Story: Bean Thirteen
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Illustrator: Matthew McElligott

Teacher: Madeline Price
Setting of the class / school: A fifth grade classroom with students of mixed math abilities at a large public elementary school in Haslet, Texas
Age group: 10-11 year olds (Grade 5)
Number of children in the class: 22

Learning intention: To teach the concept of prime and composite numbers
Key mathematical vocabularies: prime, composite, factors, multiples
Resources needed: A copy of 'Bean Thirteen', 24 beans per small group, Hundred charts

Synopsis by the publisher:

Ralph warns Flora not to pick that thirteenth bean. Everyone knows it's unlucky! Now that they're stuck with it, how can they make it disappear? If they each eat half the beans, there's still one left over. And if they invite a friend over, they each eat four beans, but there's still one left over! And four friends could each eat three beans, *but there's still one left over!* HOW WILL THEY ESCAPE THE CURSE OF BEAN THIRTEEN?!

Starter / Teaching input (20 minutes):

I started the lesson by reading the book, Bean Thirteen. As we went through the story, I stopped and asked the students to make predictions about whether or not the characters would be able to divide the thirteen beans by the different numbers of characters (i.e. the crickets) so that the beans can be shared equally. Many times the students were accurately able to tell whether or not it would be an equal share. We discussed the fact that sharing the 13 beans between two crickets would not work because 13 is not an even number, for example.

Once we finished reading the story, we discussed as a class the factors of 13. (Prior to this lesson, the students had learned about factors and multiples in previous grades, but we had not discussed it yet this school year.) We started by making the connection that an addend plus an addend equals the total and similarly a factor times a factor equals a multiple. By making this connection, the students were able to see the relationship between addition and multiplication. To deepen their understanding of factors, I subsequently gave each group of students 24 beans and asked them to find the factors of 24 by building arrays of beans and splitting them into equal groups (see Figure 1). Once students found a factor of 24, I asked them to write the multiplication sentence next to it (see Figure 2).

First main activity (15 minutes):

Once the above investigation was complete, we discussed the concept of *prime* and *composite numbers*. To develop students' understanding of the concepts, we used a math tool that we use in the classroom often, a Hundred chart. Specifically, I told the students that I was skip counting and landed on 54, and asked them where I could have started. While collaborating with their partners, the students were able to start skip counting wherever they wanted, but many of them began at smaller digits, for example, 2 or 3. While walking around and talking with students, I began to hear many students say that if we skip count by 2 and land on 54, then 27 would work too. (I wanted students to see that they did not need to start with just the single digit numbers because larger numbers, such as 54, do have larger factors.) We then discussed as a class the numbers they found that did or did not work, for example, the students quickly found that 2 would work, but 5 would not, based on their understanding of factors and multiples. We also discussed whether 54 is a prime or composite number, and explored students' reasons.

Second main activity (15 minutes):

To further develop the students' concept of prime and composite numbers, the students were given a Hundred chart each, and were asked to cross out the multiples of 2, 3, 5 and 7 (see Figure 3). The students were asked what they noticed about the Hundred chart as they were crossing out the multiples of these numbers (e.g. after crossing out the multiples of 2, many students noticed that the numbers were even). This continued until the students had gone through

all of the numbers. Looking at the numbers that students have left on their Hundred chart, I asked them to discuss at their table what they found that these remaining numbers had in common (i.e. that they are prime).

Plenary (10 minutes):
After coming to the above conclusion, we ended the lesson by discussing the divisibility rules of 2, 5, and 10, whose multiples my students are more familiar with. Students could explain, for example, that any number that ends in a 0 or a 5 would be a multiple of 5, and any number with a zero in the 'ones' column in the place value chart is divisible by 10. We then discussed how any number that is divisible by 10 is also divisible by 5.

Reflection:
Since this lesson, we have referred back to Bean Thirteen multiple times when discussing prime and composite numbers. Using literature in the math classroom is a new teaching strategy that I have begun to implement. By doing so, it has given the students something to anchor their learning to. I have noticed an increase in engagement and level of thinking from my students. I am excited to see how this mathematics teaching approach continues to develop my mathematics teaching and my students' learning in the future!
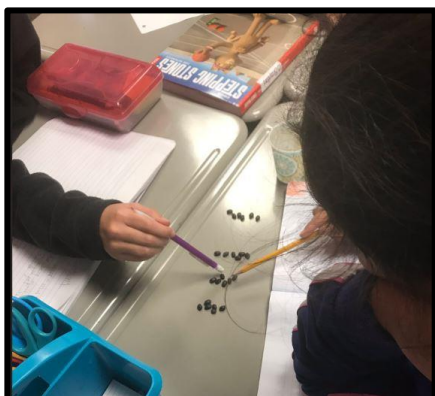
Figures:

Figure 1: Student are working together to put 24 beans into equal groups to find the factors of 24.
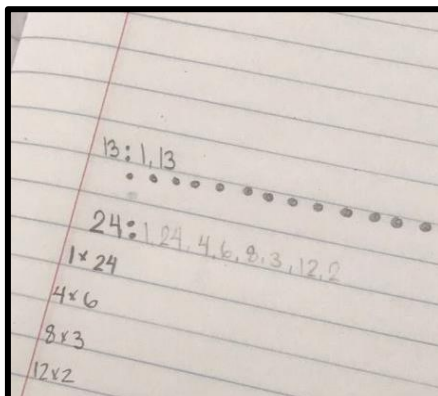

Figure 2: Students recorded their findings by writing the factors of 24, drawing an example of an array, and writing it as a multiplication sentence.

Figure 3: Students crossed out the factors of 2, 3, 5, and 7 on a Hundreds chart to find the prime numbers up to 120.