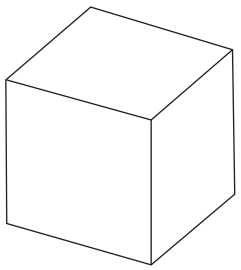
CHAPTER

1

Describing 2-D and 3-D objects



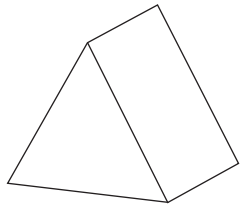
Ask a group of fourth-grade students to describe a geometric shape, such as a cube, and you will hear a variety of ideas. One may tell you, "It looks like a box." Another may notice, "It has six sides and eight points." Yet another may describe it as "a 3-D square." These comments are typical of the ways children describe geometric shapes. They might refer to everyday objects, they might enumerate a list of attributes or components of the shape, or they might comment on the three-dimensional aspect of the object. Sometimes, they demonstrate the way the component parts fit together to make a coherent whole.

Children bring their personal experience with real-world objects to the study of geometric shape. They describe everyday objects by calling upon a variety of attributes, including size, color, shape, orientation, and texture. As children begin to develop a sense of geometric shape, they need to determine which aspects of the object to ignore and which to consider. For instance, a chalkboard eraser and a box of tissues are both rectangular, even though one might be soft and black while the other might be hard and blue.

CASE 6
Observations of geometric solids
Paul
Grade 4, April

While they differ in these and other aspects, geometrically the two shapes can both be seen as examples of rectangular prisms.

In addition to noting which attributes of an object carry geometric meaning, children must also develop the ability to note the attributes of a shape and to coordinate those components into a coherent whole at the same time. This is not an easy task. Consider the reaction of some kindergarten and first-grade children who were asked to describe a triangular prism: "It is a rectangle . . . It is a triangle . . . How can it be a triangle and a rectangle?" They could see both of these shapes, but were not able to reconcile how a single object could contain both. They are just beginning to learn how to coordinate features of shape into a single 3-D object.



You will encounter these examples of student thinking as you read this chapter. Through the cases, you will visit six classrooms that range from kindergarten to fourth grade, witnessing the ways children describe the shape of geometric objects. The nature of their descriptions provides a window into their thinking about shape. As you read the cases, take note of the following:

- Do the children draw upon their experience with everyday objects or call upon geometric terms?
- Are they thinking of the shape as a whole, or are they focused on a single component of the object?
- Do they pay attention to the orientation of the shape?
- Do they distinguish between objects that are 2-D and those that are 3-D?
- Are they aware that some attributes of the object carry significant mathematical meaning and some do not?

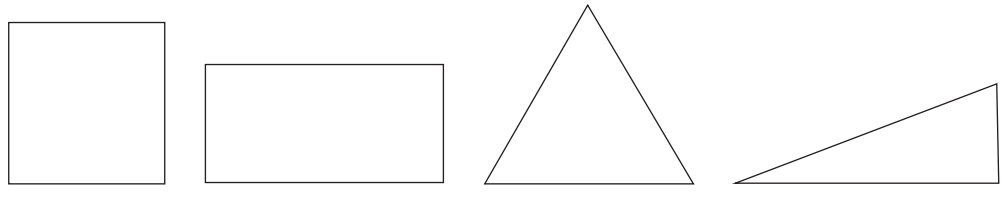
In general, consider what the children's responses might indicate about the way they think about geometric shape.

case 1

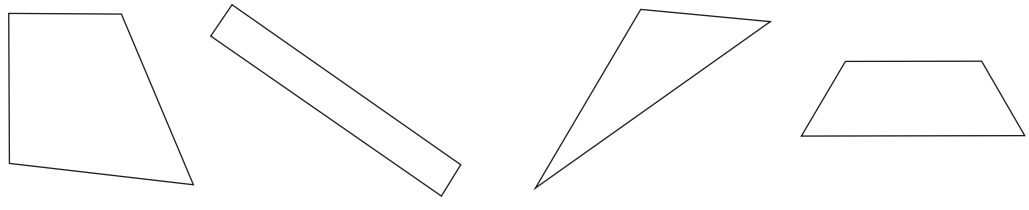
Shapes all around us

Evelyn
KINDERGARTEN, NOVEMBER

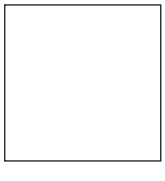
During a conversation with a third-grade teacher, I became fascinated by her account of some lessons she had done using a set of cards with 2-D drawings. I was wondering how my kindergarten children would react to these shapes. At my request, the third-grade teacher lent me a set of shape cards. Each card in the deck had a different 2-D shape drawn on it. Some of the shapes were quite common: a square, a rectangle, and some familiar-looking triangles.



