Teacher Note

Three Approaches to Story Problems

Students commonly take one of these three approaches to solving an addition or subtraction story problem:

- Counting All
- Counting On (or Up) or Back (or Down)
- Numerical Reasoning

Each approach is described below and illustrated with examples of student work on the following problem. (Subtraction story problems are presented in Investigations 2 and 3.)

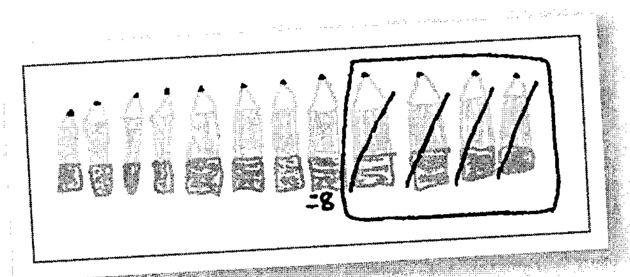
Last night I picked up 12 pencils from the floor. I put 4 of the pencils in the pencil box. How many pencils did I have left in my hand?

Counting All

When young students first encounter story problem situations, they usually model the actions in the problem step-by-step in order to solve it.

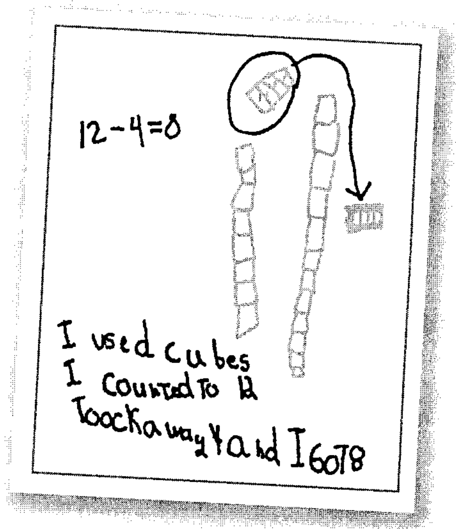
Students who are using a direct modeling strategy might count out 12 cubes, take 4 of them away to represent the 4 that were put in the pencil box, and then count the number of cubes remaining.

Leah drew 12 pencils, crossed out 4, and then counted the remaining pencils.



Leah's Work

Edgar counted out 12 cubes, took away 4, and counted the remaining cubes.



Edgar's Work

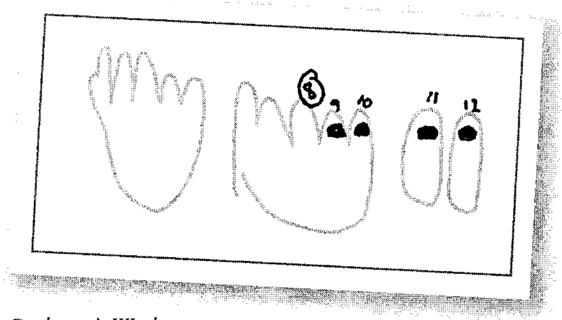
As students gain skill in visualizing problem situations and begin to develop a repertoire of number relationships they know, they gradually develop other strategies based on counting on or counting back and on numerical reasoning. These strategies require visualizing all of the quantities of the problem and their relationships, and recognizing which quantities are known and which need to be found.

Counting On or Counting Back

Some students, who perhaps feel more confident visualizing the problem mentally, use strategies that involve counting on or counting back.

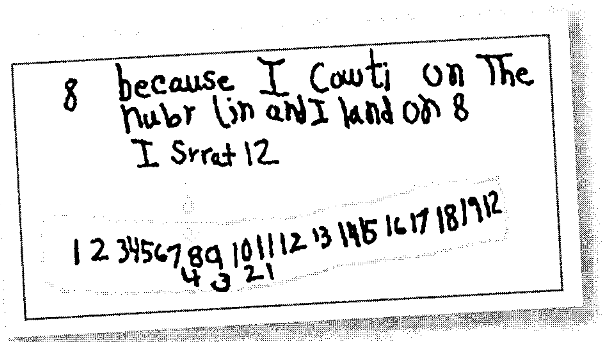
Deshawn counted on his fingers. To get 12, he explained that he used both hands and visualized 2 "imaginary fingers." He counted back from 12, first counting back 2 in his head, using his imaginary fingers and then counting back 2 more on his actual fingers to get 8.

Deshawn recorded his counting back strategy on paper.



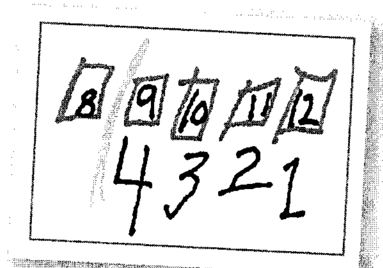
Deshawn's Work

Nicky used the class number line. She started at 12 and counted back 4.



