Addition and Subtraction: Grade 3

Transcript

Teacher: My students are becoming more efficient in using open number lines and place value or expanded forms to add numbers. However, I was wondering if you have any ideas to help my students make the connection between open number lines, expanded forms, and the standard algorithm when adding whole numbers.

Instructional Coach: I have worked with some third graders who needed scaffolding to see the connections between expanded forms and the standard whole number addition algorithm. I used their knowledge of place value and expanded form to bridge to the standard algorithm. Will you show me an example of how your students might use an open number line to solve a problem?

Teacher: Sure. Here's an example of a problem that I recently gave my students. The table below shows the number of textbooks given to a school. The table says that there were 237 math textbooks, 328 reading textbooks, and 468 science textbooks. How many math and science textbooks were given to this school? As I mentioned before, most of my students are becoming proficient at composing and decomposing numbers and using place value to solve problems on an open number line. I need help moving students with this conceptual understanding to the standard algorithm. Many of my students see the standard algorithm as something completely different. How do I help my students make that connection?

Instructional Coach: Can you show how one of your students used the open number line to solve this problem?

Teacher: Sure. Several students started by placing 468 on the open number line because it is the larger addend. If students used place value or expanded form, they typically start with the digit in the hundreds place from the other addend. In this case, the student would use the 200 from 237, the other addend, so they would take a jump of 200, landing on 668. This leaves 37. The students would take the digit in the tens place, three, and interpret it as 30. They would make a jump of 30 and land on 698. At this point, they still need to add seven more. I noticed that some students didn't recall the sum of seven and eight. For example, one student decomposed seven into two and five, then added two to 698. First, the student made a jump of two to go from 698 to 700. Then, a jump of 5 to get the sum of 705.

Instructional Coach: Great.

Teacher: Thank you.

Instructional Coach: Let's use this to bridge to the standard algorithm. I'll write the expression horizontally to give us space to record your example of the open number line. As you mentioned earlier, students have used expanded form to focus on place value, so we can build on that to help students begin to make connections. I added the digits in the hundreds place first. 400+200=600. These lines show the addition of 400 and 200. I am going to use the yellow highlighter to connect place value to the steps your student took on an open number line. Now, I'm going to do the same thing with a green highlighter to the digits in each of the tens places. Now for the ones place. Eight and seven combine to make 15. If I add 600, 90, and 15, I get the sum of 468 and 237.

Teacher: A few students may need to decompose 15 into ten and five to add 90 and 15. Is that okay?

Instructional Coach: Absolutely. Decomposing 15 into a 10 and five ones allows the student to use the associative property of addition to add together 90 and 10 to equal 100. Of course, we don't expect the students to call it that. Most students are able to add 600, 100, and five mentally to calculate the sum. This looks like a lot of work. It may or may not be the most efficient strategy for any given student. However, we can use this work to connect the open number line and addition based on place value to the standard algorithm. Let's keep our goal in mind. We want students to understand why we start in the ones place when using the standard algorithm after starting in the hundreds place when using a strategy such as open number line or using expanded form for addition. When we write an addition problem vertically, we start by adding the values of the digits in the ones place of each addend.

Teacher: 8+7=15.

Instructional Coach: To help your students record the 15 in the standard algorithm, refer them back to the place value model to show how 15 ones were decomposed into a group of 10 and a group of five.

Teacher: Decomposing 15 into 10 and five is the same as writing a five in the ones place and placing a one above the tens place to represent regrouping one 10 from a group of one 10 and five ones.

Instructional Coach: What do you notice about the value of the digits in the tens columns?

Teacher: I see why you asked, we are adding 60, 30, and 10, not six, three, and one.

Instructional Coach: Exactly. We have to be very specific with our language. The expanded form representation helps make that connection. Notice that the sum of 60, 30, and 10, or 100, or 10 tens, is represented in the expanded form.

Teacher: To record the value of 100 when we use the standard algorithm, a zero is written in the tens place and a one above the hundreds place to represent regrouping 10 tens as one 100.

Instructional Coach: Finally, we need to look at the values of the digits in the hundreds column and add the values of those digits; 400, 200, and the regrouped 100.

Teacher: The total is 700, and I notice how the 700 is represented in the expanded form strategy. To represent the sum of 600 and 100, a seven is written in the hundreds place to represent the value of 700.

Instructional Coach: Do you think your students would recognize what would have happened if we had started adding in the hundreds column first before adding the tens or ones?

Teacher: With this, *(points to work on table)* my students can now make the connection between the models as well as the reasoning for starting the process in the ones rather than the hundreds. I cannot wait to help my students see these connections. Thank you.

Instructional Coach: You are very welcome.