Creating One Million

Instead of finding one million objects, some classes have undertaken to create their own million. Students love the challenge, and this task can help them experience this large number in several dimensions. For instance, in *How Much Is a Million?,* David Schwartz offers a visual representation of the height of one million children standing on one another's shoulders and the volume of a bowl large enough to hold one million goldfish. Invite students to create their own visual representations of one million and explore the concepts of measurement, area and volume, and geometric proportions.

CREATING INVESTIGATION 1

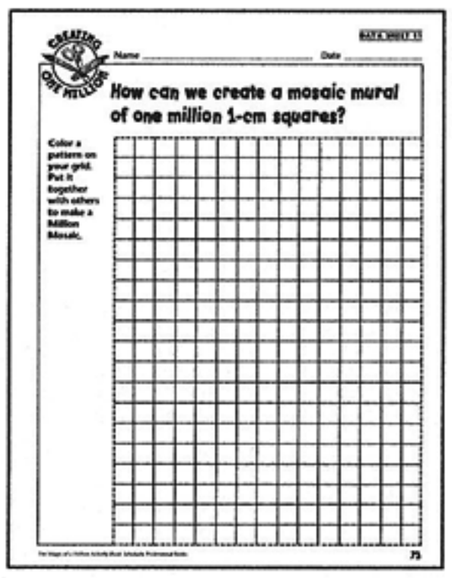
A Million Mosaic

BIG IDEA: How can we make a mosaic of one million 1-cm squares? What shapes can we create?

PROCESS SKILLS: counting, recording, using geometric shapes

What to Do

1. Show students a 1-cm square, and ask them if they think a million of the squares would be enough, just about right, or too many to cover your classroom chalkboard. Let students make predictions, encouraging them to suggest ways they could test and confirm them.
2. Copy and distribute Data Sheet 11 on page 73 and have students use the block of 300 1-cm squares to make closer approximations of how large an area one million 1-cm squares would cover. Discuss how to find out how many squares there are if each student in the class has one sheet of squares; then let students figure it out.
3. Have students cut out the block of 300 squares. Then invite them to color the squares in a colorful pattern of their own devising. Post the rectangles edge to edge so students can see how large an area is covered.
4. Invite students to figure out possible dimensions of a one-million-square array. During the next several weeks, let students color and post additional sheets of squares; or invite other classes in the school to participate in the project. You may want to move the project to a hallway or the cafeteria or gym wall. The goal—to create a mosaic of one million squares.



