

Place Value and the Manipulatives

Two skills are needed to function in the decimal system: the ability to count from zero to nine and an understanding of place value. In the decimal system, where everything is based on ten (deci), you count to nine and then start over. To illustrate this, count the following numbers slowly: 800; 900; 1,000. We read these as eight hundred, nine hundred, one thousand. Now read these: 80, 90, 100. Notice how you count from one to nine and then begin again. These are read as eighty, ninety, one hundred. Once you can count to nine, begin work on place value. The two keys are learning the counting numbers zero through nine, which tell us how many; and understanding place value, which tells us what kind.

Counting

When counting, begin with zero and proceed to nine. Traditionally, we've started with one and counted to ten. Look at the two charts that follow and see which is more logical.

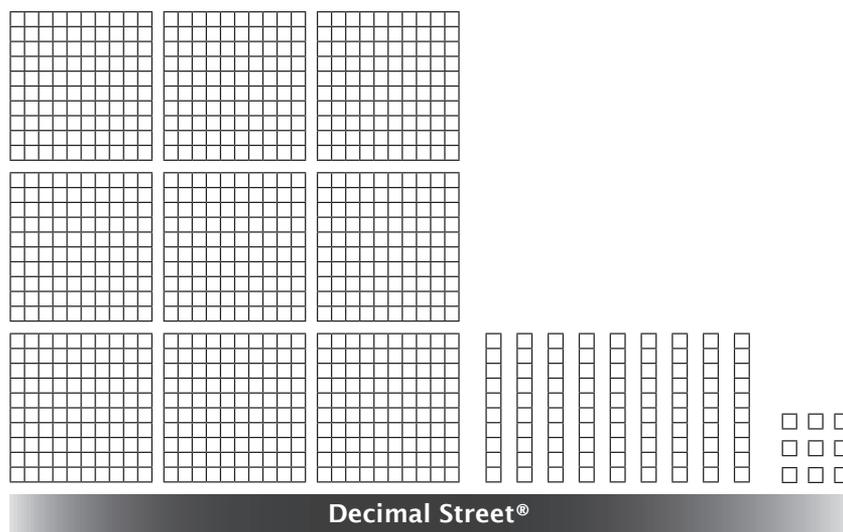
1	2	3	4	5	6	7	8	9	10	0	1	2	3	4	5	6	7	8	9
11	12	13	14	15	16	17	18	19	20	10	11	12	13	14	15	16	17	18	19
21	22	23	24	25	26	27	28	29	30	20	21	22	23	24	25	26	27	28	29

The second chart has only single digits in the first line. In the second line, each digit is preceded by a 1 in the tens place. In the next line, a 2 precedes each digit instead of a 1. The first chart, though looking more familiar, has the 10, the 20, and the 30 in the wrong lines. When practicing counting, begin with zero, count to nine, and then start over.

When explaining this important subject, I tell students, "Every value has its own place!" To an older child I would add, "Place determines value!" Both are true. There

are ten symbols to tell you how many and many values to represent what kind, or what value. Zero through nine tell us how many; units, tens, and hundreds tell us what kind. For the sake of accuracy, *units* will be used instead of ones to denote the first value. One is a counting number that tells us how many, and units is a place value that denotes what kind. This will save potential confusion when saying ten ones or one ten. Remember, “one” is a number, and “units” is a place value. The numerals 0–9 tell us how many tens, how many hundreds, or how many units. We begin our study focusing on the units, tens, and hundreds, but there are other values such as thousands, millions, billions, and so on.

To illustrate this lesson, I like to use Decimal Street®, since I’m talking about a place. On this street I have the little green units house, the tall blue tens house next door, and the huge red hundreds castle next to the tens. We don’t want to forget what we learned from counting—that we count only to nine and then start over. To make this more real, ask, “What is the greatest number of units that can live in this house?” You can get any response to this question, from zero to nine, and you might say “yes” to all of them, but remind the student that the greatest number is nine. We can imagine how many little green beds, or green toothbrushes, or green chairs there would be in the house. Ask the student what else there might be nine of. Do the same with the tens and the hundreds. Remember that in the houses all the furniture will be blue (tens) or red (hundreds).



