

MP3, Grade 2

Task: Meg's Balloons

Practice standard focus: MP3 Construct viable arguments and critique the reasoning of others. Mathematically proficient students at the elementary grades construct mathematical arguments—that is, explain the reasoning underlying a strategy, solution, or conjecture—using concrete referents such as objects, drawings, diagrams, and actions. . . . Mathematically proficient students present their arguments in the form of representations, actions on those representations, and explanations in words (oral or written). In the elementary grades, arguments are often a combination of all three. Some of their arguments apply to individual problems, but others are about conjectures based on regularities they have noticed across multiple problems.

Content standard focus: 2.OA Represent and solve problems involving addition and subtraction. 2.NBT5 Fluently add and subtract within 100 using strategies based on place value, properties of operations, and/or the relationship between addition and subtraction.

Introduction

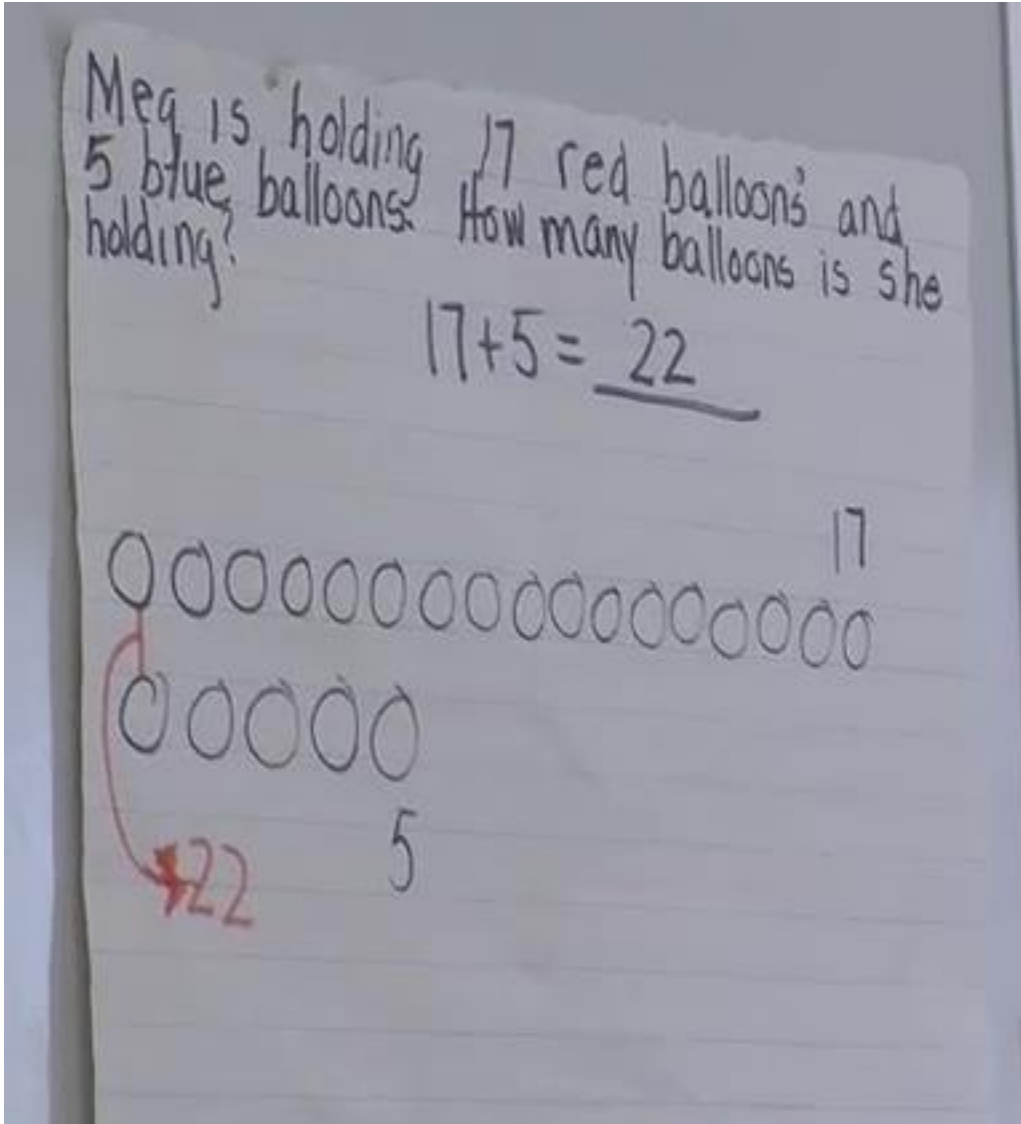
Although students may have methods to calculate and to solve different kinds of story problems, it is a different skill to look *across* related problems to notice generalizations about the behavior of the operations involved. In this illustration, a teacher gave her second-grade class sets of related problems to draw their attention to the relationship between addition and subtraction. One set posed the following problems:

