

Collecting One Million

There is perhaps no better way to experience the magnitude of one million than by attempting to collect one million of something. A collection project gives children a chance to see, perhaps for the only time in their lives, a pile of one million objects. But it does much more—it generates excitement about big numbers, and it teaches a great deal about our number system. Since collecting one million objects usually takes some time, students gain a patient understanding for how large this number is. As the collection grows, students see first-hand the emerging pattern of hundreds, thousands, ten thousands. Graphing the results of the growing collection is a way for students to examine their efforts. The data from the graph encourages them to predict and verify the amount of time needed to reach their goal.



COLLECTING INVESTIGATION 1

A Hill of Beans

BIG IDEA: How can we keep track of one million things?

PROCESS SKILLS: counting, collecting, recording, explaining methods

What to Do

1. Ask students to suggest items they might gather to make a collection of one million. Don't steer possibilities at first; rather, encourage students to brainstorm a list. Write all the suggestions on the chalkboard. Then review the list with the class, and ask students to evaluate the practicality of each collection. The field of possibilities is vast, but the best choices are inexpensive or free, small, and light. Dry beans work nicely.
2. When students have narrowed the list to three or four possibilities, ask them to vote on what the class will actually collect. If your whole school will be involved, the list and voting could be done by posting one suggestion per class and having everyone vote. Volunteers can record and tally the votes.
3. Be sure students discuss where materials will be stored as they are collected. They also might want to consider what could be done with the materials, if anything, when the collection is complete.
4. An important task in the collection of one million is determining how counting will be tracked and in what quantities the collected materials should be stored. You might make envelopes of 100 beans each; jars of 1,000 beans; and so on. Use Data Sheet 7 on page 69, if you wish.

 How can we keep track of one million things?	
Follow these steps to help you collect and group one million.	
1. With your class, decide what you will collect. Write the name of your item here: _____	
2. Decide on an orderly way to count and store your things. For example, you might make groups of 100. Keep track of the following numbers on your way to one million.	
• 100 is _____ groups of 50.	
• 1,000 is _____ groups of 100, or _____ groups of 10.	
• 10,000 is _____ groups of 1,000, or _____ groups of 100.	
• 100,000 is _____ groups of 10,000, or _____ groups of 1,000, or _____ groups of 100.	
• 1,000,000 is _____ groups of 100,000, or _____ groups of 10,000, or _____ groups of 1,000.	
3. Look at the number of zeros after the number 1 in each of the following numbers. Write down what you discover.	
1 [one]	_____
10 [ten]	_____
100 [one hundred]	_____
1,000 [one thousand]	_____
10,000 [ten thousand]	_____
100,000 [one hundred thousand]	_____
1,000,000 [one million]	_____

