DEVELOPMENT OF UNDERSTANDING OF PLACE VALUE

In Kindergarten, students built the foundation to understand place value by paying a lot of attention to 10.

COMMON MISCONCEPTIONS

• We count the tens and ones as separate numbers.

When students count a collection of base-ten blocks made up of tens and ones, they may count the tens and ones as separate numbers. For example, they may count 36 as 10, 20, 30, 1, 2, 3, 4, 5, 6. When students count like this, they are not seeing the number as one number. Remind students that when they count, the number they say should represent how many they have counted so far, in all. For students who have this misconception, count collections of base-ten blocks made up of tens and ones, writing the numbers you say as you count. Have the student count with you and also write the sequence of numbers. When you feel the student understands, give the student a collection of base-ten blocks and observe as they count and write down the count. Finally, give the student a collection of base-ten blocks and have the student count and write down the count on their own. In the end the student should be able to count a group of blocks representing 36 as 10, 20, 30, 31, 32, 33, 34, 35, 36.

• The value of digits is independent of place value.

When students need to find the value of the digits in a number, for example 49, they say that the values are 4 and 9. They do not make any connection to the place the digit is in. These students need more experience modeling numbers with base-ten blocks. Start by putting 4 ones blocks in front of the student and ask for the value. Do the same with 4 tens blocks. Write the numeral 44 and help the student understand that each 4 has a different value based on its position in the number. Model some two-digit numbers with students, pointing out that the place farthest to the right has a value of 1, and the value of each place increases as you move to the left. The next place to the left has a value of 10. Let them know that later on in school they will learn that the place to the left of 10 has a value of 100. Give the student two-digit numbers to model with base-ten blocks and also have the student say the value of each digit in the number.

• Zeroes in a number don’t mean anything.

Students with this misconception may think of a number such as 50 as 5. These students need more practice representing numbers with base-ten blocks. They need to understand that when there is a 0 in the ones place it is just as important as any other digit in the ones place because it tells us that there are 0 ones. For example, 50 is 5 tens, rather than 5 ones. Have students practice representing a number like 60 with base-ten blocks and then talk about how the zero shows up in the model. They should point out that there are 0 ones in the model. Ask students questions such as: Would you rather have 30 pieces of candy or 3 pieces of candy?
They learned to view the numbers from 11 to 19 as 10 ones and some more. In grade 1, students begin to think of groups of ten objects as a unit and learn to think of two-digit numbers as being composed of 9 or fewer tens and 9 or fewer ones. In grade 2, students will expand this understanding to three-digit numbers. In grade 3 and beyond, students will work with numbers up to 6 digits and extend their knowledge of the place-value system to six places. They start to see the regularity with which the system works. Around grade 5, they will learn to generalize that the value of a digit is ten times the value of the previous digit as they move to the left. In grade 5 students are introduced to decimals and generalize that the value of a digit is \( \frac{1}{10} \) times the value of the digit on the left as they move to the right.

**NUMBER WORDS**

The number words can be challenging for young students because of the inconsistencies in the way the numbers are said. For example, teen numbers are said with the number of ones first (four-teen) but numbers from 20 to 99 are said with the number of tens first (fifty-six). Some of the decade words sound very similar to teen numbers. For example, 50 sounds like 15. Also, the teen numbers do not clearly indicate a number of tens. For example, 11 and 12 do not reveal their tens and ones as clearly as 25. Because of this, students may count past ten before going to the next decade number, like this: twenty-eight, twenty-nine, twenty-ten, twenty-eleven, twenty-twelve. Give students lots of practice with counting to 120. Have them count with base-ten blocks frequently so they can “see” the tens and “see” the ones. And have them sometimes count using the format 3 tens and 1, 3 tens and 2, 3 tens and 3, 3 tens and 4, etc.

**STAGES OF UNDERSTANDING PLACE VALUE**

Note what stage of understanding place value each of your students is in. Some students realize that if they organize a group of objects by tens and discover that the number of objects is 4 tens and 2 ones or 42, they do not have to count the objects by ones. These students are in a stage of understanding place value. They know that if they count by ones they get 42, so they don’t need to actually count. You may have students who don’t believe that the number when counting by ones is also 42. They can count by ones to see that the number counting by ones is the same as the number found counting by tens. It is important to let these students discover this for themselves, rather than telling them that the number is the same whether they count by tens or count by ones. Give these students lots of opportunities to count the same group of objects by ones and by tens. They should eventually trust that they always get the same answer.

**TEACHER TIPS**

Estimation activities can help students develop their number sense and their understanding of place value. Fill bags with different numbers of small objects, from 10 to 99. Label each bag with a different letter of the alphabet. Have students work in pairs and give a bag to each pair. Have students estimate or guess the number of objects in a bag and record it. Then have them group the objects by tens and count to see how many objects there are. Finally, they should record the estimate and compare the number of objects to the estimate. After they finish counting one bag, have them trade bags with another pair of students and repeat the activity.