Teacher Note

Place Value in Grade 2

Understanding the place-value structure of our base-ten number system and how it applies to and supports number composition and computation is a central piece of work in the number and operations strand of the *Investigations* curriculum. The base-ten number system is a "place-value" system. That is, any numeral, say 2, can represent different values, depending on where it appears in a written number: it 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 and seventeen) with how those symbols represent quantities.

In Second grade, students make a critical shift from thinking and working primarily in ones, to thinking and working with *groups* of tens and ones. Understanding the 10:1 relationship of one ten is equal to ten ones is the foundation for understanding the base-ten number system. In order to make this shift, important groundwork must be laid. In Kindergarten and First grade, students focus on being able to count sets of objects by 1s accurately and fluently. They begin to think about counting by groups as they investigate the number of eyes or hands in their classroom. They play games which involve splitting numbers. In Grade 1 they engage in a series of activities which involve organizing objects into groups of ten, developing fluency with the 2-addend combinations of ten and also thinking about the teen numbers as $8 + 5 = 10 + 3$. While students do not explicitly discuss the value of each place in a two-digit number, they work extensively with the ideas that support their work with place value in Grade 2.

In order to successfully work with place value, students need to not only know that one ten is equal to ten ones, they must also be able to coordinate groups of tens and ones at the same time and use this information in flexible ways. Consider for example the number 32. One aspect of understanding the value of each place in this number is knowing that the 3 represents 3 groups of ten, the 2 represents 2 ones, and this can be expressed as $30 + 2$. It is also important for students to understand 32 as 2 groups of ten and 12 ones ($20 + 12$). While much of the foundation for this work is laid in Kindergarten and First grade, coming to *understand* and *know* that ten ones is equivalent to one ten, *applying* this 10:1 relationship (10 tens is 1 hundred), coordinating these multiple units (groups of tens and groups of ones), and *working with* these ideas as they apply to larger quantities is the focus of the place value work in Second grade.

In Grade 2 students work extensively with concrete models that represent the place-value structure of our base-ten number system. They use a "sticker" context where stickers come in singles, strips of ten, and sheets of 100. They also work with a money context thinking specifically about pennies, dimes, and dollars. They use these contexts to build and visualize how 2-digit numbers are composed as they focus on creating different combinations of stickers or coins to make a certain quantity. For example, 87 can be composed of eight strips of 10, and 7 individual stickers, (or 8 dimes, and 7 pennies) but it can also be composed of 7 strips of 10 and 17 individual stickers (or 7 dimes and 17 pennies). Students also work with other models including the number line, 100 chart, and connecting cubes organized into towers of ten, The purpose of these models is to help students build mental images that they can then use in visualizing and solving problems. While no one model is a perfect match for every idea, the purpose of these contexts and models is to give students different examples to use and compare. With these models in mind, students can more easily discuss how 15 and 51 are different. Students also can discuss what happens to a number when 10 is added or subtracted, looking at both how the digit in the tens place changes (increases/decreases by 1), and how the value of the number changes (increases/decreases by 10).

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, 1000, and so forth, is the basis of most of the strategies students use for computation with whole numbers. In Grade 2, students' work with place value

becomes a basis for the development of strategies for adding and subtracting 2 digit numbers. The two strategies for addition, adding by place and adding on one number in parts and the strategy for subtraction of keeping one number whole and subtracting the other in parts, depend on an understanding of how to decompose numbers into tens and ones.

For many reasons, grade 2 is somewhat of a turning point for the work students are on the brink of doing with understanding number and operations. In kindergarten and first grade, students are developing many of the foundational pieces necessary to shift their thinking primarily from working with single units (ones) to thinking and working with groups. In grade two, students need to have the time and opportunity to solidify these ideas and relationships as they represent numbers a variety of ways using tens and ones, and as think flexibly about how numbers can be combined and separated. Building a solid understanding of two digit numbers and having strategies for adding and subtracting that are build on this understanding becomes the basis for the work students will do in grade 3 and beyond.