

Provoking Place Value Reasoning with Groups-of-Ten Word Problems: Excerpts from Ms. Brannon's First-Grade Class

Tanya Vik Blais: I had many opportunities to work with a first-grade classroom over the course of a school year, and in this particular class the students were spending a lot of time working on place-value ideas and building their understanding of two-digit numbers, so we're going to see a video of Mrs. Brannon, the classroom teacher, as she's working with kids on developing some of these ideas. She's going to pose a word problem to these kids. Basically, a seven-groups-of-ten word problem, and it's based on a story that they've just read recently, called "Creepy Carrots."

Ms. Brannon addresses the class

Ms. Brannon: Jasper Rabbit finally built seven fences to keep the creepy carrots in. There were 10 creepy carrots inside each fence. How many creepy carrots is Jasper trying to keep in? No, no, I'm going to read it again. Jasper Rabbit finally built seven fences to keep the creepy carrots in. There were 10 creepy carrots in each fence. How many creepy carrots is Jasper Rabbit keeping in? Ok, so what do we know—how many fences did he build?

Students chorus: Seven

Zak: So this creepy-carrots word problem is, in essence, asking how much is 7 tens, right? And that's a multiplication-grouping word problem for first graders. I think that's pretty exciting.

Rob: In recent times I hear a lot of discussion about content limits and the standards, and I think in a lot of places multiplication and division have been pushed back to sort of third grade and higher in the curriculum standards, but it seems like in this lesson it's essentially a 7 times 10 problem, or a 7 groups of 10. But what I hear, what I think we're saying here is that, in this context, really place value and multiplication and grouping by tens and so on are sort of all integral in one piece.

Tanya: Absolutely. These kids are not viewing this as a multiplication situation, although as adults we see it as a multiplication situation. What they see it as is an opportunity is to make groups, to make these groups of ten, which is such a huge idea well before third grade, where multiplication and division really start popping up in the standards in a much bigger way.

Rob: A problem like this is an opportunity to find out what children understand about place value, about how much is 7 tens.

Tanya: So, after Mrs. Brannon posed this problem to the kids, she of course wanted to make sure they understood the story and what they were going to get ready to start solving. She moved among a few of the kids and interacted with them differently based on where their understanding was of place value.

Ms. Brannon interacts with Gunner

Ms. Brannon: *So how many fences do you have?*

Gunner: *Seven*

Ms. Brannon: *So let me ask you a question before you get ready to start. You ready? How many carrots are in each fence?*

Gunner: *10*

Ms. Brannon: *10. Ok, so what's your plan here? If you know, if you already know that there's 10 in each fence? What's your plan?*

Gunner: *Count by tens!*

Ms. Brannon: *Are you serious?*

Wendy: It's interesting that she stops him before he even starts and asks that key question: What's your plan?

Tanya: Yeah, and that is a real key question, you know. Something she knows about Gunner, and that I got to witness in looking at Gunner, is that Gunner is right on that cusp of thinking in ones to thinking in tens.

Wendy: So she's really helping him to stop and not just do what he's done on other problems like this but to try to kind of see if he thinks about it, if he can take that leap to a thinking-in-tens strategy.

Ms. Brannon interacts with Gunner

Ms. Brannon: *How many carrots is he keeping in?*

Gunner: *70*

Ms. Brannon: *Gunner, why are there no circles inside of your fences today?*

Gunner: *Because there's only 10, so I could but, and I'm counting by tens.*

Ms. Brannon: *Ok, so you didn't need to take the time to draw ten circles in every single fence, did you? Because you already knew when you heard "10" that you were going to count how?*

Gunner: *By ten.*

Ms. Brannon interacts with Rayleigh

Ms. Brannon: *Can you count for me?*

Rayleigh: *10, 20, 30, 40, 50, 60, 70*

Ms. Brannon: *It's ok, don't worry about that part! We'll just mark it out, ok? 'Cause I heard you say, "10, 20, 30, 40, 50, 60, 70." So how many groups of ten do you have?*