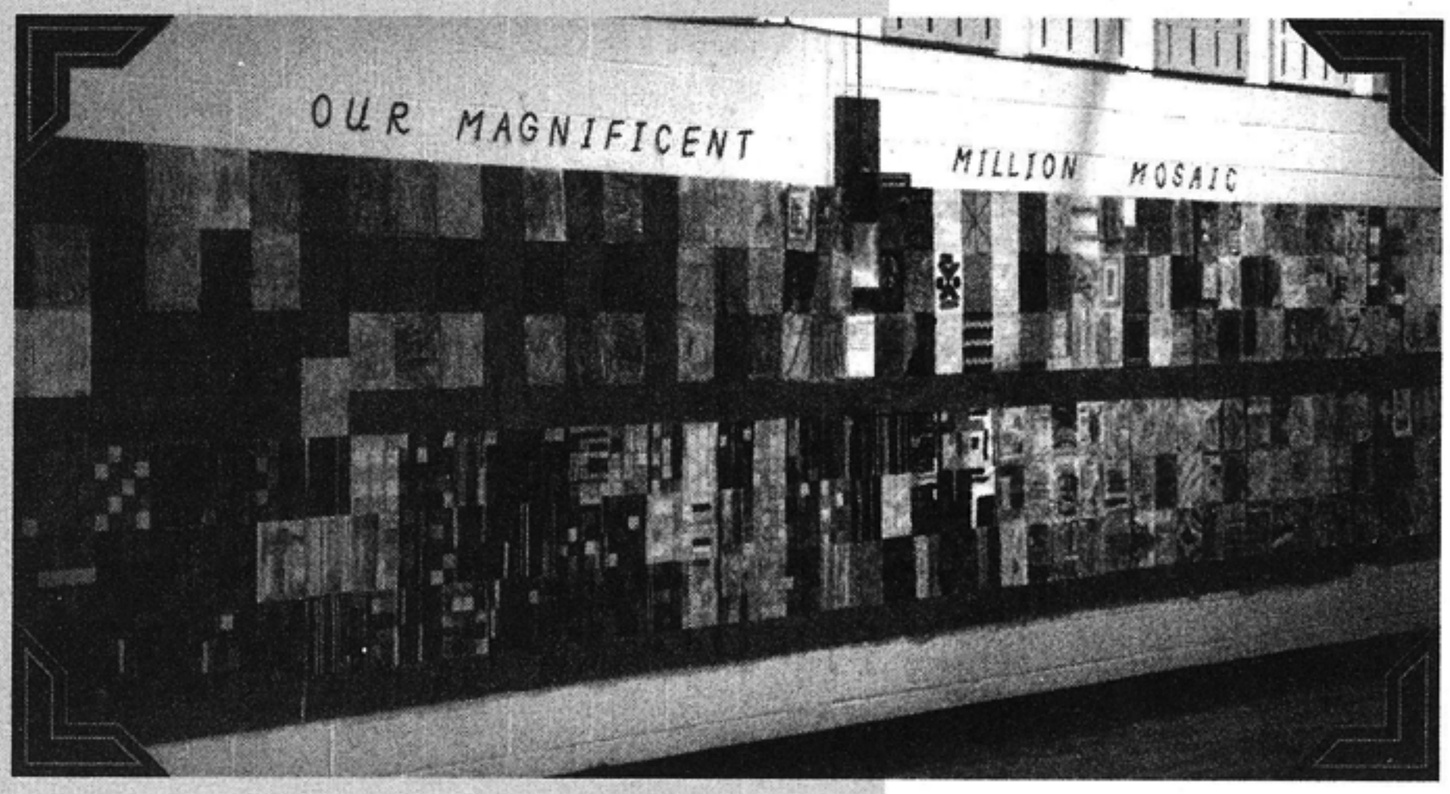
Taking It Further

Show students some examples of interlocking shapes used to make a picture. These examples could include quilts, tile mosaics, and tessellations by M.C. Escher.