Other cards had shapes that I expected my kindergartners would find unusual. These included a variety of trapezoids and some familiar shapes that I thought would look odd to my children because they were not oriented along the horizontal. I was curious to find out what my students would make of these.



I sat with one group of four students and turned the cards over one at a time. For each card, I asked the children to tell me what the shape was and what they knew about it. The first shape card showed a familiar square.



SANDY: It is a square. It has four sides. They made that language and that's how we speak.

I found it fascinating that she said it was called a "square" because somebody decided to name it that.

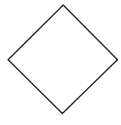
JULY: It has four sides. It has four corners.

MITCH: It's sort of, you put two skinny rectangles together; it makes one.

COTY: Square, because if you put two triangles together it makes one.

I was amazed at the variety of their responses. Mitch was describing components of the shape; Coty was visualizing other shapes making this one. We had not done work as a class on these ideas, so it was clear to me that the children were developing these thoughts on their own.

I continued showing the shape cards. The next card had a small square oriented in a diamond position.

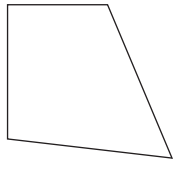


JULY: Diamond. It is like having two triangles and two skinny rectangles.

MITCH: Diamond. If you turn this other one like this [*he takes the square we had just described and rotates it so it is tilted*], it's the same. I mean, the same, but it's a bigger one.

He was comparing the two squares. Even though one was rotated, he noted that both are the same shape. He also commented on their size. The fact that he needed to turn one to make it look like the other didn't make it a different shape for him. He called them both squares.

I decided to show shapes that were likely to be less familiar to them. First, a trapezoid. Their body language changed drastically. Previously, the children were raising their hands and jumping up and down, eager to respond. This time they all sat for a few moments, just staring at the shape.

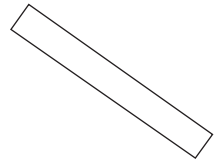


MITCH: It looks like a crystal. I don't know the name. It looks like a kite.

COTY: Kind of a boot shape. I've seen it on the computer. If you put it like this [*he turns the card a bit*], it looks a little like a diamond.

SANDY: It looks like a kite. If you put a line cross on it, it would be a kite.

Next I showed them a familiar shape, a rectangle, oriented in an unfamiliar position.



JULY: It's a line. If you put another cross on it, It would be an x.

SANDY: It looks like a noodle. You could put it into your mouth and slurp it up!

COTY: It looks like a big piece of Chinese rice. It looks like something you floss your teeth with.

MITCH: It's a skinny rectangle. A really fat noodle.

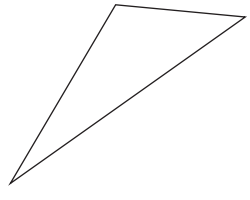
TEACHER: Why is it called that?

JULY: It's a shape of a line.

SANDY: 'Cause it does, just 'cause it does. I ate noodles like that.

COTY: Because there are the points and it's white.

We continued with this triangle.



JULY: It looks like a sail of a boat, or a wing of an airplane.

MITCH: It's a crooked wing of an airplane.

COTY: It looks like a hat and sort of a triangle.

TEACHER: Why is it called that?

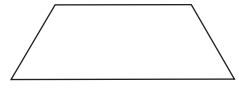
SANDY: It really looks like that.

JULY: I It's a sort of triangle that makes that shape.

COTY: It has a point and three corners.

MITCH: A wing is shaped like that. It's leaning sideways.

Finally I showed them this trapezoid.



MITCH: It's a dog food bowl.

SANDY: It looks like a rug, a flying rug. It looks like a shape, but I don't know what it would be.

As I thought about their responses to these shape cards, I realized that they often made connections between the shapes and objects from their real-world experience. Sometimes they had mathematical language to use. For example, they could identify some shapes as squares or triangles or rectangles. Other times, the children were able to relate to a shape only by connecting it to an object in their life, like a noodle or a piece of dental floss. They also used everyday words, like point or corner, to express their geometric ideas. It will be interesting to see how their ideas and their vocabulary develop as we continue to work with shapes this year.

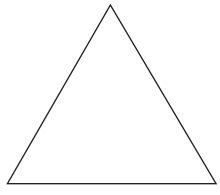
case 2

Falling triangles

Molly

GRADES 1 AND 2, SEPTEMBER

It's early in the year, and I am doing a lesson in geometry. Today, I asked them to look at an equilateral triangle. "Who can tell me what you know about this shape?"



