MP8, Grade 2

Task: **Related Problems**

Practice standard focus: MP8 Look for and express regularity in repeated reasoning. Mathematically proficient students at the elementary grades look for regularities as they solve multiple related problems, then identify and describe these regularities…. As students practice articulating their observations, they learn to communicate with greater precision (MP.6). As they explain why these generalizations must be true, they construct, critique, and compare arguments (MP3).

Content standard focus: 2.NBT.B.5 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 example, a second-grade class is given the following problems.

- On Saturday, 5 girls and 5 boys came to the swimming pool. How many children were there?

- On Sunday, 5 girls and 6 boys came to the swimming pool. How many children were there? How can you use your work on the first problem to help you with the second problem?

These problems are very easy for the students to solve individually. Everyone in the class knows that 5 + 5 = 10, and most know that 5 + 6 = 11. The teacher begins with easy numbers so that the students can pay attention to the *relationship between the two problems.*

Prior to the scene shown in the first video clip, students have worked alone and in small groups to think about the relationship between the problems and to write out their ideas. The clip begins as the students gather for whole-class discussion.

Video: Related Problems, Part 1 (Grade 2)[1] http://vimeo.com/66200697

[1]Unpublished video from the project, *Using Routines as an Instructional Tool for Developing Elementary Students' Conceptions of Proof*.

In sessions following the first video clip, students explore more examples of what happens when 1 is added to one of the addends in an addition expression, and then they work to articulate a conjecture. Later, they explore what happens when any amount is added to an addend. In the next clip, the teacher helps students articulate their conjecture again, and then gives them a new challenge.

Video: Related Problems, Part 2 (Grade 2)[2] http://vimeo.com/66217440

Commentary

In these two video segments, a second grade class is shown to be enacting Mathematics Practice Standard #8. In part 1, the teacher has given the class a pair of problems that illustrates increasing an addend by 1. By posing the question, "How can you use your work on the first problem to help you with the second problem?" the teacher is encouraging his students to learn to look for regularity. In the whole group discussion, the teacher uses students' thinking to highlight the relationship in words, in equations, and in diagrams.

The relationship between the two problems presented in part 1 may be seen as an application of the associative property of addition:

$$5 + 6 = 5 + (5 + 1) = (5 + 5) + 1 = 11.$$

However, examination of one case does not bring students to a general claim. As the class continues this line of exploration in subsequent lessons, they have opportunities to see the same relationship with other pairs of addition expressions. That is, they notice that they can apply the same reasoning to different pairs of problems. Then they work to express the regularity they noticed. The second graders state their generalization as follows: "If you have any addends, and you change an addend by 1, the sum will change by 1."

The lesson sequence continues with investigation of a broader claim. After considering what happens when 1 is added to an addend, the students now encounter problem pairs in which other amounts are added to one of the addends. Again, they notice regularity as they compare problems and work as a class to express it. In part 2, we hear the students'

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conjecture: “If you have any addends, and you change an addend by any amount, the sum will change by that amount.”

At the end of part 2, the teacher introduces the next task: to use representations of addition to demonstrate *why* this generalization *must* be true. Thus, once their conjecture has been articulated, students are challenged to engage in MP3: *Construct viable arguments and critique the reasoning of others*.