When we teach we teach a new concept, we always use the following strategy: Build, Write, Say. To teach place value, we build the number, count how many are in each place, write the number, and read what we’ve written.

Let's build 142 (1 hundred, 4 tens, 2 units). Now count how many are "at home" at each house. I like to imagine going up to the door of each home and knocking to see how many are at home in each place. Write the numerals 1 4 2 as you count (always beginning with the units) to show the value on paper. Then say, "One hundred, four tens, and two units, or one hundred forty-two." Build another number and have the student write how many are at home. When they understand this, write the number on paper and have them build it. Try 217. After they build it, read what they have built. Keep practicing, going back and forth between the teacher building and the student writing, and vice versa.

Here is another exercise I do to reinforce the fact that every value has its own place. I like to have the student close his/her eyes as I move the pieces around, placing the red hundreds where the units should be, and vice versa. I then ask the student to make sure they are all in the right place. You might call this "scramble the values" or "walk the blocks home." As the student looks at the problem and begins to work on it, I ask, "Is every value in its own place?"

Mr. Zero is a very important symbol. He is a place holder. Let's say you were walking down Decimal Street® and knocking on each door to see who was at home. If you knock on the units door and three units answer, then you have three in the units place. Next door at the tens house, you knock, and no one answers. Yet you know someone is there feeding the goldfish and taking care of the bird, as someone might do when a family goes on vacation. He won't answer the door because he's not a ten, but he's the one who holds their place until the tens come home. Upon knocking at the big red hundreds castle, you find that two hundreds answer the door. Your numeral is thus 203.

Mention that even though we begin at the units end of the street and proceed right to left, from the units to the hundreds, we read the number from left to right. We want to get into the habit of counting units first so that when we add, we will add units first, then tens, then hundreds. On the student worksheets have the students count the correct number at the top of the page; then have them build the number shown next. Remember we teach with the blocks and then move to the worksheets once the student understands the new material.

You've probably noticed the important relationship between language and place value. Consider 142, read as "one hundred forty-two." We know that it is made up of one red hundred square (one hundred), four blue ten bars (forty-ty for ten), and two units. The hundreds are very clear and self-explanatory, but the tens are where we need to focus our attention.

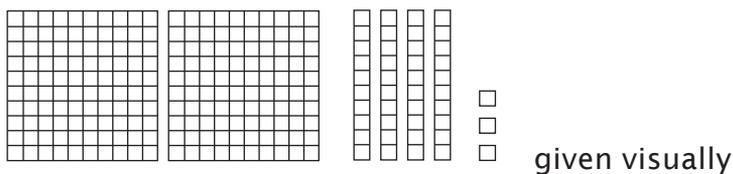
When pronouncing 90, 80, 70, 60, and 40, work on enunciating clearly so that 90 is ninety, not “ninedec.” 80 is eighty, not “adee.” When you pronounce the numbers accurately, not only will your spelling improve, but your understanding of place value will improve as well. Seventy (70) is seven tens, and sixty (60) is six tens. Forty (40) is pronounced correctly but spelled without the *u*. Carrying through on this logic, 50 should be pronounced “five-ty” instead of fifty. Thirty and twenty are similar to fifty, not completely consistent but close enough so we know what they mean.

The teens can be problematic. Some researchers believe that students in Japan and China have a better understanding of place value than students in Europe and the United States. One of the reasons for this is that, in the Chinese and Japanese languages, the words for numbers are very regular, and the words for numbers greater than nine are built quite logically from the words for zero to nine. In contrast, there are a number of irregular words for numbers in English and in other European languages, and the English language in particular is very irregular in the words for eleven through nineteen.