HOLLY: It's a triangle.

LIANA: It has three points.

TREVOR: It's a triangle.

ALEX: It has three straight lines.

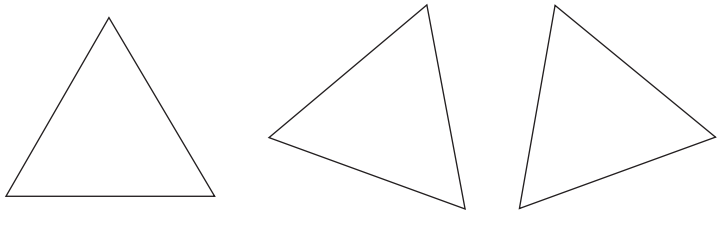
NIKKI: It has like a corner that has a little short top. It has a little corner. [*She comes up to the screen so she can point.*] The corner is small, and it gets bigger and bigger. [*She runs a finger down each side, from the vertex of the top angle, showing us how they get farther apart.*]

LIANA: It has three faces. [*When asked to show us, she points to the three sides.*]

MELISSA: It has three flat sides and three corners.

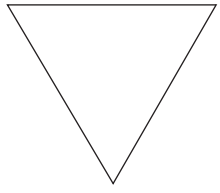
STEVEN: It has three points on each side.

Alex mentioned that if you turn the triangle, the point is crooked on top. As he spoke, he tilted the triangle to the right and left.



I turned it back so one side was horizontal, and Micah said that, that way it looked just regular. Other children said that it looked perfect the original way, but decided it didn't look right when Alex moved it.

I turned the triangle so that it pointed down.



NIKKI: It looks like it's upside-down because the point is supposed to be up there and it's supposed to come down, and instead the point is down there and it swings around and goes down and it's sort of looking backwards from here.

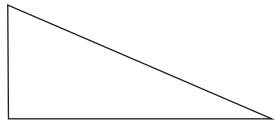
As the children talked, I saw there was general agreement about Nikki's statement. What was it that made this other orientation not correct for them? Was it that they haven't been exposed to other triangle shapes? As I reflect, I think it is more than that. Besides, this wasn't a discussion of what is or isn't a triangle. This was about why a regular triangle shape didn't look right when we changed its orientation.

I again asked why it wasn't right. Nikki repeated that the bottom was on the top and the top was on the bottom, but added that if you turn it a little, "it's a little falling to that way." Then Melissa chimed in.

MELISSA: I think that every way it's still right, but the card isn't. It's always the right way. If you're facing this way, it's the right way to you, and [*she turns her body and turns the card*] if you're facing this way, it's the right way to you.

She was saying that you could always look at it some way and see the bottom flat.

So now I was beginning to wonder, was this the same old discussion about the only "real" triangle being an equilateral triangle sitting on its base? I wanted to find out. I decided to have the class revisit a shape that we had looked at yesterday. It was a right triangle with sides of three different lengths. I asked if there was a right way and a "less right" way for that triangle to sit. There were yeses and nos, and then a lot of spontaneous comments.



ALEX: It kind of looks like half a square?

TEACHER: It looks like half a square. Is there a right way and a not-right way for it to sit?

ALEX: It can sit any way.

TEACHER: So how come the first one can only sit this way, but this one can sit any way?

ALEX: No, the other one can sit any way, too.

TEACHER: It just doesn't look right? It can sit any way, it just doesn't look right?

ALEX: Yeah.

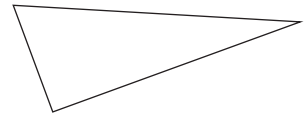
TEACHER: Holly?

HOLLY: If it were that way, it couldn't sit.

TEACHER: If it were this way, it couldn't sit? What do you mean?

Holly said that it wouldn't feel right, and Alex said that it could sit only three ways, but not on the point. It could only sit on the three flat sides. I rotated the image and showed it "sitting on each flat side" and Alex said that it could sit on those three flat sides and that was what he was trying to tell me.

TEACHER: So I have a question about this. [*The image s now sitting on a vertex*.] When you say it can't sit on a point, do you mean that it doesn't feel right, that it looks weird, or do you mean something else by that? What do you mean when you say it can't sit that way?



DOMINIC: If you flip it over, it will be the right way. [*He comes up to show me, flipping the triangle so that it sits on a flat side*.]