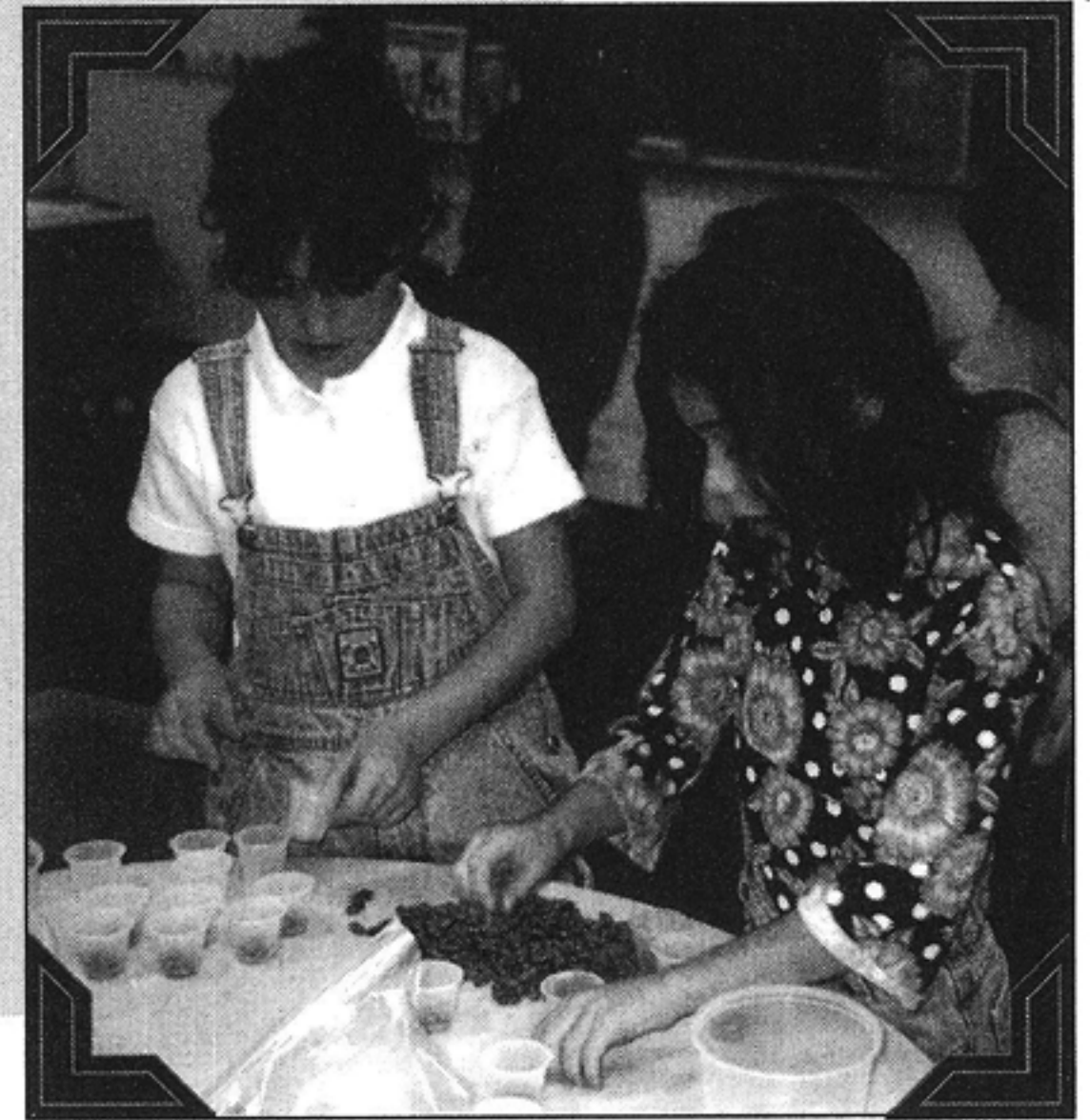
The Math Classroom in Action

A Hill of Beans

The children of Julius Marks Elementary School in Lexington, Kentucky, created an enormous hill of beans—one million altogether—that they planned to donate to a local food pantry. But the food handlers had to turn them down since the food had been handled. The experience inspired new lyrics to an old song.

(Sing to the tune of "I've Been Working on the Railroad.")

We've been counting navy beans, for a solid week!
If we see another bean, we will all scream, "Eeek!"
Yes, we think we have a million, but they weigh a ton!
Yes, we counted to a million, thank God we are done!
Gotta million beans, gotta million beans,
Gotta million beans, we know oh, oh, oh.
Gotta million beans, gotta million beans,
Gotta million beans, Yo Ho!



At Armstrong Elementary School in Dallas, Texas, the classes of Debbie Rhines and Jan Norris jointly undertook "Project One Million." By turning their classrooms into "factories" for processing computer holes, children achieved an impressive collection of exactly one million and also deepened their understanding of our number system.

Rhines and Norris used the perforated edges of computer paper, dotted with holes. They cut the perforated strips into two pieces, of ten holes apiece, and discarded the remaining piece with two holes. Working in groups of four, children formed "factories" that stapled ten 10-strips together into one 100-stack, rubber banded ten 100-stacks into one 1,000-bundle, and bagged ten 1,000-bundles together into one 10,000-bag.

At times, children tried working alone to see how their production would compare with that of the group. They were able to assess the advantages and disadvantages of job specialization. As Claire discovered when she worked apart from her team, "They made a lot more because they could work together and I couldn't. Also, if you're doing the same thing over and over again, it's more boring but it's a lot faster once you get good at it."

Fifth grade teachers Leasha Segars and Lindy Hopkins, at Saltillo Elementary School in Saltillo, Mississippi, embarked on a collection project using popped kernels of corn. The project took six weeks. One big challenge was where to store a million pieces of popcorn. The father of one of the students solved the problem with the loan of a cotton wagon—20 feet long, 7 feet wide, and 6 feet high. The wagon was parked behind the school, and every day students added more popcorn, eventually filling it with one million pieces of popcorn to a depth of two feet. And in the end, pigs at a local pig farm had a delicious treat as students solved the final problem of how to use one million pieces of popcorn!



COLLECTING INVESTIGATION 2

Making It Pay

BIG IDEA: How can we collect and keep track of a million pennies? How many dollars is that?

