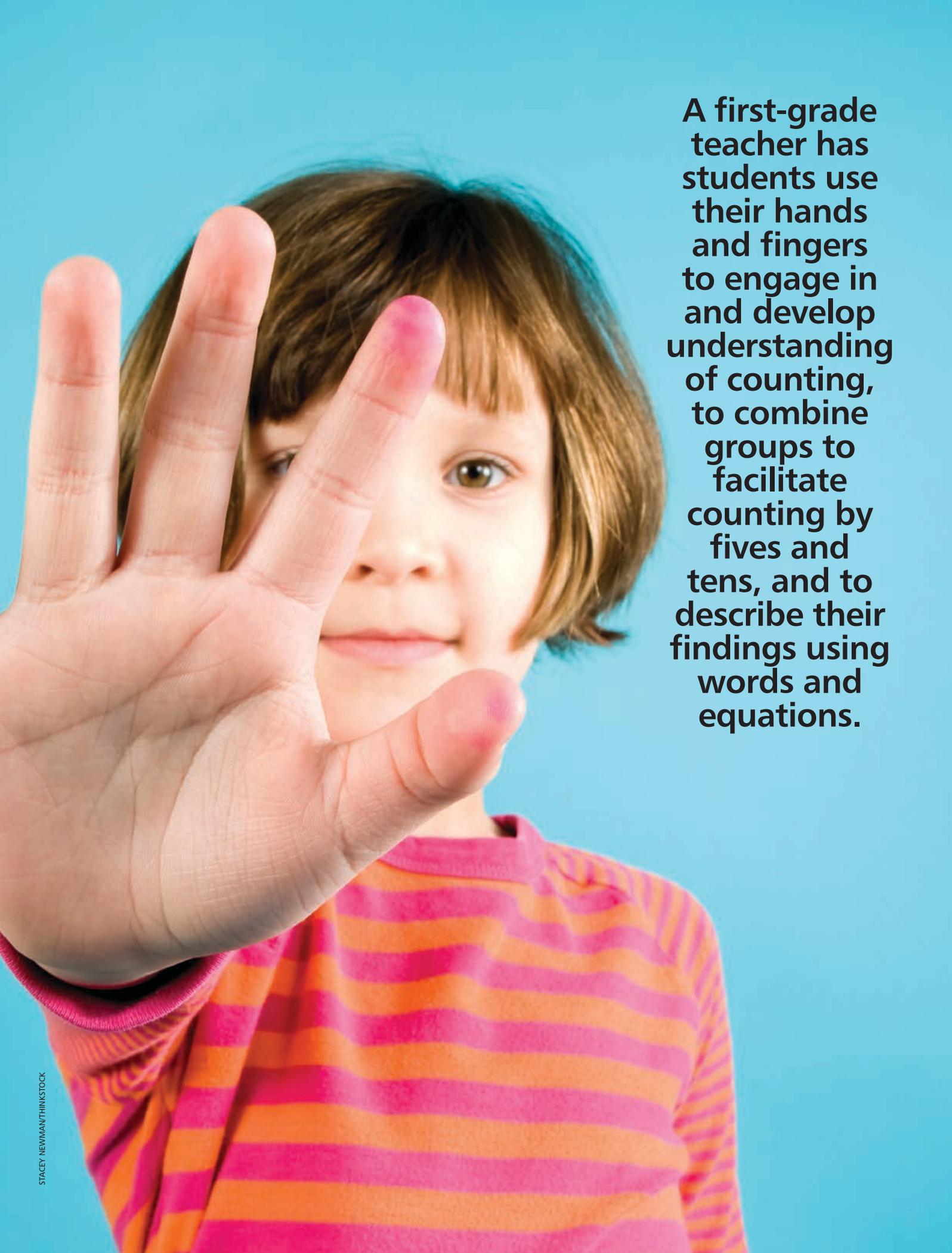


High Five for Mathematics



Susan Looney and Kristen Carr

It is time for math in Kristen Carr's first-grade classroom. Students excitedly gather on the rug to determine the number of paper fingers that are displayed on the board today (see **fig. 1**). The goal of the activity is to use the visual model of fingers as a representation and model for base ten. The model proves to be powerful for helping students understand multiple mathematical concepts and discuss their thinking.

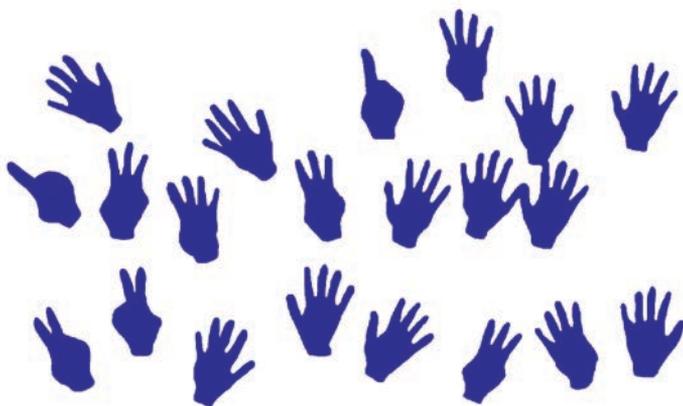


A first-grade teacher has students use their hands and fingers to engage in and develop understanding of counting, to combine groups to facilitate counting by fives and tens, and to describe their findings using words and equations.



