Modeling Addition and Subtraction

Reporting Category   Computation and Estimation

Topic   Adding and subtracting whole numbers

Primary SOL   4.4   The student will

b) add, subtract, and multiply whole numbers.

Materials
- Base-10 blocks
- Blank base-10 chart
- Calculators

Vocabulary
add, subtract, sum, difference, cube, flat, rod, unit

Student/Teacher Actions (what students and teachers should be doing to facilitate learning)

1. Have students explore with base-10 blocks how regrouping is used in both addition and subtraction. Display a base-10 block chart similar to the one at right, and review the names of the blocks and their values: cube = 1,000; flat = 100; rod = 10; unit = 1.

cube   flat   rod   unit
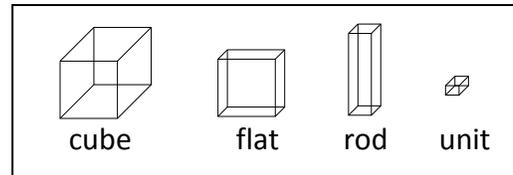
2. Distribute base-10 blocks, and instruct students to use the fewest possible number of blocks to construct each of the following numbers: 675 (6 flats, 7 rods, and 5 units), 846 (8 flats, 4 rods, and 6 units). Then, ask them to represent the sum 675 + 846 with the fewest possible number of blocks. Have them describe in writing what happened in the addition, including drawings of the addition. Ask the following questions:
   - What happens to 5 units and 6 units? (11 units become 1 rod and 1 unit.)
   - What happens to 7 rods and 4 rods? (11 rods become 1 flat and 1 rod.)
   - What happens to 6 flats and 8 flats? (14 flats become 1 cube and 4 flats.)
   - What is the total? (1 cube [1,000], 5 flats [500], 2 rods [20], and 1 unit, or 1,521)
   Have students perform the addition with paper and pencil and then check their addition with a calculator.

3. For the next example, have students use the fewest possible number of blocks to construct again the numbers 675 and 846. Then, ask them to represent the difference 846 − 675 with the fewest possible number of blocks. Have them describe in writing what happened in the subtraction, including drawings of the subtraction. Ask the following questions:
   - What happens to 6 units and 5 units? (5 units subtracted from 6 units equals 1 unit.)
   - What happens to 7 rods and 7 rods? (7 rods subtracted from 4 rods does not work, so we must regroup and "borrow" 10 rods (or 1 flat) from 8 flats, changing the 8 flats to 7 flats. Now, 7 rods can be subtracted from 14 rods, equaling 7 rods.)
   - What happens to 7 flats and 6 flats? (6 flats subtracted from 7 flats equals 1 flat.)
   - What is the total? (1 flat (100), 7 rods (70), and 1 unit, or 171)

Have the students perform the subtraction with paper and pencil and then check their subtraction with a calculator.

4. Provide additional math problems for students to solve, using base-10 blocks. Give students opportunities to move from the manipulative (base-10 blocks), to the representational (drawings), to the abstract (vertical and horizontal addition and subtraction/calculator computation).

Assessment
- **Questions**
  - ○ How could this strategy help you to add or subtract large (more than four-digit) numbers?
  - ○ What kind of base-10 block could be used to represent 10,000?
- **Journal/Writing Prompts**
  - ○ Explain what you notice about the relationship among the various base-10 manipulatives.
  - ○ Using base-10 blocks, represent 5,624 − 2,589, and write an explanation of the steps.

Extensions and Connections (for all students)
- Have students use base-10 blocks to represent 376 in a variety of ways, *not* including 3 flats, 7 rods, and 6 units.
- Have students write several ways to rename 245 without using manipulatives (e.g., 2 hundreds, 4 tens, 5 ones; 2 hundreds, 2 tens, 25 ones)

Strategies for Differentiation
- Have students demonstrate the process of regrouping during addition or subtraction. For example, begin with a four-digit number such as 1,234. Have a student stand in the thousands place and hold 1 large cube to represent 1,000, another student stand in the hundreds place and hold 2 flats to represent 200, another stand in the tens place and holds 3 rods to represent 30, and another stand in the ones place and hold 4 units to represent 4. Then, have another student pose a subtraction problem for the students holding the blocks, such as 1,234 − 567. The students holding the base-10 blocks must determine how to demonstrate the solution by regrouping the blocks they are holding.
- Have students continue work with manipulatives and place value charts until they are able to demonstrate a clear understanding of the process of regrouping.
- Have students use grid paper to keep digits in their proper place value positions.