Beansticks: How to Teach Place Value Effectively

by Marilyn Harrison

Several years ago, my husband received a copy of Beryl Cochran's handout, "An Approach to Place Value Using Beans and Beansticks" (Cochran 1972). Since I was involved in teaching elementary school mathematics as the EOF project teacher in the Highwood math lab, he suggested that I use beansticks. I thought, "He doesn't understand—Grade 1 students and beans and glue and Popsicle sticks . . . it couldn't possibly work." So we continued to struggle with bundling Popsicle sticks with elastics . . . the elastics breaking, the children not being able to twist them . . . anyone who has used this approach knows about all the frustrations. Finally, we decided to try using beansticks.

Following Beryl Cochran's outline, we asked the children to suggest a number of beans to take. One student suggested "Seven." Another child said "Eight." "How many altogether?" we asked. The children decided they had "15" altogether.

We asked the children to keep the "15" and suggest another number. Someone suggested "Two." It was revealing to notice which children began to count from the beginning and which students counted on from 15 to get "17." The students continued to suggest numbers until we had counted to about "45." We put the beans away.

The next day, we followed the same pattern, but suggested that whenever they had a group of "10" they could put them in a pile. We continued until we had about five piles of "10" and some "extras" or "leftovers," as the children liked to call them.

On the third day, we suggested that, to keep track of the piles of 10, we could glue the beans on Popsicle sticks. We set out Popsicle sticks, glue bottles, chili beans (they fit best on a Popsicle stick), and paper towels. The children (or teacher) put a strip of glue on the Popsicle stick, then arranged 10 beans on each stick. Some students made up to 10 sticks and told us they had used 100 beans. They thoroughly enjoyed the activity, and silence reigned as each child made certain there were 10 beans on each stick, counting silently so that other students would not be disturbed. We left the beansticks to dry on paper towels. After school, the teacher put a strip of glue (white glue that dries clear) across the top of each row of beans to keep them more secure.

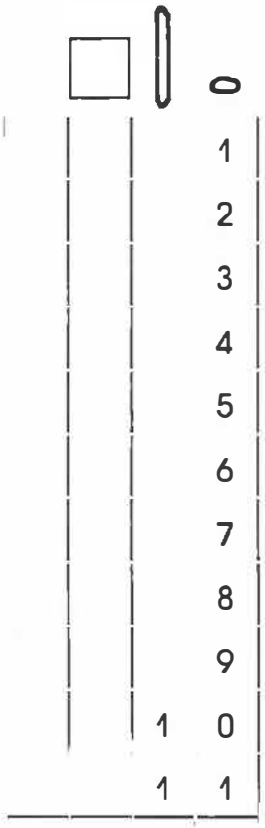
We allowed the children to play with the beansticks. What can you do with them? Since you can't really build much with them, they turned to making numbers. For instance, the children discovered the connection between four beansticks, four 10s, and 40 by counting the beans. We overheard comments to one other, such as "40 and 40 is 80 . . . well, because four and four is eight."

To help students with the concept of "trading" 10 beans for a beanstick, we played "Race to 100."

Materials: One die marked 1 to 6, beans, and beansticks.
Play: Play with a partner. Roll to see who goes first.
Player A: Roll die. Take that many beans (e.g., "6").
Player B: Roll die. Take that many beans (e.g., "2").
Player A: Roll die. Take that many beans, and add them to the first beans (e.g., "6" on the first roll; "5" on the second roll). Now, trade 10 beans for a beanstick. Player A has one beanstick and one bean.

Winner: First player to get 10 beansticks (or a raft) or more.

Next, we gave all the children a strip of paper like this:

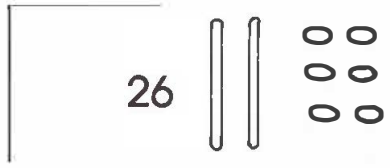


We asked them to take a bean and write "1"; to take another bean and write "2"; to take another bean and write "3"; and so on. When we got to 10, we traded 10 loose beans or a beanstick and wrote "1" in the beanstick column and "0" in the loose-bean column.

As soon as the students saw the pattern, they were anxious to continue at their own speed, which they did, but we asked them to take a bean each time they wrote a number. When they filled one strip, they glued a second strip below it, and carried on. They didn't want to stop the activity. Most of the students were intent on reaching 100. When we finally had to stop, their strips were rolled up and fastened with a paper clip. The next day, the students were eager to continue, each child taking the number of beans where he or she left off (e.g., "36" or 3 beansticks and 6 "loose beans") and carrying on from there, taking one bean at a time and writing the new number. Some children passed "100." They all took their strips home, rolled up and fastened with a paper clip. (The strips could be rolled around one-half a toilet paper tube.)

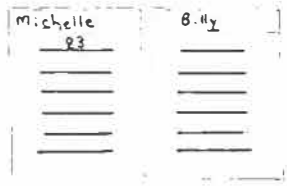
We put the numerals 1 to 100 in the middle of the table. The students chose a numeral and made it with the beansticks. It becomes evident, as you watch them make the numbers, which children have a clear understanding of place value. If children continue to make numbers such as "13" by counting 13 loose beans, you might ask them, "Is there a faster way?"