PROCESS SKILLS: counting, recording, calculating

What to Do

1. Ask students to imagine what a million pennies might look like. Would they fill your classroom wastebasket? The classroom itself? The entire school? Students tend to overestimate the volume occupied by a million objects, and they may be surprised once they have refined their guesses. With a small sample, such as a jar filled with one hundred pennies, students may be able to predict how large a container they would need to hold one million pennies.
2. Initiate a penny collection in your school. First decide how the pennies will be used once the collection is complete. Individual students or entire classes might suggest worthy causes, such as playground equipment, library books, or computer hardware. Some schools have donated money to local or international charities, particularly child-centered organizations such as UNICEF.
3. Invite the community to become involved: parents, organizations, other schools. As class collections grow, each class can chart or graph their progress.
4. Ask students to work with pennies or to calculate equivalent values.
For example:
 - ★ How many pennies make one dollar?
 - ★ How many pennies make one hundred dollars? One thousand dollars?
 - ★ If you have one million pennies, how many dollars do you have?
5. Encourage students to make predictions based on their data. For example, at their rate of collection, how long will it take to reach one million pennies? On approximately what date will they reach their goal of one million pennies?
6. If you wish, copy and distribute Data Sheet 8 on page 70. Ask students to mark the thermometer graph each day and record in the table the cumulative number of pennies the class has collected. If students construct their own thermometer graph, the height should be divided so that the scale is accurate, with marks representing equal amounts.

Taking It Further

How much would one million pennies weigh? Ask students how they could find out, without actually having to put a million pennies on a scale.

DATA SHEET 8

Name _____ Date _____

How can we collect and keep track of a million pennies?

Make a thermometer graph like the one shown to record progress toward your goal as your class penny collection grows. Each week, record on the chart the number of pennies the class collects. Then, add that amount to the previous total to keep showing the new amount collected and the new total. Extend your chart with extra pieces of paper if you want to show more than 15 weeks.

Week	Number of Pennies Collected	Cumulative Total
1		
2		
3		
4		
5		
6		
7		
8		
9		
10		
11		
12		
13		
14		
15		

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The Math Classroom in Action

Making It Pay



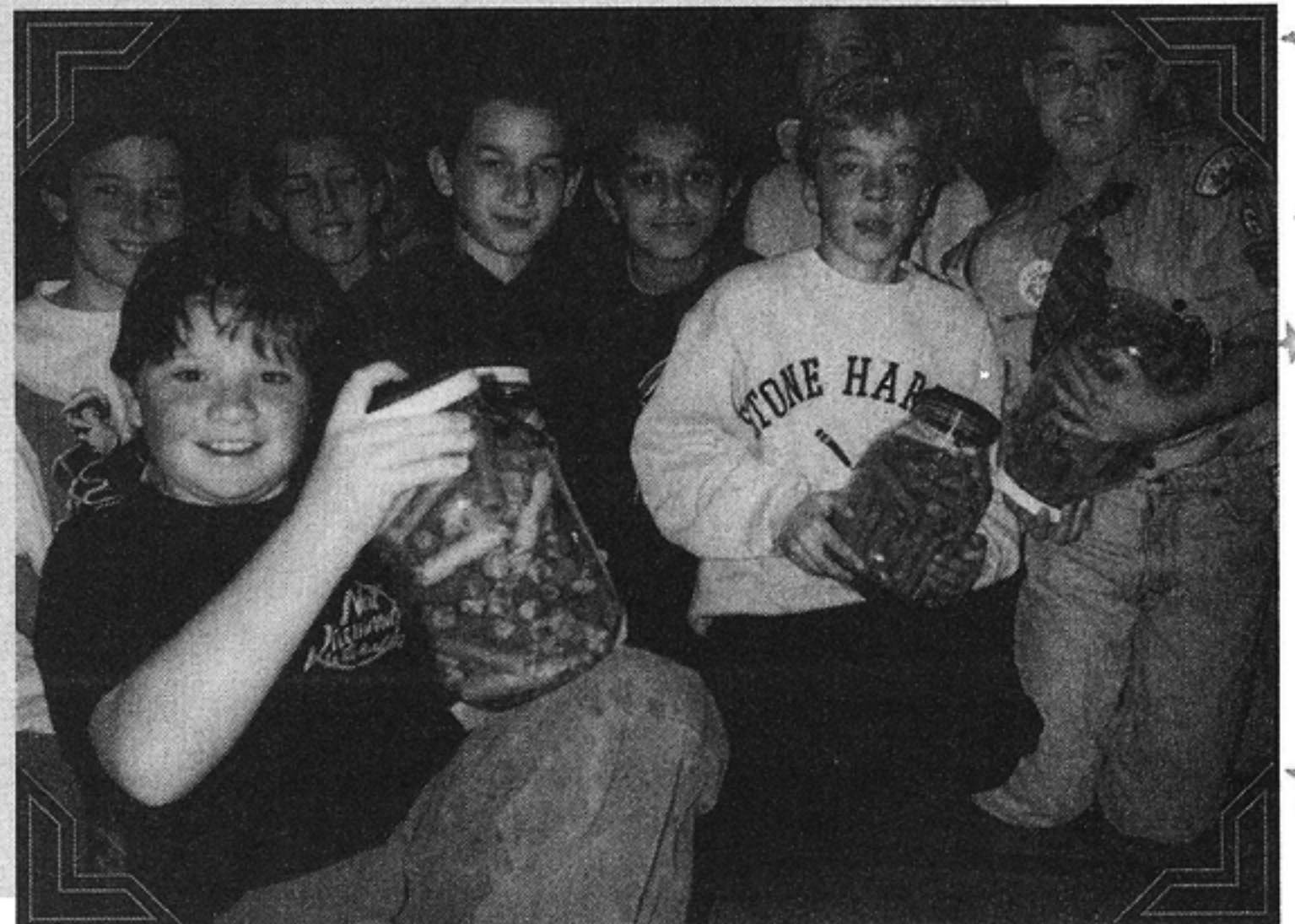
When Laurie Addeo's fourth grade class at South Country School in Bay Shore, New York, heard that an aquarium was to be built in their town, the students set to work mobilizing the community to collect a million pennies. Collection containers were placed throughout the town, and as the money came in, students graphed their progress. Working with the art teacher, they designed and printed T-shirts. They also constructed a huge model whale, which rode grandly on a float in the town's Memorial Day parade.

