

# Helping English Language Learners Make Sense of Math Word Problems A Lesson with Second Graders

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*Alison Williams's second-grade class has the full range of English language learners (ELLs), from beginning to advanced, including a few native English speakers. Native languages spoken by the students include English, Vietnamese, Spanish, Somali, and Laotian. Alison knows that ELLs typically experience difficulty understanding and therefore solving math word problems for a variety of reasons. She understands that word problems require more careful and slower reading than other prose because they are packed with some or all of the following: symbols such as  $\times$ ,  $>$ , and  $=$ , concept words related to math such as greatest amount, least amount, and difference between, and math vocabulary terms that have different meanings in everyday usage such as even, odd, and operation.*

*A couple of times a week, Alison poses math word problems for her second graders to solve. Sometimes she uses them as a warm-up to math time; other times, she uses them as a main focus. Each time, however, she begins with a class discussion on how to use manipulatives, which she refers to as "math tools." In this excerpt from *Supporting English Language Learners in Math Class, Grades K–2* (Math Solutions, 2009), the authors show how Alison helps ELLs use language to deepen their math learning.*

## Focusing on Manipulatives

Once the students were seated in a circle, Alison Williams placed several zip-top bags on the rug in reach of the children. Inside the bags were manipulative materials such as color tiles, base ten blocks, interlocking cubes, and toy dinosaurs. Although manipulatives can build students' confidence by giving them a way to test and confirm their reasoning, Alison knows they can pose a management challenge. For this reason, she always leads a brief conversation at the beginning of math time about how to use them. Students typically remind one another to

- share the math tools;
- use the tools for math and not for playing;
- stop using the tools when someone is explaining her or his thinking;
- listen for a signal from the teacher to put the tools away; and
- put away the tools safely, quickly, and quietly.

## Posing Word Problems as Warm-Ups

"Today, we're going to begin math class with a warm-up word problem," Alison told the class. "Who can tell us what we do after I tell the story problem?"

"You tell us a story, and we have to tell it back three times," Ricardo said.

"That's right," the teacher acknowledged. "I tell the story, and then I call on three different people to retell it in their own words. That way, you all get four chances to understand the story problem."

"Does everyone who retells the story have to say it in the exact same way I do?" Alison asked.

"No," Tommy replied. "We can use different words. But it has to be the same story."

Having the students retell the story problem gives English learners access to the math content because everyone gets a chance to hear the problem explained in multiple ways, possibly with simpler syntax and vocabulary.

Alison then posed the following word problem orally to the class:

*Yesterday I went to the park. There were 5 benches. There were 2 people sitting on each bench. How many people were there altogether?*

"Do you know what *benches* are?" Alison purposely asked to make sure that students understood the meaning of this important word in the problem.

"They're like things to sit on, like chairs," Thomas said.

"We have benches at school to sit on when we eat lunch!" Jessica exclaimed.

The teacher drew a quick sketch of a bench on the board and wrote the word *bench* next to the illustration. Whenever possible, she uses visuals to assist English learners. She also knows that presenting the word problem orally requires the students to pay close attention and focus on the words.

Alison told the story again and then asked the students to think of another word that means the same as *each*. *Each* is another key word in the story problem, one that students would have to understand in order to solve the problem correctly.

"Every!" students chorused.

"So there were two people sitting on *each* bench," Alison reminded, emphasizing the word *each*. "Or, we could say that there were two people sitting on *every* bench."

Alison then had the students pair up and retell the word problem in their own words, thereby giving everyone an opportunity to think through the problem. Partner talk is an important strategy because it gives students time to rehearse. When they were finished, Alison asked three volunteers to share. Yareli went first.

“When you go to the park you see five benches and two people on each benches,” she began. When it was evident that Yareli was having difficulty remembering the rest of the problem, her teacher provided some help.