TEACHER: OK. So Liana, what do you mean when you say it can't sit on a point?

LIANA: It can't sit on a point, because . . . can I go show you something? [*She goes to get a green pattern block*.] If you put this on a flat surface, say like here [*she tries to stand the block on one of the vertices*], it'll tip over. It won't stand up. [*She sets it on one side*.] Right here it will stand up, [*turns it to another side*] right here it will stand up, [*turns it to the third side*] and right here it will stand up.

TEACHER: So what Liana said is that if we look at this three-dimensional object and try to stand it on a point, it won't stand.

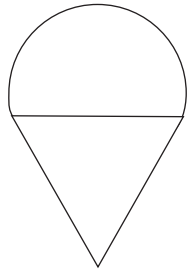
LIANA: It'll just flip over.

TEACHER: So you're looking at this picture and you're thinking about what would happen if it were a thing.

Melissa gave us another example by getting a block from the block area—a right isosceles triangular prism—and showing us that this block also wouldn't balance on an edge at the vertex of the face of the triangle.

I then drew an ice-cream cone with a triangle for the cone. I asked if the equilateral triangle could be an ice-cream cone. I heard yeses and a few who said, "No, it's not tall enough." So I asked if our original triangle shape could be the right way now (as an ice-cream cone), and

the answer was yes. In fact, Steven added that if I turned it over (put it on a flat side), the ice cream would fall out.



Now that this lesson is over, I am reflecting on their comments. Is there something about how children develop these mental pictures that is determined by how three-dimensional objects operate? Maybe a triangle feels "more right" sitting one way because in the physical world it can, in fact, only sit one way. Have my students not yet abstracted these 2-D shapes past their three-dimensional counterparts? Or because the equilateral triangle is the most familiar, does that make the rest not "look right"? I know I'll explore this idea of moving between 2-D and 3-D further this year.

case 3

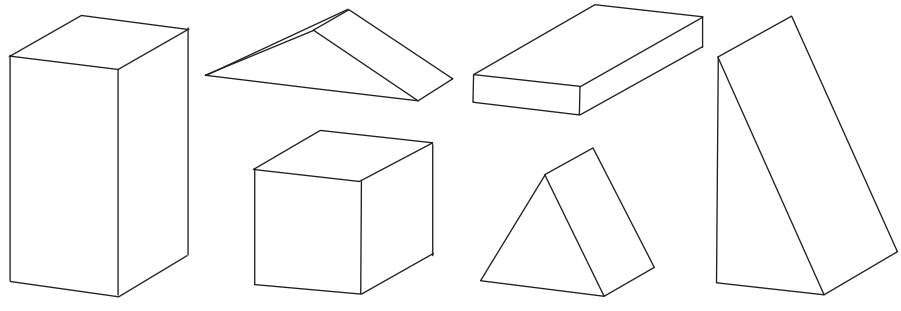
Describing geometric blocks

Rosemarie

GRADE 1, JANUARY

My first graders have been exploring a set of wooden blocks of various shapes. I had noticed during earlier work that they often spoke of the blocks in terms of things they know from their environment; for example, a triangular prism was often described as being "like a ramp." Now I had set up an activity designed to find out explicitly how they would describe the shapes of the blocks.

We started by gathering on the rug. I placed six pairs of blocks in the middle, and asked several children to find matching pairs so that we could make two sets of blocks that were exactly the same. After this was done, I asked a child to put one set in a brown bag. We left the other set on the rug where everyone could see them.



TEACHER: Each block on the floor has a matching block inside the bag. I'm going to ask someone to reach in the bag, pick a block without looking, and describe it—just by feel. Your job is to describe that block really well so that we can find the matching block on the rug, just from your description. For everyone else, your job is to listen carefully and look at the blocks on the rug to see which one fits the description we are hearing.

I then asked Isaac to pick one block inside the bag and describe it without taking it out or looking in the bag.

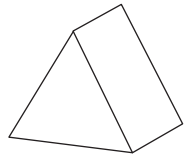
ISAAC: It has 3 sides. It has 3 points.

EMILY: There is nothing here that has 3 sides or 3 points.

I noticed that both Isaac and Emily were using 2-D terms usually associated with a triangle to describe this 3-D object. Isaac paused, felt the block again in the bag, and changed his description.

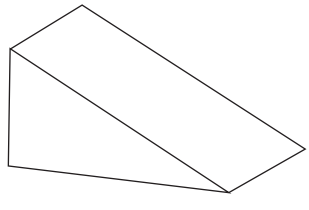
ISAAC: It has 5 sides. It has 6 points.

