

The Problem of Word Problems: Supporting Student Access

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Moves to Support Student Access to Problems in Context

Move	What it is:	Use it to:	Examples
Retelling	Prompting students to retell the story aloud	- Assess comprehension and identify where understanding broke down - Support understanding of vocabulary and the story sequence - Support identifying the mathematics in the story	"What's happening in the story?" "What happened next?" "Let's go back to the story (or text)." "What does the story say about that?" "Tell me the story again." - Refer students to a chart or story as an anchor text.
Visualizing	Prompting students to make a mental image of the story or particular elements of the story, such as the setting or key objects	- Support understanding of vocabulary - Bridge (and leverage) varied students experiences - Develop a more detailed understanding of the story and mathematically important parts	"What does it look like?" "Can you picture what is happening? Tell me about it." "Have you ever seen a ____? What does it look like?"
Expanding	Co-constructing with students additional storytelling details that make the context clearer or more vivid	- Support students in visualizing and comprehending the story - Motivate the question being asked	"So, imagine..." "What would ____ do (to accomplish the action in the story)?" <i>These moves are highly contextual.</i>
Acting Out	Performing the story physically	- Make the action – typically the source of the mathematics – concrete - Moves students toward modeling	"Let's do it. Who's going to be ____?" "How can we act it out?" "I'll be _____. Tell me what to do."
Modeling	Prompting students to represent the story with objects or pictures	- Represent and make visible the mathematics of the story - Support students in physically manipulating and reasoning about the mathematics - Move toward developing a strategy for solving the problem	"How could we do it with some objects?" "What could we use to represent the ____?" "How could we show what's happening?"
Connecting the Representation to the Story	Clarifying the meaning of students' representations	- Support students in reasoning about the work they have already begun - Reconnect students to what action they have modeled and what they still need to - Identify and address misunderstandings about the story's meaning - Support precision	"What does this number represent in the story?" "What does this (object, circle, tally, dot, etc.) represent in the story?" "Where are the _____ (items or people from the story)?"

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A pair of students, Joanna and Jessinia, were working on the vending machine problem, trying to figure out how many six-packs of water would fill a machine that held 156 bottles. They had an answer of 35 but could not explain it and began to get mixed up with the juice vending machine which had 6 flavors arranged in columns.

Coach: Can you tell me where that came from?

Jessinia: You can show that here [pointing to drawing of vending machine] because it's all blocked. Instead of using the water, I used the juice, and to add six of those, and I counted it.

Coach: So I have a question. Is the juice machine set up the same way as the water machine?

Jessinia: Yeah.

Coach: They're the same on the inside?

Joanna: Yeah, 'cause, it says right there [pointing to class chart with problem] that they both have 156 bottles.

Coach: They both have 156 on the inside.

Joanna: Yeah.

Coach: But I'm wondering if the inside of the machine, with the water, is it like this with the columns.

Joanna and Jessinia: No.

Joanna: I think it's divided up in rows.

Coach: It could be. We just don't know, do we? It could be by rows, it could be by columns, it could be by something else. We can't see it, can we? So do you think this is going to help you – that the juice machine is going to help you to think about the water machine?

Jessinia: No

Joanna: No, not really.

Coach: Maybe not? Okay. Can we set this one aside, because maybe this is a separate problem and we're going to focus on the water. So I notice that you did a couple of things here. So one thing is that you know that 156 is 100, 50, and 6. You know that, right? And you confirmed that by adding them together, and you saw that it is true, right here [pointing to student work]. But now I'm wondering, you told me that you're trying to figure out how many six-packs, how many groups of 6, will fit –

Joanna: - in there –

Coach: - in there. How could you show that somehow?

Joanna: I tried to show Jessinia a strategy, but I don't know if it will take long.

Coach: Was that what this was here [pointing to student work]. (pause) Why don't you tell me about this.

Joanna: I was going to put 6...6 circles and then...

Coach: So I see a circle, and inside I see 6 dots.

Joanna: Yeah.

Coach: So what does this represent? Can you tell me what that means?

Jessinia: Six.

Joanna: Six. I was going to put six circles and six dots in each, and see how much water bottles we needed. And, so then –

Coach: - So, for you, when you were drawing this, what did this represent, again?

Joanna: The six, the six...

Coach: The six. Does it represent the 6 from the 156?

Joanna: Yeah.

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Coach: It did. Okay, so why did you want to represent that six.

Joanna: Because I that, um, when we were in third grade, we had answers, we had to divide them.

Coach: Okay.

Joanna: So what I knew about this was, um, whenever you put it, like, dots, like 6 dots, whatever was the problem, you put six dots. I put six dots and six circles and it gave you an answer, you put it there. You put it up here, and it gives you an answer. It equals 150, 150, 150...but we don't know...

Coach: Okay, so, can we pause for a second? [To teacher] So, they're doing a lot of thinking, right? So one of the things that I'm noticing is that I feel like because of all of the different moving parts of the problem we're sort of losing track of what's the story –

Teacher: - right.

Coach: [To students] So, let's go back to the story. I'm going to turn this [paper] over because I know what this represents now and I know what you did here. But I want to start us back at the beginning just for a moment to see if we can find a way to moving on the problem. Alright? Alright. So, if we go back to the beginning, can you tell me what Jessica is doing? With the water machine – what's happening?

Jessinia: She's –

Joanna - she's trying to, um, she knows how to open the machine, but her problem, the problem that she doesn't know how to do is how much water bottles does she need to put in the vending machine.

Coach: She doesn't know how many water bottles to put in the vending machine. And is it just how many water bottles that she doesn't know?

Joanna: It's packs.

Coach: It's packs she doesn't know, right? So I want you to imagine Jessica has this cart [points to picture] and she's at her truck and she's trying to take the packs off –

Joanna: - I think she's going to take 4 packs...

Coach: She'll start with 4 packs? (pause)

Joanna: 6, 12,...

Coach: And you're going to see where that gets you? Okay, so, how could you show, with some kind of drawing, the four packs that you're going to take? Is there some – so maybe we need a fresh place to draw. [Jessinia hops up] You're going to get something?

Jessinia: Yeah.

Coach: Jessinia's going to go get something. Let's wait a second for her. (long pause) [Jessinia returns with paper.] Okay, so you want to start with 4 packs, and just see how that is? So can you guys think, how could we show the four packs here?

Joanna: I think I'll use the strategy, I think I'll use the strategy that I did before. Like, here I want to put four of these [pointing to circles].

Coach: Okay, and what is each circle going to represent now?

Joanna: They're going to represent, uh, the water bottles and...

Coach: Is each circle a water bottle?

Joanna: No, they're six-packs.

Coach: They're six-packs. Okay, so the circle is the six-pack and inside the circle –

Joanna: - there're six bottle, water bottles.

Coach: Okay, so why don't you go ahead and draw that.