Nicky's Work

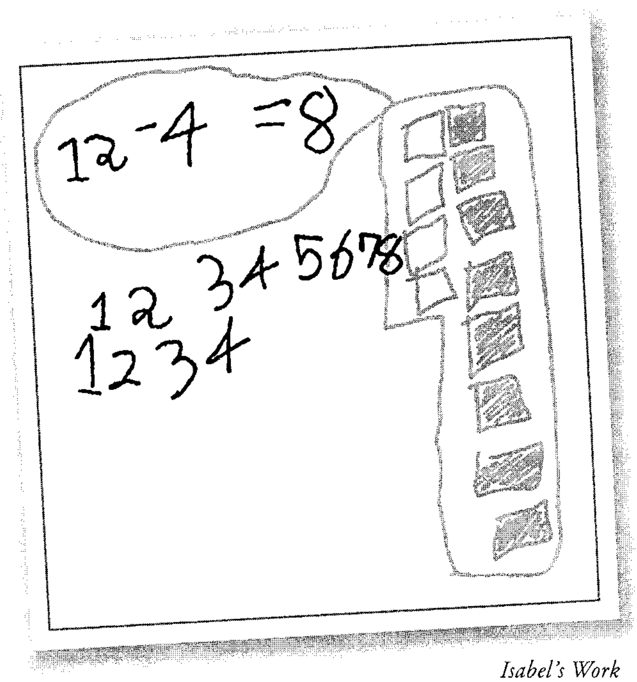
Bruce counted back 4 from 12 in his head.



Bruce's Work

Although these three students' methods somewhat resemble the methods of the students who directly modeled the action in the problem, there is an important difference: None of these students had to construct the 12 from the beginning by 1s. Deshawn quickly made the 12 out of larger chunks (5 + 5 + 2), and Nicky and Bruce simply started with 12. Counting back for subtraction requires a complex double counting method. These students must simultaneously keep track of the numbers they are counting back (11, 10, 9, 8) and the number of numbers counted (1, 2, 3, 4).

Isabel used a different counting strategy. She counted out 4 cubes in a column to represent the 4 pencils taken away. She continued putting cubes in a second column, counting on from 4 until she had a total of 12. Then she counted the number of cubes in the second column. Isabel was able to transform the problem into a different structure: 4 + ____ = 12, counting on to find the solution. See **Teacher Note:** The Relationship Between Addition and Subtraction, page 163, for more information.

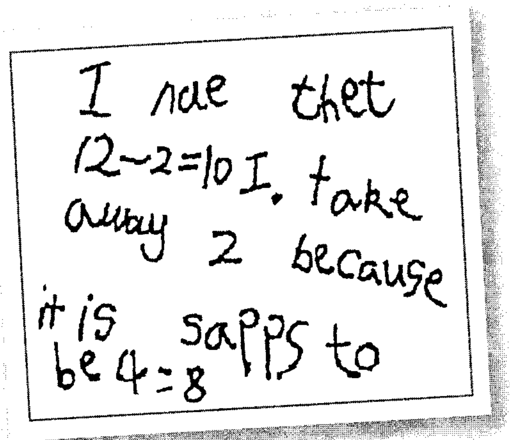


Isabel's Work

Using Numerical Reasoning

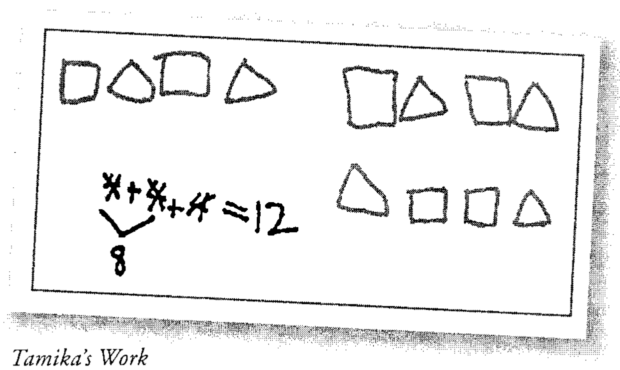
As students learn more about number relationships, they begin to be able to solve problems by taking numbers apart into useful chunks, manipulating those chunks, and then putting them back together.

Lyle broke 4 into 2 and 2. He then subtracted each chunk separately: 12 − 2 is 10, and then 10 − 2 is 8.



Lyle's Work

Tamika explained, "I know 4 and 4 and 4 is 12. Two 4s is 8, and then there's 4 in the pencil box."



Tamika's Work

These students are using strategies that involve chunking numbers in different ways, rather than counting by 1s. They are able to visualize the structure of the problem as a whole in order to identify number relationships they know that might help them solve the problem. It is important to encourage strategies such as these, but keep in mind that ability to work with chunks greater than 1 develops gradually over the early elementary years. Many first graders will need to continue counting by 1s for most problems. As they build their understanding of number combinations and number relationships over the next year or two, as well as their ability to visualize the structure of a problem as a whole, they will begin to develop more flexible strategies.