Emily pointed to one of the triangular prisms, and Isaac took the matching block out of the bag. At first, he was describing the block as if it were a triangle, a two-dimensional object. When Emily pointed out that no block matched what he said, Isaac corrected himself. Once Emily chose a block, everyone was satisfied. The other two triangular prisms also fit Isaac's description, but none of the children commented about that. Now it was Gita's turn.



GITA: It has 5 faces, 6 corners. Three of the faces are rectangles.

Gita was calling a "corner" what Isaac had called a "point" and what I know as a "vertex." Just like Isaac, she used a familiar word to express herself. Also just like Isaac, Gita gave a description that wasn't specific enough to pinpoint the particular block. Three blocks in the bag—the three triangular prisms—would all fit the description "5 faces, 6 corners, 3 rectangular faces," but none of the children seemed to notice this. Lakshmi pointed to one of the triangular prisms on the rug, and Gita showed them the block.



After a few more turns, I asked the class to think about what they had been doing.

TEACHER: Tell me what you find easy or hard in this activity.

MELANIE: When Sam said his block had 8 corners and 6 sides, it was confusing. There were two blocks like that. But it was easy when he said it had square sides.

TEACHER: When he said it had 8 corners and 6 sides, it could be any of three blocks: the cube, or the two rectangular prisms. What words did he use that helped you decide which block he was describing?

MELANIE: Sam said that it had squares on opposite sides and it was kind of long.

TEACHER: So you really need to listen to every part of the description before you pick a block.

EMILY: Some kids said that the block has 4 sides, but none of them have 4 sides.

Emily's comment reminded me that some children were describing the blocks as if they were two-dimensional, just as Isaac had. Although children are surrounded by 3-D objects in their environment, they often considered only one of the faces for their description. I wonder whether they just talk about the face that appears on the "front" of the block as they look at it, because they can't see what is on the sides or the back of the object all at the same time. Maybe that's why their initial descriptions are 2-D.

After our short discussion, I asked another child to choose a block in the bag by feel and describe it to us.

KJELD: It has 6 sides and 8 corners. It is kind of thick. The sides are kind of long.

TEACHER: [*I see that the terms "sides" and "corners" are becoming commonly used in this discussion. I wonder when I should begin to introduce the correct words.*] Is there anything else that you can tell us about it?

KJELD: Two sides are square.

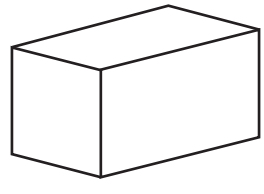
TEACHER: Who can remember Kjeld's descriptions for his block?

SAM: It has 6 sides and 8 corners. It is kind of thick. Two sides are square.

KJELD: There is one more thing that I said.

SAM: The sides are kind of long.

I noticed some children were pointing to the thin rectangular prism until Kjeld mentioned the 2 square sides. Chandra pointed out that it has to be the rectangular prism with two square faces.

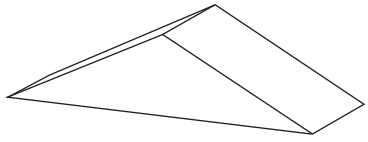


TEACHER: Now I am going to have you do this activity in small groups so that everyone has a chance to describe a block. All the materials you need are in bins on your table. There are six pairs of blocks in a bin. Put one of each pair in the bag.

While the children were doing the activity in small groups, I listened to some of their conversations.

TESSA: OK. It has 5 sides, 6 corners. None of the sides are parallel, and it's like a ramp going down, that's all.

Mitchell guessed the block, but Tessa wanted Kjeld to find the block she had described. Kjeld picked the wrong block. She asked Genya, but Genya picked a cube. So then she asked Mitchell, and he picked up this triangular prism:



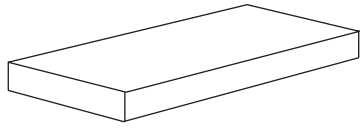
Then Mitchell had a turn to use the bag.

MITCHELL: It has 6 sides and 8 corners. It is kind of long.

TESSA: Is it skinny?

MITCHELL: Yes, it is.

Tessa picked the right block, the thin rectangular prism.



At first, the children tended to make their guesses before they heard all the descriptions. Being able to guess the block quickly seemed to be their focus rather than waiting for more descriptions to be sure they guessed the right block. As the children continued to do this activity, however, they became better at describing the properties of each block. They also began to ask questions if the description was not complete. I also noticed that the children narrowed their choices right away when a block was described as having 5 sides and 6 corners. They seemed to know that it could be any one of the triangular prisms, and they immediately excluded the rectangular prisms.