Rayleigh: *Uh, seven.*

Ms. Brannon: *Seven! So, seven groups of ten is the same as what?*

Rayleigh: *70*

Ms. Brannon: *70. So what if I only had five fences with ten in each one?*

Rayleigh: *50*

Ms. Brannon: *Ok, and I saw you say—what were you saying?*

Rayleigh: *10, 20, 30, 40, 50.*

Ms. Brannon: *So, five groups of ten is...*

Rayleigh: *50*

Ms. Brannon: *Five groups of ten would be...*

Rayleigh: *50*

Zak: It's almost like the teacher was trying to help reinforce the idea that she doesn't have to count by ten to know it, sort of moving toward that understanding that 5 tens is 50 and 7 tens is 70. But it does seem like Rayleigh is really hanging on to that, sort of 10, 20, 30, 40, 50...50.

Tanya: Well, maybe it might be worth pointing out something about Rayleigh. She routinely counts by tens on these groups-of-ten word problems.

Zak: And again, following the fact that Rayleigh just determined that these 7 tens made 70, it seems really natural to say, “Well, what about 5 tens?” to see if she could make that leap to—

Rob: Sort of generalizing that idea.

Zak: Right, right. It wasn't about a bigger number, it was about something she could hold in her mind and make sense of.

Tanya: So after the students had had a chance to solve this problem, Mrs. Brannon wanted to lead a class discussion where different kids were sharing their strategies. She was really intentional with which strategies she selected to have shared, so that the entire class was engaging with that thinking and really making sense of some place value ideas that they still needed to learn.

Ms. Brannon interacts with Draydon and NyJalia

Ms. Brannon: See if you can decide what decision she made after she drew her pictures by ones.

Draydon, what decision did she make:

Draydon: Count by tens?

Ms. Brannon: How can you tell that she made a decision to count by tens?

Draydon: Because she said, “10, 20, 30, 40, 50, 60, 70.”

Ms. Brannon: Alright, NyJalia, is that the decision you made, to count by tens?

NyJalia: Hm mm

Ms. Brannon: Why did you make that decision?

NyJalia: Because that would be a lot faster.

Ms. Brannon: Ok, it was going to be a lot faster—what was your other choice?

NyJalia: I would have another X—when I had another 30, I X'ed out—

Ms. Brannon: *So what were you going to have to do if you didn't count it by tens? You would have had to have counted them...*

NyJalia: *longer... longer.*

Ms. Brannon: *Longer—because, guys, how would she have been counting them?*

Class choruses: *By ones!*

Wendy: NyJalia's strategy is such a great one to open a discussion with because, with all of those creepy carrots drawn out and each of the fences having ten creepy carrots in each fence, it really, it pulls along those kids who are still really thinking in ones. They can see all the carrots in NyJalia's picture but then helping them to think about: well this is a group of ten, and hmm, even though I have ten individual carrots in each of my fences, I can count this by tens—it's starting to kind of move them forward.

Zak: And NyJalia knew that like, she wanted to count them in tens. I loved her language about if I were to count them a different way it would be longer. I think it's interesting that she knew that. But, right, the teacher sort of bringing her in and letting her explain how she counted in tens to get to the answer was important.

Wendy: And it was probably reinforcing to her. If she's just moving toward this starting-to-count-in-tens way of doing things, choosing her, letting her be the one to get up and to show that counting-in-tens strategy, she's probably really proud of it, and it's really a new thing for her.

Ms. Brannon interacts with Gunner, Carly, and Chloe

Ms. Brannon: *Now, Gunner, I came back and wrote these tens in here, right? And after we did that, we knew there were 10 here, 10, 10, 10, 10, 10, 10. How many groups of ten, Gunner, did Jasper have? How many?*

Gunner: *Seven*

Ms. Brannon: *Do you guys agree that there are seven groups of ten?*

Class choruses: *yes*

Ms. Brannon: *Can we check to be sure?*

Class choruses: *yes*

Ms. Brannon: *I want everybody with me to check to be sure. There's 1 group of ten, 2 groups of tens, 3 groups of ten, 4 groups of ten, 5 groups of ten, 6 groups of ten, 7 groups of ten. And I can look underneath and tell that he counted his seven groups of ten and found out there were how many carrots?*