“So when I went to the park, I saw five benches and there were two people on each bench,” Alison paraphrased, modeling correct grammar. “What do I want to know? What’s the question we have to answer?” Figuring out the question to be answered in word problems is difficult for the students in Alison’s class, especially for the English language learners.

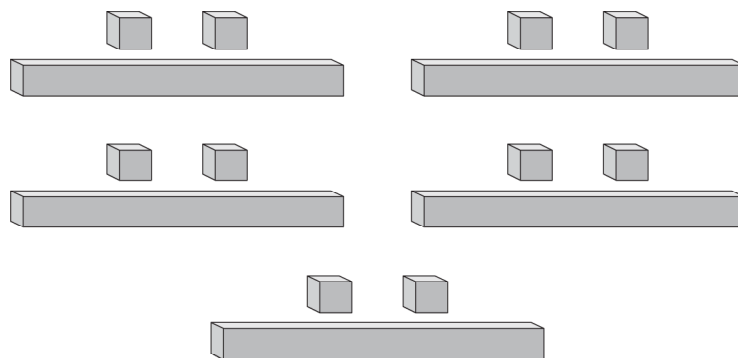
“How many people were on the benches?” Yareli asked in an uncertain tone.

“That’s right!” Alison responded.

After listening to two more students retell the story, the teacher directed the class to start working on the problem. As they worked, she made her way around the circle of students, observing and taking mental notes about the strategies that they were using. When the students were finished, she called for their attention and asked for volunteers to explain how they solved the word problem.

Nearly everyone’s hand flew into the air. Since Alison has worked hard to create a safe learning environment, one in which students feel safe to make mistakes, it was no surprise that so many students were eager to participate.

Michelle went first. “Right here is the bench,” she began, pointing to the base ten blocks she used to model the problem. “Here’s the two people. On each bench two people are sitting. There’s two people on each bench.”



“Does everyone see what Michelle did?” Alison asked the class. “How did you find out the answer, Michelle?”

"I counted them all," Michelle responded. Alison waited to see if Michelle would tell the class how she counted. When no further explanation was forthcoming, Alison helped by asking questions and providing some sentence starters.

"What did you do first?" Alison asked. "First I . . ."

"First I made the five benches," Michelle began.

"Next I . . .," Alison prompted.

"Next I put two people on each bench," Michelle continued. "Then I counted by twos."

Alison directed Michelle to point to her materials as the students counted aloud by twos: "Two, four, six, eight, ten."

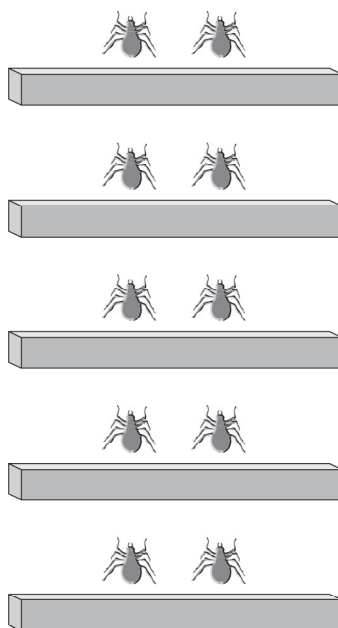
When Michelle was finished, Alison led the class in a round of applause. Jennifer, a student with beginning English language skills, was next to share.

"They were on the benches eating the snack," she began, pointing to the materials on the rug in front of her. "They're eating. And, um, and they were separately. There were two on the bench. I counted the people. They were eating."

Recognizing that Jennifer was having some difficulty, Alison asked her a question designed for a beginning English learner. "Can you point to the objects that are the people?" This question was suited for a beginning English learner because it required Jennifer to show, not explain.

Jennifer pointed to the two plastic spiders on each bench.

"So you counted the spiders for people?" Alison clarified. "Two on each bench?" Jennifer nodded.



“Count and see how many people there are,” Alison directed. Pointing to the spiders, Jennifer counted aloud, one by one, until she arrived at the correct answer of ten.