As I thought about the way the class worked today, I realized that the children were developing vocabulary to describe 3-D shapes. They also were able to identify 3-D objects by matching them to descriptions from their classmates. The ability to give accurate descriptions of the block from feeling it in the bag improved as the other children asked for more information. The children were very much aware of the differences between a triangular prism and a rectangular prism; I saw they noted the number of faces and vertices. By the end of the day, they also knew the difference between the description of a 2-D shape and a 3-D object. I was pleased to see that they were able to choose a 3-D object on the basis of a verbal description. There is more for them to learn—including the meaning of *face* and *vertex*—but this was a good beginning.

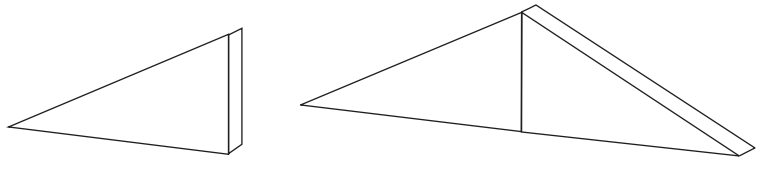
case 4

The shape of things

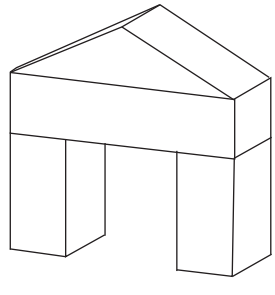
Bella

GRADE 1, OCTOBER

I have a first-grade inclusive class of eleven students. The children were working in groups to explore a set of wooden blocks of various shapes. Mark, Jerome, and Keitha worked together. I watched as Mark picked up a thin triangular prism and examined it very carefully. When I asked what shape he thought it was, Mark said it was a triangle, but it looked like a half of a hill. I asked him why he thought that. Mark placed the triangular solid on the floor to show how the longest side looked like one slope of a hill. He ran his finger up the side as he explained this; then he picked up another block, the same shape and size, and put the short sides together to create a larger triangle, which he identified as a hill. When I asked him what the new shape was, Mark had no trouble telling me that it was a "bigger" triangle.



Jerome built a structure of four blocks and said it was a gate. He explained that he could drive through the gate and demonstrated this by using another block as a car.



When I asked him what shapes he had used, he called them "rectangles and a triangle," pointing to each block as he named it. I asked him how many of each shape he used, and he said three rectangles and one triangle.

Shala caught my attention and I moved over to where her group was working. I asked her to tell me about the large, cumbersome structure that her group had built. She said that it was a house. Nolan chimed in that he thought that it was an apartment building. Shala added a triangular solid to the highest point of the structure, explaining that it was a flag. This surprised me, so I asked her what shape a flag was. She said "a triangle" and pointed out that it looked like our

classroom flag. In my mind's eye, I was thinking a flag was a rectangular shape. However, when I looked over to the classroom flag, I saw that it did make a triangular shape as it hung motionless. I listened for a while as Shala described the different block shapes. She had used quite a few cubes in her building, which she called "squares."

As I review what I saw and heard from the children, I am thinking of my next steps. What do I need to do to help them better understand the different shapes? I think about having them look at a specific block, perhaps a triangular block or a cube, to describe what they see.

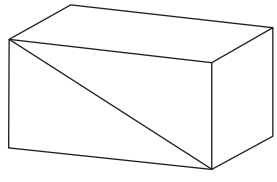
I also think I want them to compare a cube to a drawing of a square, or a block with triangles as faces to a drawing of a triangle. I wonder if this would help them to see any of the other features—like the "3-Dness" of the blocks—which I feel these first graders aren't noticing. They seem to compare the shapes to things that they see every day in their environment. It would be interesting to find out how they would describe a single block without using the environmental descriptors to help them. I'm not sure exactly what they are capable of, but it will be fun trying to find out.

case 5

How can it be a triangle *and* a rectangle?

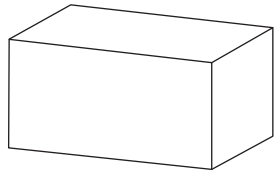
Alexandra
KINDERGARTEN AND GRADE 1, FEBRUARY

For the past three weeks, we have been using a set of geometric solids for geometry work. Students have had ample opportunity to handle the blocks; many built towers or other structures, and some combined blocks to create other shapes—for instance, joining two triangular prisms to make a rectangular prism.