To compensate for this, I’m suggesting a new way to read the numbers 10 through 19. You decide whether this method reinforces the place value concept and restores logic and order to the decimal system. Ten is “onety,” 11 is “onety-one,” 12 is “onety-two,” 13 is “onety-three,” and so on. It is not that students can’t say ten, eleven, twelve, but learning this method enhances their understanding and makes math logical. Also, children think it is fun.

When presenting place value or any other topic in this curriculum, model how you think as you solve the problems. As you, the teacher, work through a problem with the manipulatives, do it verbally, so that as the student observes, he/she also hears your thinking process. Then record your answer.

Example 1



Say the number slowly, going from left to right: “Two hundred forty-three.” Count, beginning with the units: “1-2-3” and write a 3 in the units place. Count the tens: “1-2-3-4” and write a 4 in the tens place. Finally, count the hundreds: “1-2” and write a 2 in the hundreds place. Do several examples this way and then give the student the opportunity to do some.

Example 2

274 (given as a written number)

Read the number: “Two hundred seventy-four.” Say, “Two hundreds” as you pick up two red hundred squares. Then say “Seven-ty or seven tens” and pick up seven blue ten bars. Say “Four” and pick up four green unit pieces. Place the pieces in the correct places as you say, “Every value has its own place.” Do several of these problems and then give the student the opportunity to do some.

Example 3

“one hundred sixty-five” (given verbally)

Read the number slowly. Say, “One hundred” as you pick up one red hundred square. Say, “Six-ty or six tens” and pick up six blue ten bars. Now say, “Five” and pick up five green unit pieces. Place the pieces in the correct places as you say, “Every value has its own place.” Finally, write the number 165. Do several of these problems and then give the student the opportunity to do some.

Game—Pick a Card

Make up a set of cards with 0 through 9 written in green, with one number on each card. Then make another stack of cards with the same numbers written in blue. Create one more stack of cards with the numbers 0 through 9 written in red. Shuffle the green cards. Then have the child pick a card and display that number of green unit blocks. For example, if a child picks a green 4, four green unit blocks should be counted out.

When the child is proficient at this game, try it with the blue cards and do the same thing except choose the blue ten blocks instead of the green unit blocks. When he can do the tens well, use both sets of cards. Have the child choose one card from the green pile and one card from the blue pile and then choose the correct number of blue ten blocks and green unit blocks. When he or she is an expert at this, add the red cards and proceed as before. Shuffle each set and place them in three stacks. Have the student draw from each stack and show you with the blocks what number was drawn.



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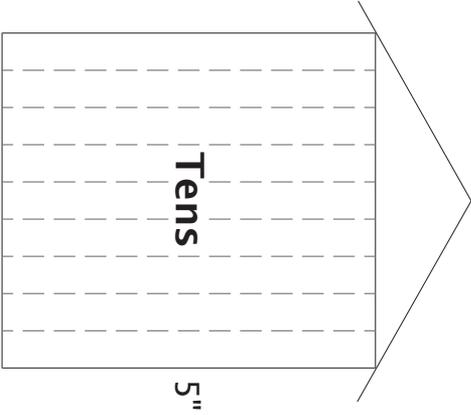
Get a large piece of paper for your background and cut out three houses. The units house should be green and measure $1\frac{1}{2}$ " x $4\frac{1}{2}$ " (as a rectangle) or $1\frac{1}{2}$ " x $1\frac{1}{2}$ " (as a square). The tens house should be blue and measure $4\frac{1}{2}$ " x 5 ". The hundreds house should be red and measure 15 " x 15 ". Each of these should be able to hold exactly nine of each piece. This drawing is not to scale.

15"



15"

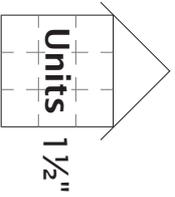
Decimal Street®



$4\frac{1}{2}$ "

Tens

5"



$1\frac{1}{2}$ "

$1\frac{1}{2}$ "

Units