Firefighters to the rescue

The Falcon class at the River School in Washington, D.C., shared its solutions to the Firefighters to the Rescue problem from the September 2012 issue of Teaching Children Mathematics. The River School is inclusive, with best practices in early childhood and oral deaf education. This inclusive model offers opportunities to maximize early learning for all children in the context of flexible and naturally occurring interactions. Marie Wright’s, Sharlene Wilson Ottley’s, and Ashley Steehler’s third graders constitute the Falcon class.

Young number detectives
Mathematicians in the Falcon class are called number detectives. Each student has an agent name and attends spy school every day. This approach supports a rich language environment and many problem-solving opportunities. The teachers presented the Firefighters to the Rescue problem to the third graders as follows:

Today in agent school, we are going to solve a problem about fire trucks. For your mission, you will discover all the different ways that firefighters can go on the fire trucks. The firefighters have asked you to follow several guidelines.

The teachers explained the problem to the agents and shared the guidelines from the problem. They furnished each student with a Problem Solvers activity sheet, drawing paper, teacher-created math graphic organizers, dry erase boards and markers, and various manipulatives. In Wright’s classroom, students were asked to share what manipulatives and tools they thought they would need to solve the problem.

Jack: I know! I can use counters. I think the problem is asking how many for each truck.
Leah: My partner wants to build the trucks. I want to use cubes for the firefighters. What should we do?
Anna: Me and my partner are definitely using Unifix® cubes. We can actually make the trucks that way.
Lila: I think we should use little cubes and mark each kind of truck. Do you think that would work?
Emma: I think using the white board is the best because you can make each truck and then just erase and you can just keep drawing.

From listening to these discussions, the teachers knew that their third graders had a strong understanding of the mathematical tools in the classroom as well as how to best use these manipulatives when problem solving.

Beginning the problem
The teachers instructed, “We want to see you working cooperatively with your partner and explaining why you think your solution works. Please record your strategies in your number detective notebooks.”

Before having students separate into pairs, Wright began by asking them to visually show the minimum number of firefighters allowed on each truck, followed by the maximum. These two vocabulary terms required clarification, and by building background knowledge of the terms, the children had greater success and confidence when approaching the problem.

“Is this right, Mrs. Wright? I tried to put two little cubes for each one. The minimum is the littlest, right?” asked Ella. “Like it needs to have only two because it’s the littlest number.”

Students worked with their agent partners to solve the problem. Each child was required to collect and record information and answers on his or her respective activity sheet.

Combinations of firefighters
The children excitedly began the experiment; each one created a unique fire truck design. Following are some of Wright, Ottley, and Steehler’s anecdotal notes of students’ comments.

“I think this is like adding. You can start small and then build it bigger and keep going,” described Kelsey. She put two Unifix cubes, representing firefighters, on each truck and then added cubes until she had twelve firefighters altogether. She checked the total number of firefighters on each truck to be sure she did not go over the maximum number the truck held.

“Look at what we did!” exclaimed Emma. “We figured out that you can move some of the same numbers around and it will still work. Like if you put five cubes on the air truck, you can move them to make five on the ladder truck on the next turn. You just can’t go over the maximum for each truck.”

The partner teams worked well, although several partners challenged their partner’s thinking: “I just don’t agree with you. I think the minimum is just as important,” Patricia said to her partner. “Plus, think about the maximum. You keep going over the maximum of five on the rescue. Remember? That truck can only hold five! I think you keep going over.”

The problem challenged one pair, and this lesson proved to be practice in not only problem solving, patterns, and sum combinations but also teamwork. To engage her partner, Tamar asked, “How about we do both our ideas? Do you think that would work? Once we try both, we can decide together.”

After forty-five minutes of problem solving, the children presented their strategies and answers to their peers in a whole-group setting.

Students’ mathematical connections
The teachers found that many of the students used their knowledge of addends for sums of...
8, 6, and 5 to determine their answers. The problem challenged the Falcon class agents in a number of ways, particularly in realizing that more than one correct answer was possible. The lesson gave the class a strong introduction to dealing with constraints in problems.

The teachers were excited to see students discussing the relationships with numbers with one another in mathematical terms. They counted, recorded data, skip-counted, practiced their understanding of addition, and combined their strategies with their partners. The problem enabled Wright, Ottley, and Steehler to assess students’ abilities to justify how they identified, described, represented, and extended number patterns. The children explored patterns relating to the number of firefighters on each truck when there were twelve firefighters and when Captain John joined the crew. This activity presented a distinctive opportunity to work on finding three addends for sums of 12 and 13 and the relationships among them. Wright explains,

Students did a fantastic job of reasoning and discussing their strategies. We felt this was due to their lengthy discussion about their knowledge of patterns with addends and our preteaching the vocabulary through visuals. Many of the students made strong mathematical connections after listening to their peers’ ideas and were successful in finding solutions to the problems. Typically, we find our class discussions to be one of the most enlightening parts of our lessons for many of our students.

The Firefighters to the Rescue problem prompted students to engage in Common Core Standards for Mathematical Practice, such as making sense of the problem, participating in viable discussions and justifications, using reasoning skills, using mathematical tools strategically, and applying structures in mathematics. These agents had success finding solutions using various approaches and enjoyed solving the firefighters’ dilemma.

Marie Wright, mwright@riverschool.net, teaches third grade at The River School in Washington, D.C. She also works as the curriculum and learning specialist and enjoys teaching academics through hands-on, thematic curriculum. Edited by Jane Wilburne,