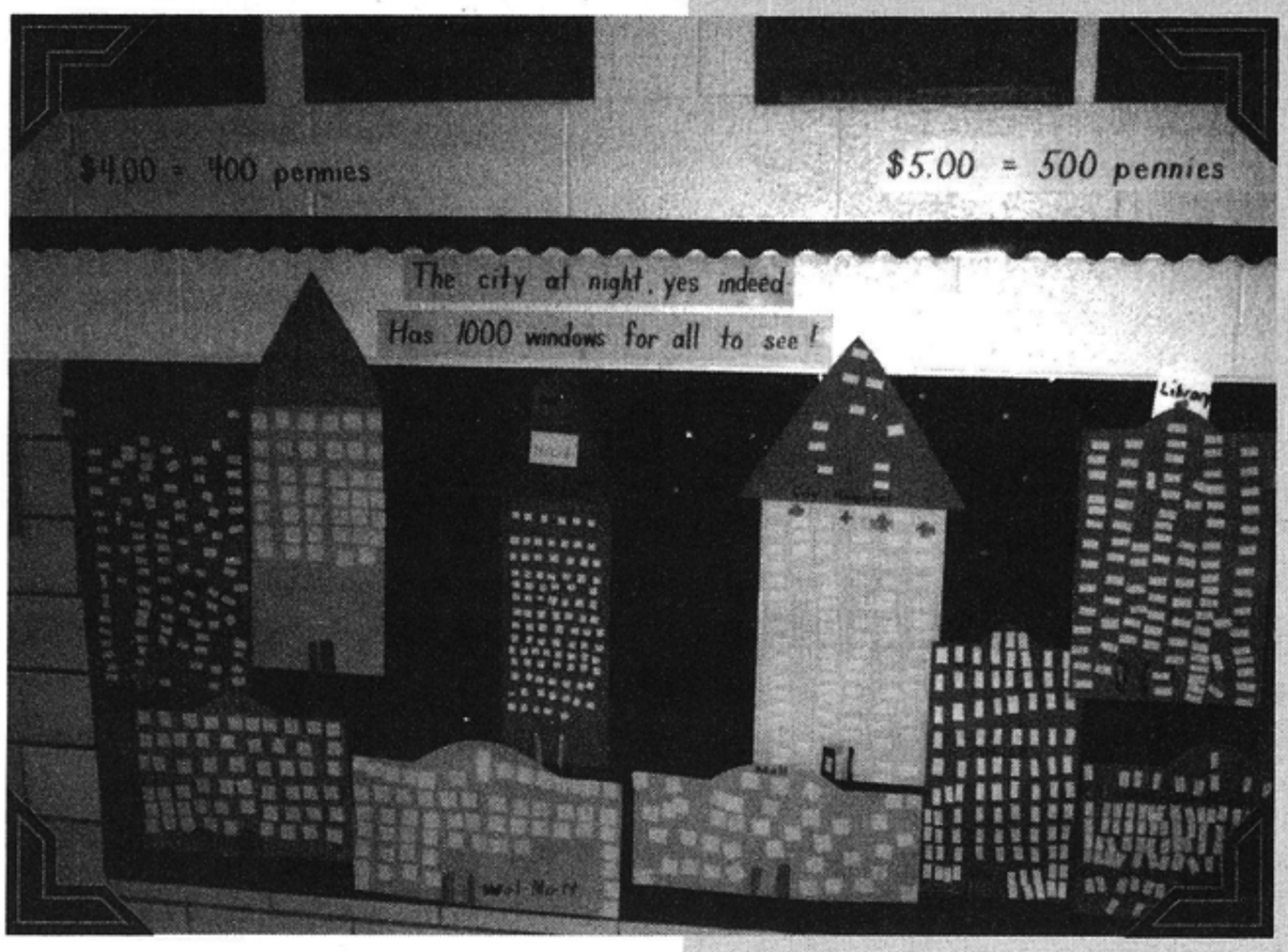
The Math Classroom in Action

A Million Mosaic

Math coordinator Maureen Stryker of Southern Boulevard School in Chatham, New Jersey, worked with all classes in the school to create a striking mosaic mural made of one million 1-cm squares. The 500 students of the school were each given a large sheet of paper (40-cm squares by 50-cm squares) and asked to color a pattern. The colored sheets were then arranged in a huge array, covering an entire gym wall.



Ms. Stryker used the mural as a vehicle for presenting many types of math problems. The youngest students talked about the shapes they had created in their own colorings. Older students calculated the number of squares on each sheet, the number of squares used by each class, the area of the gym wall the mural covered, the ways changing the dimensions of the mural affected area and perimeter, and so on.



Another wall mural emerged as one of many "millions" projects at Farmington Elementary School in Culpepper, Virginia. The display of 1,000 lighted windows in a city of buildings could inspire an even larger city as a whole-school project. Or it might lead to calculations of how many more buildings would be needed for a city of one million lighted windows. Sometimes just starting the journey toward one million is enough for students to grasp how 1,000,000 relates mathematically to other numbers.

CREATING ONE MILLION

CREATING INVESTIGATION 2

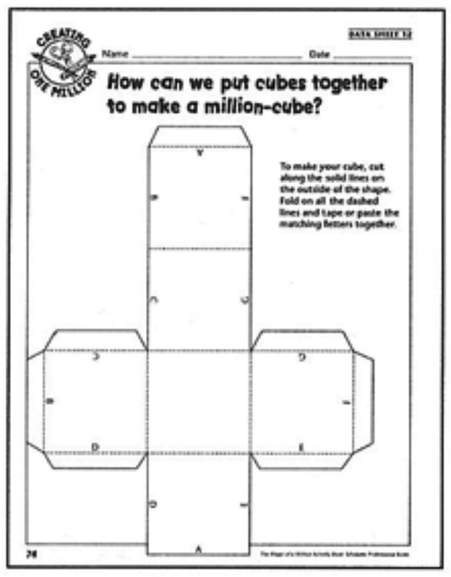
The Million-Block Cube

BIG IDEA: How can we put cubes together to create a million-cube?

PROCESS SKILLS: counting, recording, calculating, constructing, justifying answers

What to Do

1. Use base-ten blocks to help students conceptualize a million-block cube. Begin with one 1-cm cube. Then show a hundred-flat. Ask students if they can tell you how many flats you would need to make a cube. Put flats together by adding one at a time so students see the construction of a thousand-cube. Ask students to tell you how many 1-cm cubes it takes to make the larger cube. How do they know?
2. Now ask students to imagine a cube with 25, then 36, squares to a side. See if they can devise a rule or formula for finding the volume—the amount of space taken up by each cube.
3. Copy and distribute Data Sheet 12 on page 74. Have students cut around the outside edges, then fold and paste or tape the tabs to create a cube. Ask: What are the dimensions of the cube? What is the volume?