After two more students finished sharing their solution strategies, the warm-up for math class was over. The teacher then directed the students to put their materials away, and she proceeded with the math lesson for the day.

### **Devoting Math Time to Word Problems**

On another day, the students were again gathered on the rug, listening to Alison present the following word problem orally.

*Yareli has 10 treats for her puppies. She has two puppies.*

*How many treats does each puppy get to make it fair?*

“Do you know what dog treats are?” Alison asked the class.

“They’re like snacks,” Isela said.

“If dogs are good, you give them treats,” Chris added.

Alison then held up a little doggie biscuit that she had brought from home to show the students.

To retell the problem, the teacher decided not to have the students use partner talk. Instead, she asked three students to retell the story. She gave each volunteer lots of think time before he or she shared. Mei Ling, a student with intermediate fluency whose native language is Vietnamese, was one of the three students who retold the problem.

“Yareli got ten snacks for her two puppies,” she began. “And how many, how many snacks does she need to give her puppies to make it fair?”

“How many treats does she need to give *each* dog?” Alison repeated, emphasizing *each*. As much as possible, Alison either paraphrases or rephrases students’ ideas, or she asks the students to rephrase their classmates’ ideas. Paraphrasing or rephrasing is beneficial in several ways. It gives English learners another chance to understand an idea; it provides an opportunity to practice producing language; and it gives the teacher a chance to model correct usage of grammar and syntax.

Instead of having the class solve the word problem at the rug, Alison dismissed the students to their seats to work. To transition them from the rug, she distributed to each student a sheet of paper on which was written the word problem and a reminder to show their work using numbers, pictures, or manipulatives. In addition, there were three sets of number choices that students could use when solving the problem:

$(10, 2)$   $(12, 3)$   $(15, 2)$

These number choices allowed Alison to differentiate instruction. For example, dividing ten dog treats into two groups would be easier than dividing fifteen into two groups. Students would be able to self-regulate, sometimes with assistance from their teacher, and choose which numbers were appropriate for them. Having three different number pairs also gave early finishers an opportunity for further practice.

As the students worked, Alison circulated around the room. When students work on word problems, she sees her role mainly as an observer, keeping track of the strategies students are using. Sometimes she chooses a few children who have solved the problem differently to share in the upcoming whole-class discussion in order to give all students access to a variety of ways to solve word problems.

When everyone seemed ready, Alison transitioned the class back to the rug by having the children leave their manipulatives at their tables and bring only their papers. Once all were seated in a circle, she asked the students to raise their hands if they had solved the first problem: ten dog treats for two dogs. Then, on the count of three, she directed the class to say the answer to the problem aloud.

Yareli, a student with advanced fluency in English, volunteered first to share her thinking. "I already knew that five plus five equals ten," Yareli said. "I could break apart the ten to give five treats to one puppy and five to the other. So each puppy gets five." Yareli is a good example of an English learner who has some strong language skills that help her explain her thinking clearly and accurately. Her explanation served as an excellent model for others. (See Figure 1.)

Dog Treats

Yareli had 10 dog treats. She gave them to her 2 puppies so they each got the same amount. How many dog treats did she give to each puppy?

(10, 2)      (12, 3)      (15, 2)

Use numbers, pictures or manipulatives to solve. Show work below

If I had ten treats and I brake the ten apart. I will have two Fives. If I had two Fives I would shar. I would give 5 to one puppy. And give the other part to the other puppy.

Figure 1. Yareli is an example of an English learner with strong language skills.

Vanessa, another student with advanced fluency, went next. She had worked on the problem with three dogs and twelve dog treats. “I had three puppies,” she began. “I mean Yareli had three puppies. Then I got—then I found that twelve is an even number and then I got the cubes.”

Alison gave Vanessa a bag of interlocking cubes so that she could show the class what she did.

Continuing, Vanessa said, “I gave one to this puppy, one to this puppy, and one to this.” Vanessa was making three groups, or puppies, and divvying the cubes or treats to each puppy, one at a time.

