

## C H A P T E R

# 6

## Measuring volume: Structuring boxes

**CASE 25** Making, comparing, and packing boxes

*Terry, Grade 1, April*

**CASE 26** Acorns and tiles

*Lydia, Grade 3, September*

**CASE 27** The color-cube sandwich

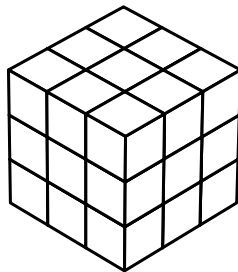
*Lydia, Grade 3, May*

**CASE 28** How many cubes fill the box?

*Rita Lucia, Grade 5, February*

**H**ow many cubic units constitute the volume of this box? If you can look at it only from the outside, how can you tell? What must we understand about the box in order to reason this out?

In chapter 4, we considered the challenge children face in learning to visualize a rectangular array—to recognize rows and columns and their coordination in a rectangle. Seeing this structure is key to keeping track of or calculating the number of squares used to cover a rectangular region, or in other words, finding the area of a rectangle.



JOHN: They both have six faces.

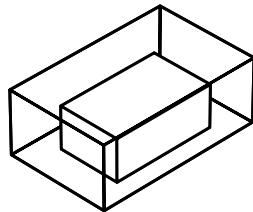
RHEA: One of them, the top opens. The other is all taped up.

TEACHER: I noticed that you put one box inside the other one. How many boxes do you think will fit inside the bigger box?

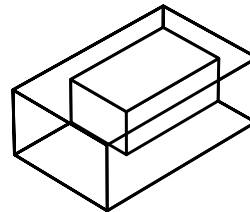
40

Rhea picked up the smaller box that was nested inside, placed it back down in the center of the larger box and said, "One!"

John agreed, pulling the box closer to himself. "Yeah, one."



One smaller box fits inside.



Rhea moves the box over.

I was curious about their responses. Certainly the smaller box easily fit inside the larger one, but that there was a lot of space left over. Might the children wonder about this extra space? I paused for a moment to think of a question that might encourage them to give more thought to the space inside the larger box. Finally I asked, "Do you think there might be more?"

45

JOHN: No.

50

RHEA: Wait, if you move this over, maybe we can fit another one in.

She moved the smaller box so that one of its corners fit into a corner of the larger box.

As Rhea worked with the boxes, the larger one was resting with a  $5 \times 8$  face flat on the table. The smaller box was resting on a  $3 \times 5$  face. Upon pushing the smaller box into the corner, Rhea seemed to notice something else about the boxes. She said, "No, I can flip this up, and maybe there will be more." So saying, she changed the position of the smaller box. Now it was resting on a  $2 \times 5$  face, still pushed into a corner of the larger box.

55