DATA SHEET 12

Name _____ Date _____

How can we put cubes together to make a million-cube?

To make your cube, cut along the solid lines on the outside of the shape. Fold on all the dashed lines and tape or paste the matching letters together.

74

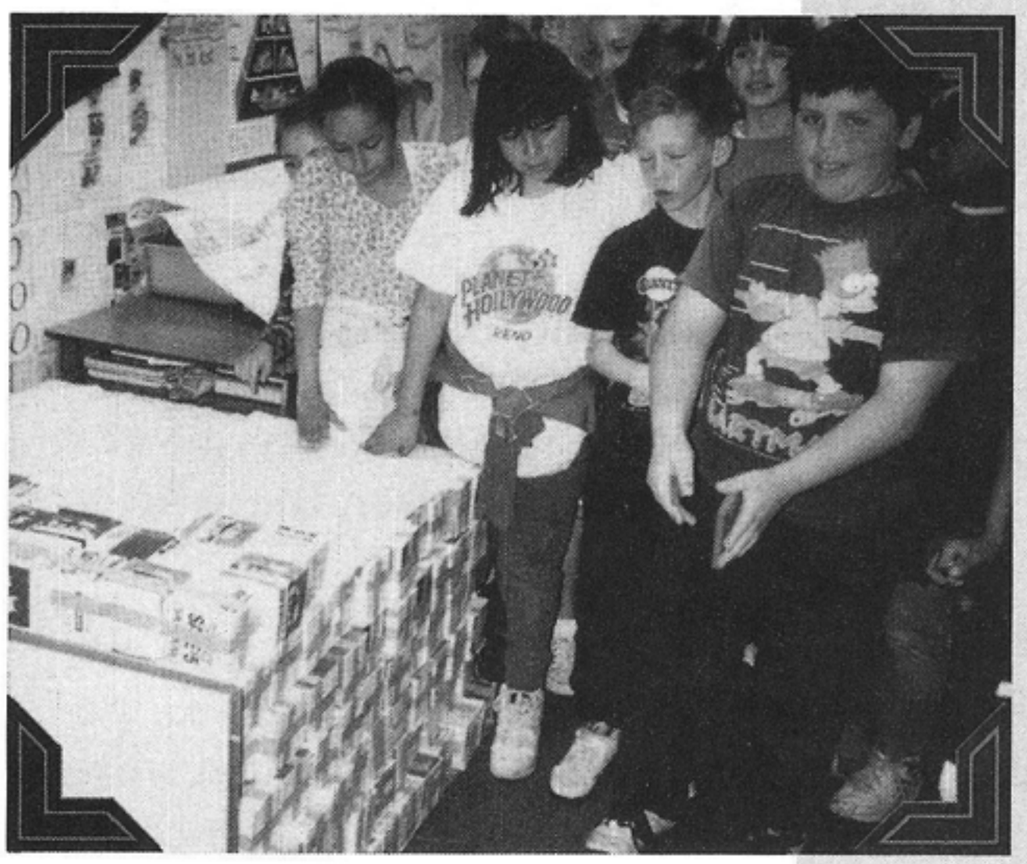
4. Divide the class into groups of 4. Ask each group to figure out the volume if all of them put their cubes together. Would the volume change depending on the shape? Ask students to try various shapes and discuss their findings.
5. What if the entire class put their cubes together? Ask students to figure out the volume of a large cube made of many of their smaller cubes. Put cubes together to see what the large cube looks like. Then ask students what the dimensions would be of a cube one million centimeters square. What would it look like? Would there be room for it in the classroom? Invite students to make such a cube using their paper cubes or other materials of their choosing.

Taking It Further

You may want to talk with students more formally about volume and designations for volume. For example, the first cube they make using the reproducible contains 125 1-cm cubes; its volume is 125 cubic centimeters. Students may have already discovered the formula for finding the volume of an object: $V = l \times w \times h$.