“And then two and two and two,” she said, placing more cubes so that there were two cubes in each group. “And then three and three and three and then four and four and four.”

Having the cubes was extremely helpful to Vanessa; the cubes seemed to facilitate her explanation and served as a conversation piece.

“Can someone tell us what Vanessa just said?” Alison asked the class.

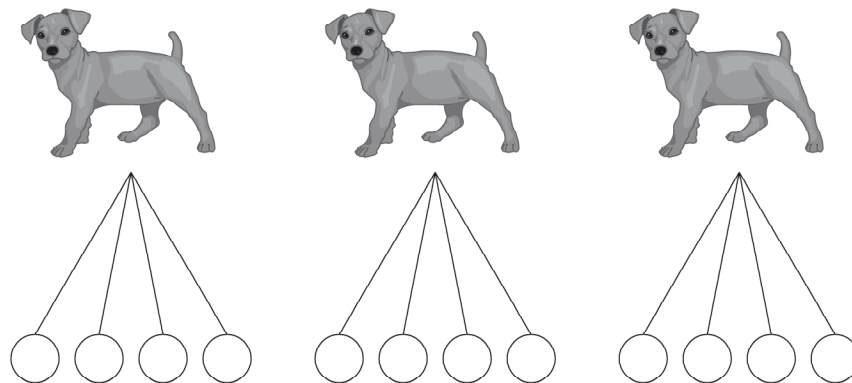
Thomas, a student with intermediate fluency in English whose native language is Vietnamese, rephrased Vanessa's explanation. As he spoke, Alison made his thinking visible to the class by drawing a picture on chart paper.

"There's three dogs," Thomas said. The teacher quickly sketched three dogs on chart paper.

"And she had twelve treats," he continued. Alison then drew twelve circles below the dogs.

"Yareli gave each dog a treat," Thomas continued, as Alison drew a line from each dog to one treat.

"Then she gave each dog another treat and she kept doing that till each dog got four treats."



"Vanessa's strategy reminds me of the other day when Kerin brought in gummy bears to share with the class," Alison said. "So that everyone got the same amount, Kerin passed one gummy bear to each student and then another to each person so that it was fair, remember?"

Students nodded their heads in agreement. Alison continually tries to find ways to connect the mathematics that students are learning to their experiences in everyday life. These connections help build and cement understanding for all students, particularly English language learners. Figures 2 and 3 show how two other students solved this problem.



Dog Treats

Yareli had 10 dog treats. She gave them to her 2 puppies so they each got the same amount. How many dog treats did she give to each puppy?

(10, 2)      (12, 3)      (15, 2)

Use numbers, pictures or manipulatives to solve. Show work below.

$10 \div 2 = 5$

$12 \div 3 = 4$

$15 \div 2 - 1 = 7$

Figure 2. Jessica was able to use division to solve the problems.

Dog Treats

Yareli had      dog treats. She gave them to her      puppies so they each got the same amount. How many dog treats did she give to each puppy?

~~(10, 2)~~      ~~(12, 3)~~      (15, 2)

Use numbers, pictures or manipulatives to solve. Show work below.

1.  $XXXXX \rightarrow \leftarrow XXXXX$

10

$10 - 5 = 5$

2. I count by 2's

2 4 6 8 10 12

$4 + 4 + 4 = 12$

3.

Good Job

Figure 3. Thomas clearly showed his thinking using words, numbers, and pictures.

Story problems are just math problems with words. But for a student who is learning a second (or third) language, words in that new language can create a barrier to understanding. By explicitly teaching English in math class, teachers can help remove the roadblock that often prevents English language learners from making sense of a math word problem and, thus, from solving it. In fact, the challenges that vocabulary, grammar, and syntax pose to English learners can become English language development opportunities in math class. Alison always looks for opportunities to use strategies, such as repeating, rephrasing, and offering prompts, that clarify language and make math content accessible.