As we began today's lesson, I held up a rectangular prism and kept turning it slowly for all to see.

TEACHER: What do you notice about this block?



CLAIRE: It is a rectangle.

SHANICE: It has a square on the end.

PORTIA: It has six sides.

MEREDITH: It has two long sides and two short sides.

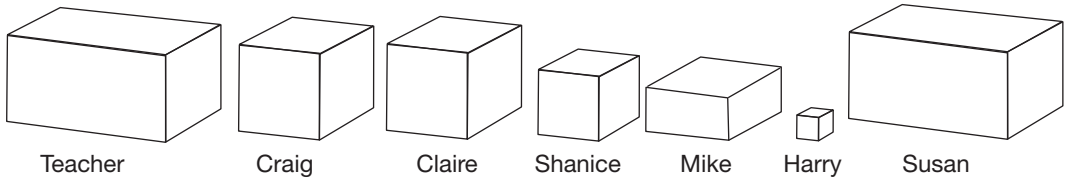
MIKE: It has corners on it, on the end.

JOSH: If you turn it the long way, it looks like my fridge at home.

CLAIRE: It looks like a box.

TEACHER:I I would like everyone to come up to the blocks bin and find a block that also looks like a box.

About half the class easily picked out a box-like block; for others it was difficult. All of them looked carefully as they made a choice, offering comments as they picked up and examined each block.



CRAIG: Mine is a square box.

CLAIRE: Mine is too. Two of mine equals yours [*she points to the teacher's block*].

TEACHER: Why do you think that, Claire?

CLAIRE: 'Cause mine is half of yours, so you need two!

SHANICE: Mine is the smaller one.

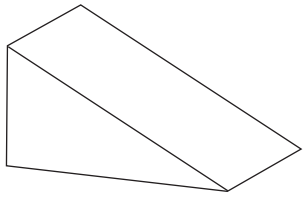
MIKE: Mine is the flat present.

HARRY: Mine is the smallest one of all.

SUSAN: Mine is the teacher's.

I was amazed to hear these comments. Claire was comparing the blocks, and her second comment about "half" left me speechless. She was seeing her block as part of mine as well as a unit of its own. The ease with which she described a half was impressive. After all agreed that their choices met the one expected criterion ("box-like"), they returned the blocks to the bin.

Then I picked out a triangular prism and asked the class to verbalize what they noticed about this block.



REBECCA: It is a triangle.

HARRY: It has six points.

CHRIS: It looks like a ramp.

PORTIA: This one has five sides.

SHANICE: It looks like a piece of cheese.

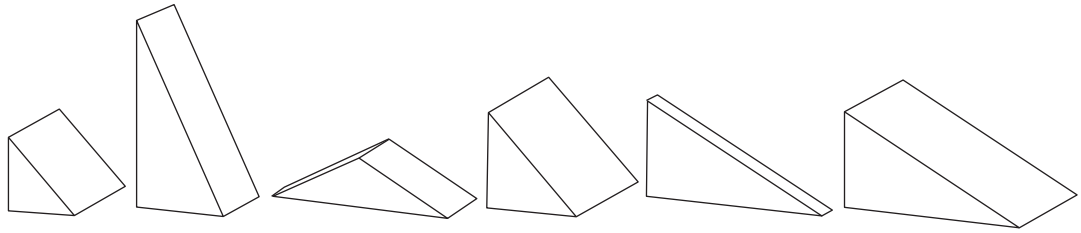
MIKE: It kinda looks like a piece of pizza.

MEREDITH: It is a rectangle too, right there on the bottom.

SHANICE: It has a square on it too, the end. It has a triangle, rectangle, and a square.

PORTIA: It has two rectangles and two triangles.

For their next choice, the students decided they would look for blocks with both rectangles and triangles. Again, about half the class located a block easily while others needed more time to handle them. These students would select a block from the bin, and then turn it slowly and carefully to examine each face. Several students needed to look at all five faces before making a yes-or-no determination. It was also evident that they viewed each face as "the whole thing" rather than as part of a whole. They could identify a triangular face and later a rectangular face on the same block, but they could not transfer these discoveries to the block as a whole. The idea of a triangular shape and a rectangular shape on one block was confusing. The question, "How can it be a triangle and a rectangle?" was heard more than once.



Claire held up her block so we could all see it and traced the different shapes with her finger as she named them. Portia did the same with her block. Shanice held her block in such a way that she showed us only one face at a time. She carefully stated the shape name ("rectangle" or "triangle") as she showed that face to the class. These demonstrations were not sufficient for everyone. It was evident that some students could "see" each face as a triangle or a rectangle, but once the block became a solid, that "seeing" was lost. I asked the children to continue describing their blocks.