The Math Classroom in Action

The Million-Block Cube



At the David Lubin School in Sacramento, California, Judy Carlisle's fifth grade class was working with base-ten blocks. One of the students noticed that the hundred-square (a 10-by-10 cm block) fit almost perfectly into the base of a cardboard half-gallon milk container. If two containers were cut off at a height of 10 centimeters, they could be pressed one into another, bases to the outside, to make a sturdy cube with a volume of 1,000 cubic cm. The discussion and experimentation didn't stop there. "What if we put 10 of these milk-container cubes in a row and then made 10 rows," someone suggested. "We would have a 100,000-flat."

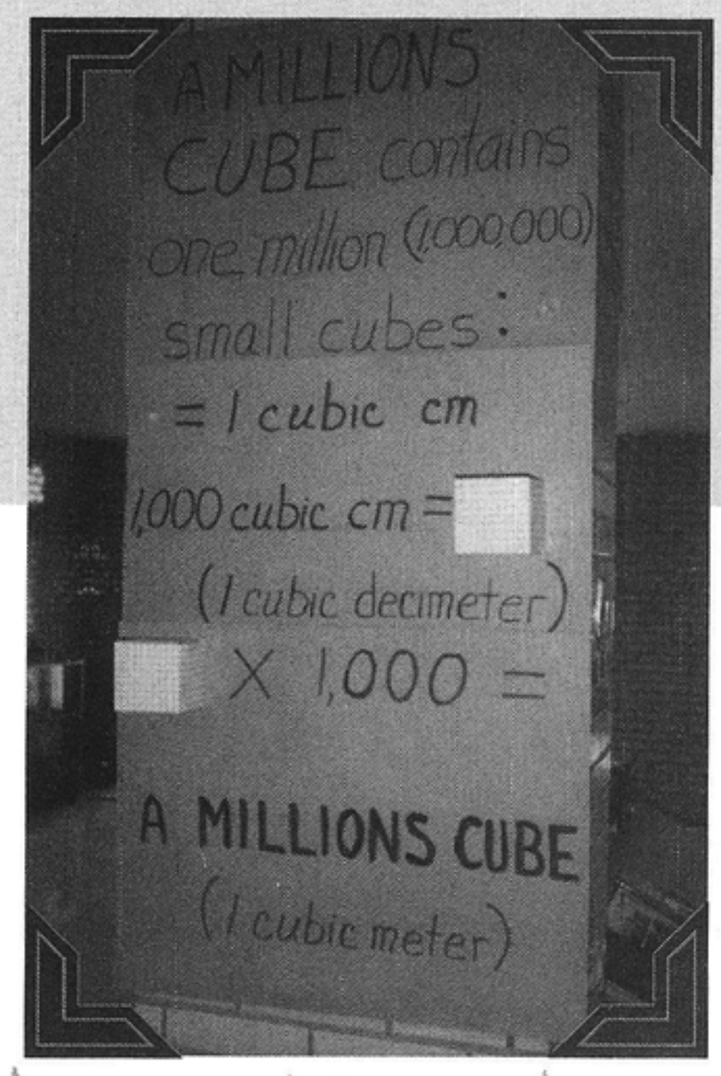
Another student built on that idea. "And then we could stack ten of those on top of each other for a one million cube!" Soon the class had completed their plans to construct a one-meter cube of milk-container cubes, representing a volume of one million cubic centimeters.

Both teacher and students posed these and other problems related to their cubes:

- ★ If we have a volume of 365,000 cubes, how many more will we need to reach 1,000,000?
- ★ At the rate we've been bringing in milk cartons, how long will it take to collect enough to make the million-cube?
- ★ If we took the little 1-cm cubes apart and stacked them on top of one another, would they be as tall as the Sears Tower plus the Empire State Building plus the Eiffel Tower?

Within a few months a giant one-meter cube stood proudly at the back of the classroom. Each student was asked to make a poster that presented and solved an original problem related to the cube. Over the course of the school year, the million-cube became a kind of standard against which many things were measured and compared, from trees to mountains to clotheslines.

Fifth graders at Sullivans Elementary School in Yokosuka Naval Base in Japan made a million-cube using graph paper on a centimeter grid pattern. Both creation and construction were a challenge, but everyone in the school got a look at a cube—proudly displayed by its creators—of one million square centimeters!



CREATING INVESTIGATION 3

Pictures Worth a Million

BIG IDEA: What kinds of art can we create with lots of dots?