We put the numerals in the middle of the table, and gave the students strips of paper. They picked a number, made it with beansticks, and then drew the picture of the number like this:

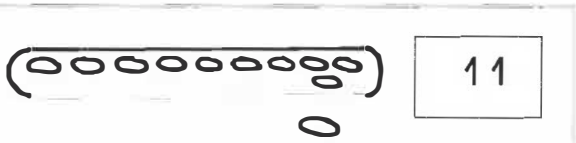


Some students made more than 10 strips in a short period. They each completed a booklet to take home. The same activity was repeated the next day.

Each child worked with a partner. One child constructed a number from beans and beansticks; the second child wrote the number.



We gave the students cards with pictures of beans and beansticks and asked them to write the number:



When we talked about "before" and "after," we made a number such as "54," with 5 beansticks and 4 loose beans. What comes before? Take away a bean. "53." What comes after? Add a bean to 54 . . . "55." For a number such as "59," we discovered that, for "after," we had 10 loose beans and could take another beanstick instead . . . "60." We had them record:

Before	*Number*	*After*
53	54	55
58	59	60

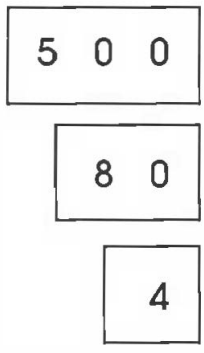
The children used the beansticks and beans to add numbers (without regrouping in Grade 2):

64
+23 and so on.

and to subtract numbers (without regrouping), such as:

39
−27

When the children reached Grade 2, we glued 10 beansticks together to make a raft by putting glue on two Popsicle sticks and gluing 10 beansticks across them. Then we repeated the activities that we had done in Grade 1, using numbers in the hundreds and place value cards:

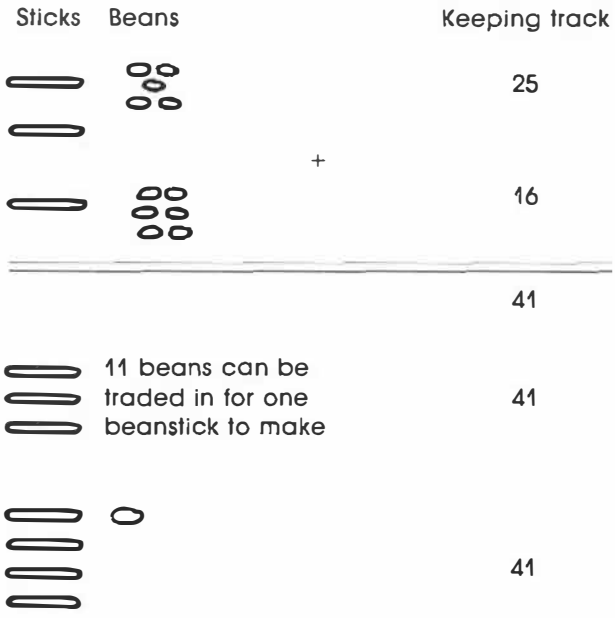


We made the cards using one color for the 100s, another for the 10s, and another for the 1s.

Students chose a card from each color, made the number by placing one on top of the other 584, then made the number with beansticks and beans.

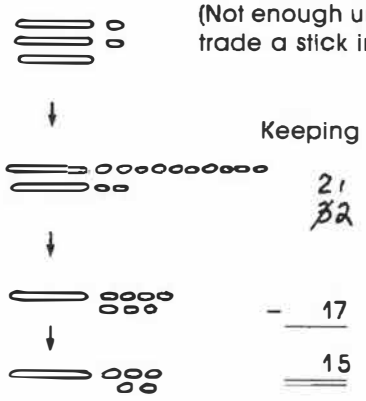
The students recorded their work by: drawing a picture of the beansticks; writing a numeral in expanded notation (500 + 80 + 4) (Grade 3 only); and writing the number "584."

To teach addition with regrouping in Grade 3, we first played "Race to 100" and then used the beans and beansticks to introduce the algorithm with understanding (ideas drawn from Wirtz 1973). "Show me a group of 25 beans." (Record or keep track on paper.) "Make another pile of 16 beans and beansticks right under the 25." "How many are there all together?"



Before introducing the subtraction algorithm, we played "Race to 0." Each player takes 10 beansticks or a raft and rolls the die, then takes away that many beans (will have to trade a beanstick for 10 beans). Students take turns rolling the die and taking away that number of beans. Winner: first player to reach 0.

Subtraction Algorithm. "Make a group of 32 beans." "Please give me 17 of those 32 beans." "How many do you have left?"



When children manipulate bean sticks and loose beans, they understand what they are doing, the mysteries of arithmetic disappear, and they see that symbols are used only to help keep track of things as they are moved around. (Wirtz 1973)

References

Cochran, Beryl. "An Approach to Place Value Using Beans and Beansticks." Workshop presented at the annual meeting of the National Council of Teachers of Mathematics, Chicago, 1972.

Wirtz, Robert W. *Drill and Practice at the Problem-Solving Level.* Washington: Curriculum Development Associates, 1973.