

Singapore Math: A Visual Approach to Word Problems

Model Drawing in *Math in Focus*TM

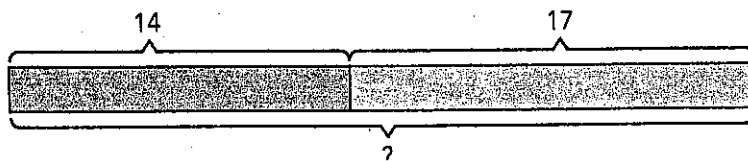
Math in Focus
Singapore Math
by Marshall Cavendish

Bar Modeling: Pictorial Understanding

Students are first introduced to model drawing in second grade to represent part/part whole situations that can be solved with addition or subtraction. The first problem, introduced in second grade, might be as simple as:

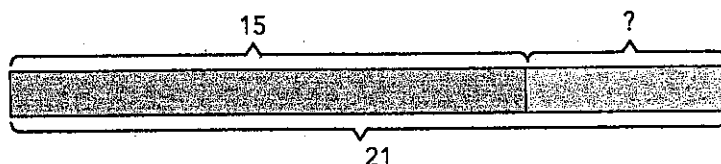
Helen has 14 breadsticks. Her friend has 17. How many do they have altogether?

Students would draw one bar, divided into two parts, one slightly longer than the other. In this problem the two parts are "known," and the student must add to find the whole or the "unknown."



But the next problem is:

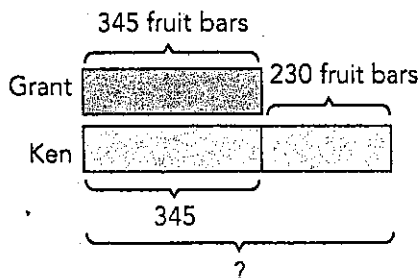
There are 21 fish in a bowl. Fifteen are from students. The rest are from the school. How many are from the school?



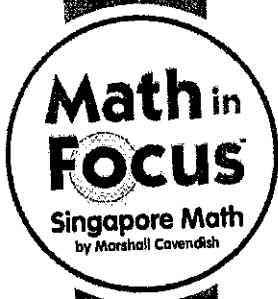
Notice in this problem, the student knows the whole and one part, and can solve for the missing part either by adding up or subtracting, so students understand the relationship between addition and subtraction. Students solve for an unknown variable at a pictorial stage, which aids the transition into the abstract.

While part/part whole models can be used to represent many subtraction problems, they cannot be used to represent comparison problems—how many more or fewer is one quantity compared to another. Such a problem might be:

Grant buys 345 fruit bars. Ken buys 230 more fruit bars than Grant. How many fruit bars does Ken buy?



Notice how visually clear these comparison problems become when the two rectangles are drawn. Even when the problems become more complex—for instance asking students how much Ken and Grant have altogether—the visual representation helps students realize they must first figure out how many Ken has and then how much they have altogether. With just these two models, students can solve most multi-step, complex addition and subtraction problems.



The comparison problems might be as simple as:

Jim has \$15. Tom has twice as much. How much does Tom have?

Or as challenging as:

The sum of two numbers is 36. The larger number is three times the smaller number. Find the two numbers.

Imagine drawing the smaller number as a rectangle. Then the larger number would be three of them and the sum of the two is 36.

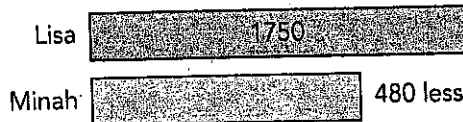


The student quickly visualizes that the sum of the four bars is 36, and that $36 \div 4 = 9$ for the smaller number and 27 for the larger one.

Students are gently led from simple problems with easily manipulated numbers to more complex ones that require more arithmetic and multiple steps. A comparable multiplication problem in fourth grade is:

Lisa had 1750 stamps. Minah had 480 fewer stamps than Lisa. Lisa gave some stamps to Minah. Now Minah has 3 times as many stamps as Lisa.

How many stamps did Minah have at first? How many stamps does Lisa have now?



$$\text{Minah} = 1750 - 480 = 1270 \text{ at first}$$

$$\text{Minah} + \text{Lisa} = 1270 + 1750 = 3020 \text{ total}$$



$$\text{Lisa} = 3020 \div 4 = 755 \quad \text{Minah} = 3 \times 755 = 2265$$

Lisa now has 755 stamps.

Fractions and Ratios

Finally, in fourth and fifth grade students use models to understand and solve problems that involve fractions and proportional thinking. Once again, some problems involve part/whole problems like this:

Vincent spent $\frac{4}{7}$ of his money on a pair of shoes. The shoes cost \$48. How much money did he have at first?



The comparison problem might read:

There are $\frac{3}{5}$ as many boys as girls. If there are 75 girls, how many boys are there?