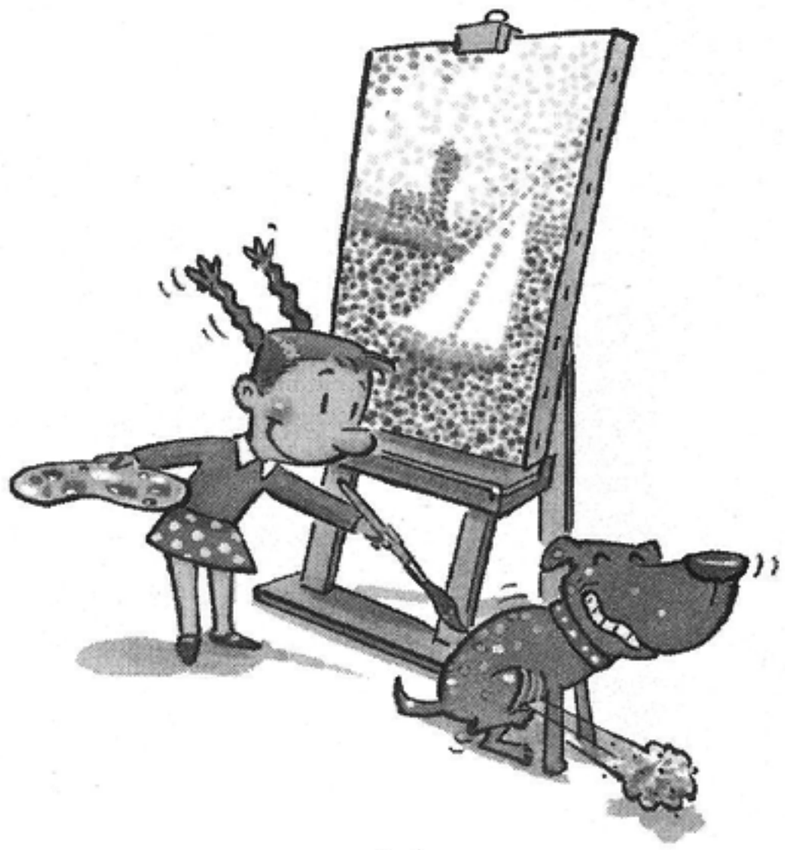
PROCESS SKILLS: counting, creating

What to Do

1. Display some pictures of paintings done with the technique known as pointillism. For example, you could show paintings by Georges Seurat, Paul Signac, or Camille Pissarro. Ask students to guess how many dots are in one of the paintings, and to speculate as to how long it might have taken the artist to create such a picture.
2. Distribute art materials: watercolor paint or tempera paint, paper, and cotton swabs. Invite students to make their own pointillist paintings.
3. Ask students to guess how many dots they used in their own paintings. Then talk with them about ways they could find out. Suggestions may range from counting every dot to making an estimate based on the number of dots in a sample area.

Taking It Further

Suggest that students gather pictures from magazines and newspapers. With the eye—or even better, with a magnifying glass—they'll see pictures composed of dots. Computer-generated images printed at home or at school will yield a similar effect. Looking at color pictures, students will even see how colors are composed of four basic colors: cyan (blue), magenta (red), yellow, and black. Ask students to choose a picture and guess how many dots might make it up. Challenge them to find a way to section off a portion of the picture to use as an average and then to figure out the total number of dots. Are there one million?



The Math Classroom in Action

Pictures Worth a Million

At University Park Elementary School in Dallas, Texas, Jan Lauer's class was studying pointillism. Jan wanted to join in the "million mania" that had swept the school, so she had the students experiment with the technique by making their own pointillist paintings. Students then made guesses as to the number of dots they had used in their own paintings.

Jan showed Georges Seurat's *Sunday Afternoon on the Island of La Grande Jatte* and students talked about how many dots they thought it had (more than a million!) and how long it took the artist to create the masterpiece.

The discussion led to further estimates of dots on a computer screen and a TV screen.

East Ward Elementary School in Downington, Pennsylvania, did a similar project with pointillist art. Students discussed how they could estimate the numbers of dots in their own art, how long it would take to put one million dots on a page, and other dotty problems.

At Farmington Elementary School in Culpepper, Virginia, students created another kind of dot picture. Here the number of dots related to a smaller number—one hundred. Younger students can count and create with 100; older students might calculate the number of pictures needed to have 1,000 or 10,000 or 100,000 or 1,000,000 dots.