FIGURE 1

For a simple activity that never seems repetitive to first graders, use a visual model of fingers as a representation and a model for counting in base ten. To show amounts less than five fingers on a hand, fold back fingers into typical finger patterns showing one, two, three, or four fingers. Show ten fingers with a left and a right hand combined and joined at the thumb.



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FIGURE 2

Looking for tens that are already composed, the first student pulled aside a joined ten and then arranged four more groups of ten, sliding the cutouts into stacks as she explained her thinking.



Setting up the routine

The finger-counting routine evolved when a classroom teacher and her math coach collaborated as they considered a base-ten model that would be appropriate and accessible to young students. All the students had been working on using fingers to recognize representations of amounts, so this finger-counting routine was particularly appealing and successful. Combining fingers to access larger numbers was a logical next step. This teacher-coach team decided to use cutouts of hands to generate larger numbers and opportunities to compose tens. They determined that the routine would take place on a rug where discussing strategies is commonplace and children are comfortable sharing and explaining their thinking. Initially, the representations of fingers displayed on the board represented smaller amounts and easily composed tens, but the representations evolved and increased in complexity throughout the year. By using this activity, all learners engaged at their own level of understanding. Whether they subitized amounts less than five by looking at the fingers, composed combinations of ten by combining fingers, or added on tens to find the total, everyone participated and learned.

Classroom excerpt

Carr begins by asking, “Hmm. . . . How many fingers do we have on the board today? Is there a way to organize them that makes them easy to count? Who has an idea to get us started?”

Enthusiasm is immediately evident in the classroom. Students point into the air, whisper to one another, and subvocalize their counting. Several students have an opportunity to come to the front of the room and explain their thinking as the class works collaboratively to find out how many fingers are on the board.

The first student looks for tens that are already composed, pulling aside one full (joined) ten and then composing four other groups of ten, using five and five, all the while talking about what she is doing. She slides the cutouts over and into a stack of tens and then explains her thinking: “I found one ten, and

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then I looked for pairs of fives to make more tens. I found five tens. I know five plus five is ten, and I know how to count by tens. I counted ten, twenty, thirty, forty, fifty." [Circling the five sets of ten, she writes 50.] (See fig. 2.)

From this point forward, students will need to look for alternative compositions of ten. The next student uses a combination of four, one, three, and two fingers and explains that he has made two fives, which together make ten. The teacher then prompts him to label an equation to match his thinking (see fig. 3). The process continues until the class is left with the challenge of combining two fours, one three, and a one, which cannot be made into a whole ten.

Another student speaks up: "I looked for doubles first, and I knew four plus four equals eight. Then I knew eight plus one equals nine. So, then I had to do nine plus three, which gives me a ten and two extras, which is twelve." (See fig. 4.)

Finally, students are asked to combine each partial total to compose the overall total number of fingers on the board. A child explains his thinking in working to combine multiples of ten to determine the total: "I took the fifty and added one ten to get sixty. Then I added one more ten, which is seventy, and one more ten, which is eighty. Then I knew that twelve had a ten hiding in it with two extras, so I added seventy plus ten is eighty, and eighty plus two is eighty-two." (See fig. 5.)

The mathematics involved

Subitizing

From the moment the finger images are placed on the board, students are subitizing. They are noticing amounts of five or fewer fingers as recognizable quantities without counting each and every finger. This skill is foundational to the development of cardinal understanding of numbers (Klein and Starkey 1988). Students should be shown pictures of numbers that encourage conceptual subitizing (Clements 1999, p. 403). When students pull out the fives or look for fours and ones, they are not counting in one-to-one correspondence of fingers but instead are subitizing the amounts. Sliding hand images aside on the board gives students a powerful visual model for recognizing fives and tens. This is then connected to the counting

FIGURE 3

This child explained his thinking and used equations to keep track of his steps.

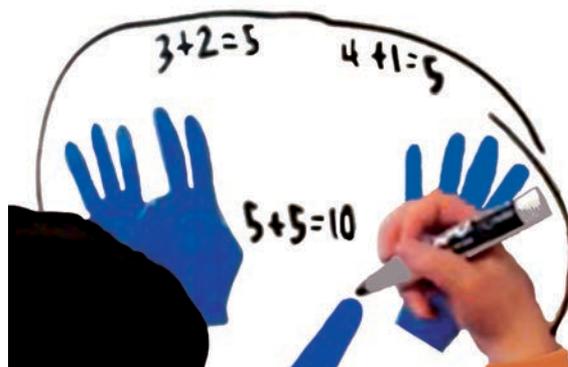


FIGURE 4

Two fours, a one, and a three cannot be made into a whole ten.