- Meg is holding 17 red balloons and 5 blue balloons. How many balloons is she holding?
- Tim is holding 5 red balloons and 17 blue balloons. How many balloons is he holding? Did the first problem help you solve this problem? How?
- Meg is holding 22 balloons. 17 balloons fly away. How many balloons is she holding now? Did the other problems help you solve this problem? How?
- Tim is holding 22 balloons. 5 balloons fly away. How many balloons is he holding now? Did the other problems help you solve this problem? How?

Notice that the teacher asked her students not only to solve each of the problems, but to think about how they could use their work from the previous problems to help with the current problem.

When they came together to discuss the problems, all of the students had strategies to solve each of the problems. Also, all of the students could talk about how they used the first problem ($17 + 5 = 22$) to help them with the second problem ($5 + 17$).

Toby's representation became the focus of their discussion.



The students talked about how you can switch the rows of balloons in Toby's representation to show $5 + 17$, and the total number of balloons will stay the same.

As the video clip begins, the teacher now turns attention to the third problem.

Video: Meg's Balloons¹ (grade 2) <http://vimeo.com/66202272>

¹ Unpublished video from the project, *Using Routines as an Instructional Tool for Developing Elementary Students' Conceptions of Proof*. © TERC, 2013. Used with permission. All rights reserved.

Commentary

The students in this class are engaged in MP3: *Construct viable arguments and critique the reasoning of others*. The students are working to understand Ethan's argument, which is presented in the representation he used to solve the following problem: Meg is holding 22 balloons. 17 balloons fly away. How many balloons is she holding now?

Each student has solved the problem using his or her own strategy, and all the students know that the answer is 5. The students also understand that the point of the discussion is to understand Ethan's representation.

These second-grade students have learned to present their mathematical ideas and listen to and consider the thinking of others. They engage in mathematics discussion with the expectation that they will understand. Those who recognize Ethan's representation as a solution to the problem explain what they see in it. Briana, the student who thinks it does not represent a solution, explains why not. Those who are not sure listen to their classmates' arguments and, as they come to new insights, share what they see.

Ryan, the student who began the discussion with an explanation of how this problem is related to the first two, listens to the ideas offered by all of his classmates. Then he tries to figure out what Briana is missing and offers a suggestion that he thinks will help her connect the representation to the problem.

Some students recognize that the components of Ethan's representation of $22 - 17 = 5$ are the same as those in Toby's representation of $17 + 5 = 22$. They point out that either representation can be used for either problem. This idea approaches an argument for a general conjecture about the relationship between addition and subtraction. However, the teacher recognizes that many members of the class are still sorting out the relationship among quantities in Ethan's representation.

Throughout the discussion, the teacher invites students to share their ideas, listens to their perspectives, and poses questions to help students identify where the components of the problem appear in the representation. Toward the end of the session, when Briana still doesn't understand the connection between the problem and Ethan's representation, the teacher suggests that some mathematical ideas need time. The class will return to the discussion of different representations of the four problems, and Briana will have another chance to make sense of what Ethan did.