Class choruses: *70! So how much—Carly—how much is 7 groups of ten?*

Ms. Brannon: *70! Chloe, I need your paper for a moment. I just need a part of it. So Chloe—just look at her picture real quickly—whose strategy does that look like?*

Class choruses: *Gunner's!*

Ms. Brannon: *It looks just like Gunner's—Ok. But, I asked Chloe then to go down here—and I want us looking at this one.... I asked Chloe to write an equation that represented her problem, and I left Gunner's work up there because they did it the same way. Now here's what I want to know—I see a bunch of tens. I want to know how in the world did she know when to stop writing*

tens because I feel like I could probably do this.... I feel like I could just be like: “10 + 10 + 10 + 10 + 10 + 10 + 10 + 10 + 10.” How in the world did she know when to stop?

Rob: The final image that’s on the screen is so intentional and deliberate and carefully constructed between those seven circles with tens in them and then 10, 20, 30, 40, 50, 60, 70 written right below them, and then $10 + 10 + 10 + 10$ and so forth equals 70 in that equation. And then it wasn’t even mentioned in the video, but then below that $7 \times 10 = 70$, and it’s all laid out right there in this sort of sequential order, these different representations of this same idea.

Zak: I think this pedagogical move of putting them all up there together is reinforcing this idea of this integrated understanding of tens and ones, right?

Tanya: So having spent the first half of the year working on place-value ideas and conceptions of two-digit numbers with her first graders, Mrs. Brannon was really curious to see how they would generalize those same ideas to three-digit numbers. So, again, she uses a groups-of-ten word problem with her kids, because those tend to be really effective tasks for kids to engage with, so look at these two problems. First one: Kiley has 160 fish. She put 10 fish in each tank. How many fish tanks does she put fish in? And the second word problem: Kiley has 16 fish tanks. There are 10 fish in each fish tank. How many fish does Kiley have? So she gave that to the kids, basically what is 16 groups of ten, to her class. What was interesting is the variety of strategies that these kids used. We had many kids that represented the 16 tens using some kind of manipulative or drawing, like Jaden did. We also had students that counted by tens 16 times, like Lara did. And what’s interesting is these kids, like Jaden and Lara, on problems where the numbers were lower, like 8 fish tanks with 10 in each, both of those kids would have just said 80. But this problem provided an interesting challenge for them, moving the same ideas into 3-digit

numbers. So in this next section, Mrs. Brannon wanted to have her class really focus in on a different strategy from these previous two, to look at Chloe's strategy.

Ms. Brannon addresses the class

Class choruses: 8 tens, 9 tens, 10 tens, 11 tens, 12 tens, 13 tens, 14 tens, 15 tens, 16 tens!

Ms. Brannon: So she's got 16 groups of ten—fabulous! Now, you don't say a word! I want you to see if you can figure out why she could have just piled all 16 tens together. Why did she choose to draw it like this? Talk to the people at your table: Why did she choose to draw it like this?

Student: From the 10 groups of ten and the 6 groups of ten.

Zak: Clearly Ms. Brannon wanted to highlight that in this conversation. She made a big point about drawing the students' attention to why Chloe might have done that.

Wendy: And moving students from understand that 10 ones can be 1 ten, kind of iterating that idea, taking it to the next step and recognizing that 10 tens is 1 hundred is huge. That's the next level. That's where a lot of these kids seem ready to go.

Zak: Yeah, I think you're right. I think that Drew's demonstrating that flexibility of thinking about 16 in this case as 10 and 6. You know, earlier we talked about thinking about 16 in lots of different ways but in this example it's convenient to think about 16 as a 10 and a 6. So while there's lots of really great place value tasks that Ms. Brannon has engaged her class in throughout the year, I think these videos highlight two maybe underutilized ways to engage kids in place value, which are these groups-of-ten word problems.