, 1 ten, and 7 ones," which students can easily learn to do without attaching meaning to the quantity these numerals represent. Students must learn to visualize how 217 is built up from hundreds, tens, and ones in a way that helps them relate its value to other quantities. That is, understanding the place value of 217 entails knowing that 217 is closer to 200 than to 300, that it is 100 more than 117, that it is 17 more than 200, that it is 3 less than 220, and that it is composed of 21 tens and 7 ones.

In this unit, students create different combinations of stickers to make a certain quantity. For example, 117 can be composed of 1 sheet of 100, 1 strip of 10, and 7 individual stickers, but it can also be composed of 11 strips of 10 and 7 individual stickers. Students also construct a 1,000 Chart. By putting ten 100 Charts together and filling in landmark numbers on these charts, they can visualize how 1,000 is composed of 100s, 10s, and 1s. They also see how the number sequence repeats on each hundred chart—199 is in the same position on the 200 Chart that 99 is on the 100 Chart; 850 is in the same position on the 900 Chart that 50 is on the 100 Chart; and so forth. Students use the 1,000 Chart to visualize and compare numbers—890 is on the next-to-last hundred chart, between 801 and 900, but much closer to 900 than to 801. Because it is just 10 less than 900, it is 110 less than 1,000.

Place Value and Computational Fluency

A thorough understanding of the base-ten number system is one of the critical building blocks for developing computational fluency. The composition of numbers from multiples of 1, 10, 100, 1,000, and so on, is the basis of most of the strategies students use for computation with whole numbers.

Throughout their work in Grade 3, students learn about using multiples of 10 and 100 in their computation work. Students work on adding and subtracting multiples of 10 and 100 (for example, in the games *Capture 5* and *Capture on the 300 Chart*) and on combinations that add to 100 (for example, in *Close to 100*). These combinations are useful as they estimate and find sums and differences involving 3-digit numbers.

The activity *Go Collecting* emphasizes the place value of the digits in the 100s and 10s places when adding 3-digit numbers. In order to determine the number of 100s in the sum, students start by looking at the hundreds place, but then also consider the tens place. For example, when adding 371 + 235, students can see that the sum must be more than 500 because the 100s digits total 500. Then by inspecting the 10s digits, they see that 70 + 30 results in an additional 100. Determining the number of 100s in a sum is useful in developing the habit of looking at any problem as a whole and estimating a solution so that they can consider whether the result of their computation is reasonable.

Students use the context of stickers (arranged in singles, strips of 10, and sheets of 100) as they break larger numbers apart by place value to solve problems. Students also use the context of traveling a certain distance in miles as they extend the addition and subtraction strategies they have been using to 3-digit numbers. To gain fluency with adding and subtracting multiples of 10 and 100, students play games such as *Capture on the 300 Chart.* Adding and subtracting multiples of 10 and 100 to any number is part of the knowledge that students use as they become more fluent and efficient in solving problems. As part of this work, they focus on the first steps they take in solving problems. For example, when adding 126 and 176, students might come up with one of the following first steps:

$$100 + 100 \quad 126 + 100 \quad 125 + 175$$

Each of these steps focuses on aspects of place value. The first one involves breaking up each number by place, starting with the largest place. The second one involves adding on one of the numbers to the other in parts, again breaking up that number by place. The third involves using known combinations that add to a multiple of 100. By describing their own first steps and trying out those with which they are less familiar, students apply their knowledge of place value to computation. Thus, they increase their fluency and flexibility in adding and subtracting 3-digit numbers.

Another focus of this unit is on using 100 and multiples of 100 as landmarks in subtraction. For example, when subtracting $127 - 76$, a key strategy for many students is to find the difference between 127 and 100 and then between 100 and 76 as they either add up from 76 or subtract down from 127. Using a number line representation helps students visualize the relationship of numbers in a subtraction problem to 100 or multiples of 100.