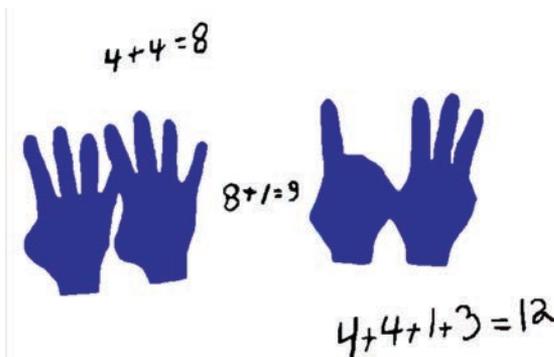
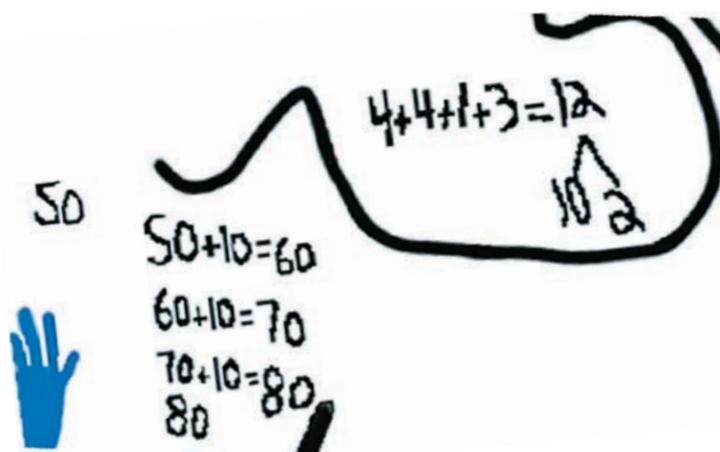


FIGURE 5

In response to being asked to combine each partial total to compose the overall total number of fingers on the board, the student who drew this combined multiples of ten to determine the total.





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A teacher and a coach collaborated to develop the strategy of using fingers as a logical next step for student understanding of base ten.

sequence of counting by tens. A written record of the total helps students connect the image to the written quantity. Engagement with the task at this level allows multiple opportunities to work with the counting and cardinality standards (K.CC.1, 2, 3, 4, 5) from the Common Core State Standards for Mathematics (CCSSM) (CCSSI 2010).

Composing numbers

Students apply this ability to recognize small amounts to compose larger amounts—in this case, the quest for tens. At this level of engagement, students are working on various standards from the number and operations domain of CCSSM: K.OA.1, 3, 4, 5 and 1.OA.3, 5, 6, 7 (CCSSI 2010). Combining smaller amounts to make tens is a powerful strategy in making sense of basic number combinations.

Number relationships provide the foundation for strategies that help students remember basic facts. For example, knowing how numbers are related to five and ten helps students master facts such as $\dots 8 + 6$ (since 8 is 2 away from 10, take 2 from 6 to make $10 + 4 = 14$). (Van de Walle and Lovin 2006, p. 94)

Children in China and other East Asian countries learn to compose and decompose numbers at a young age. This is key to their

understanding of mathematics that comes later, particularly addition and subtraction (Ma 1999, pp. 7–12). The inclusion of a written record of the count reinforces an understanding of the concept of addition to find total quantity. As children work together to compose tens and explain their thinking, everyone in the class has the benefit of hearing strategies.

When left with the task of counting twelve fingers, students are allowed the opportunity to explore larger number combinations using what they know about amounts less than ten. In this example, the student uses a doubles fact as well as building to tens and extras to solve $9 + 3$ as $4 + 4 + 1 + 3$. The student describes the answer as “ten and two extras, which is twelve.” The ability to decompose numbers into tens and extras is the beginning of place-value understanding.

Base-ten understanding

This activity provides a powerful model for understanding place value as students construct meaning for themselves by using the fingers to represent groups of tens. The activity engages students at this level with the number and operations in base-ten domain from CCSSM (CCSSI 2010). Basic understanding of place value involves building relationships and making connections between key ideas—for example, quantifying sets of objects in groups

of ten and treating the groups as single units (Steffe and Cobb 1988; Fuson 1990). According to the National Research Council publication *Adding It Up*, the materials should—

help them think about how to combine quantities and eventually how this process connects with written procedure (NRC 2001, p. 198)

Finding the total number of eighty-two fingers allows students to combine multiple tens. Students begin counting with fifty and then add on ten at a time until reaching eighty. They then add on two more to reach eighty-two. They are reinforcing the connection of the counting sequence with the number of fingers on the board. In addition, they connect counting on by tens with adding tens.

A powerful opportunity

Effective routines can be used to exemplify CCSSM goals and maximize learning opportunities. This seemingly simple routine proved to be a powerful opportunity for mathematical discourse and the development of multiple mathematical concepts, allowing all students to participate at their own level of understanding. The routine does not become routine, as children are constantly challenged.

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