SHANICE: Mine has skinny rectangles.

ROBIN: Mine has squares, not rectangles.

TEACHER: Why do you say that Robin?

ROBIN: 'Cause the ends are more square than rectangle, so it is square.

HARRY: Mine looks like pizza.

SUSAN: Mine is the same as the teacher's.

I followed up with a related activity that had students focus on the shapes of the faces of the blocks. I gave each student a work mat with six to eight 2-D shapes drawn on it. These served as "footprints" of the faces of the 3-D blocks. To play the footprint game, students worked in groups of six. Each student picked out a block, and then tried to see if it would fill an empty

"footprint" on his or her mat. If it wouldn't fill a footprint, the block was offered to others in the group or placed back in the bin.

I wondered if the work we did describing and examining the blocks would help the students play this game. For some, the effect was obvious; they were looking at all sides of the blocks to see if any of the five or six faces would fit. Others, however, still seemed to view the blocks as a single flat shape. They never turned the block to view other sides, and only flipped the block over to view the opposite side with my prompting.

Some children really made progress as they played. For example, I watched as Claire, Portia, Shanice, Craig, Robin, and Jason got started. They were all excited to play. As each student picked a block, the others scanned their mats to find a fit. They were working as a team; each student was helping to fill all six mats. Both Portia and Claire had a work mat with eight triangle outlines. At first they thought it would be impossible to find eight different triangles, so they were thrilled when they were able to fill their mats. Clearly these six were viewing the geometric solids as just that, 3-D pieces. The ease with which they handled the solids was amazing. All six could "see" all of the faces as possibilities for filling spaces. This was not the case for the students in the class who were focused on only one view. They have yet to learn that the blocks present different 2-D shapes on different faces.

Today's work was only the beginning. We will explore together the language that we use to describe the blocks. They already know words like *rectangle* and *square*. From their conversation today, I see we'll have to sort out what they mean by words like *side*, *face*, *corner*, and *edge*. There is a lot of geometry in their future.

case 6

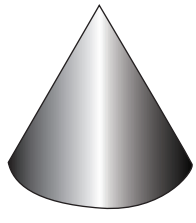
Observations of geometric solids

Paul

GRADE 4, APRIL

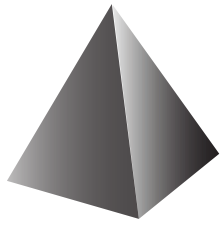
As an introduction to a geometry unit, I asked the question, "What is geometry?" About half the class conveyed something that related to shapes, but nothing (or very little) beyond that. With this information in mind, I was very curious about their intuitive responses to shapes. What geometric thinking do they bring with them from "everyday" life, I wondered.

I presented my fourth graders with a bag of geometric solids and asked the students to describe the different shapes to me. I wanted to see if they would describe them by using their experience with everyday objects, by using the geometric names such as cone or prism, or by referring to concepts such as faces, edges, and corners. At different points in the conversations, I gave them the geometric name for each solid. Following are some of the descriptions I heard.



Cone

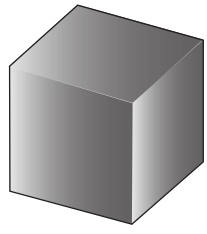
"A triangle with a flat bottom."
"A round triangle."
"A large circle with smaller and smaller circles on top until it reaches a point."
"Big to small circles."
"Like a loudspeaker."
"A cylinder, triangle, and circle in one."



Square pyramid

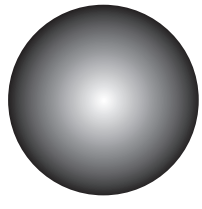
"A 3-D triangle."
"A cone, but square."

"The top of a house."
"Squares piled on top of each other, getting smaller and smaller."
"A beam of light."
"Flat sides, flat bottom, making a point."
"A cone is a pyramid's cousin."



Cube

"Looks like an ice cube."
"It's a box."
"It's a square."
"It has six sides and eight points."
"It's a 3-D square, that means that if you stick it flat on a wall, part of it will come off the wall."



Sphere

"A ball."
"A circle."
"Different-size circles piled up."

As I considered my students' responses, I was particularly interested in the way they moved back and forth between 2-D and 3-D aspects of the shape. They seemed able to view the 3-D shape as a whole. In particular, I thought that the view of a sphere as "different-size circles piled up" and the comment about the cube as "coming off the wall" were quite wonderful.