By the end of the year, they had 1,300,000 pennies. As a grand finale, the entire school held a Penny Celebration, for which classes created floats and banners. The choir sang "Pennies from

Heaven," and local dignitaries spoke. An armored car delivered the rolled pennies to a bank. Soon afterwards, representatives of South Country School presented a check for \$10,000 to the aquarium-in-progress.

Mary Costner, math specialist at Washington Avenue School in Chatham, New Jersey, wanted to coordinate a penny collection that would culminate on the day that David Schwartz was scheduled to speak at the school. With only about a month to complete the collection, she realized that the goal might be difficult to achieve, so the goal became 100,000 pennies. Classes were to collect batches of 1,000 pennies. As they did so, they posted the number of 1,000s on a large chart in the hallway.

Since she wanted a million theme, Ms. Costner added an unusual twist to her project. Once the pennies were accumulated and rolled into wrappers, students went outside and laid the rolls end-to-end in a circuitous path around the school. At recess on the day of Schwartz's visit, virtually everyone in the school—students, teachers, office staff, and the visiting author—walked the "penny route" ten times. In this way, they all had the experience of "walking a million pennies." Through a little mathematics, and exercise, the students achieved their million!





COLLECTING INVESTIGATION 3

A Motley Hundred Thousand

BIG IDEA: What kinds of things can we collect to make an assorted collection of many things? Which of these things go together?

PROCESS SKILLS: counting, collecting, sorting and classifying, recording, explaining procedures, connecting to real life

What to Do

1. Invite students to begin a collection of 10,000 or 100,000 items. This could be a grade-wide or school-wide project, depending on the size of your school. Ask students to calculate how many things each student must bring, based on the number of students that will be involved and the total number you wish to reach. Then invite each student to choose his or her own item to bring. Discuss such considerations as size, cost, and portability.
2. Make a classroom display of the items students collect. Use the items to discuss sorting and classifying: what things in the collection could go together, and in what ways? Encourage students to suggest as many different classification schemes as possible.
3. If you wish, distribute a copy of Data Sheet 9 on page 71 to each student. Ask students to make three "collections" by writing their categories and then listing things from the collection that would belong in each category. They can then use the Venn diagram, or create a giant classroom Venn diagram, to explore unique and overlapping traits.
3. When the entire grade level or school collection is displayed, ask students to see if there are any additional items they can add to the categories that were established in your class. Then invite students to determine how many such collections would be needed to have a million objects. For example, if one category had 25 items, 40,000 such groups of objects would be needed to gather one million.

COLLECTING ONE MILLION Name _____ Date _____ **DATA SHEET 9**

What things from an assorted collection go together?

Use the chart to show some categories you could make from your classroom collection. Write the names of three categories. Then list things from the collection, and other things you can think of, that would belong in each category.

Category 1	Category 2	Category 3
Things that are _____	Things that are _____	Things that are _____
_____	_____	_____
_____	_____	_____

Now put your items in the Venn diagram. The center is for items that share all three attributes.

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Taking It Further

Begin a discussion about things that come in standard numbers, such as pairs (socks, mittens and gloves, some hair clips, pillow cases, etc.); sets of four (some foods such as pudding packs); sets of six (soft drinks, juice); and sets of twelve (eggs).

Distinguish between things that come in standard numbers because of human decisions, such as those above, and things that come in standard numbers naturally—three leaflets of clover, four toes on a bird, eight legs on a spider, ten tentacles on a squid, and so on. You might post a large chart with headings for each number, and students could add items to the list over the course of several weeks.

The Math Classroom in Action

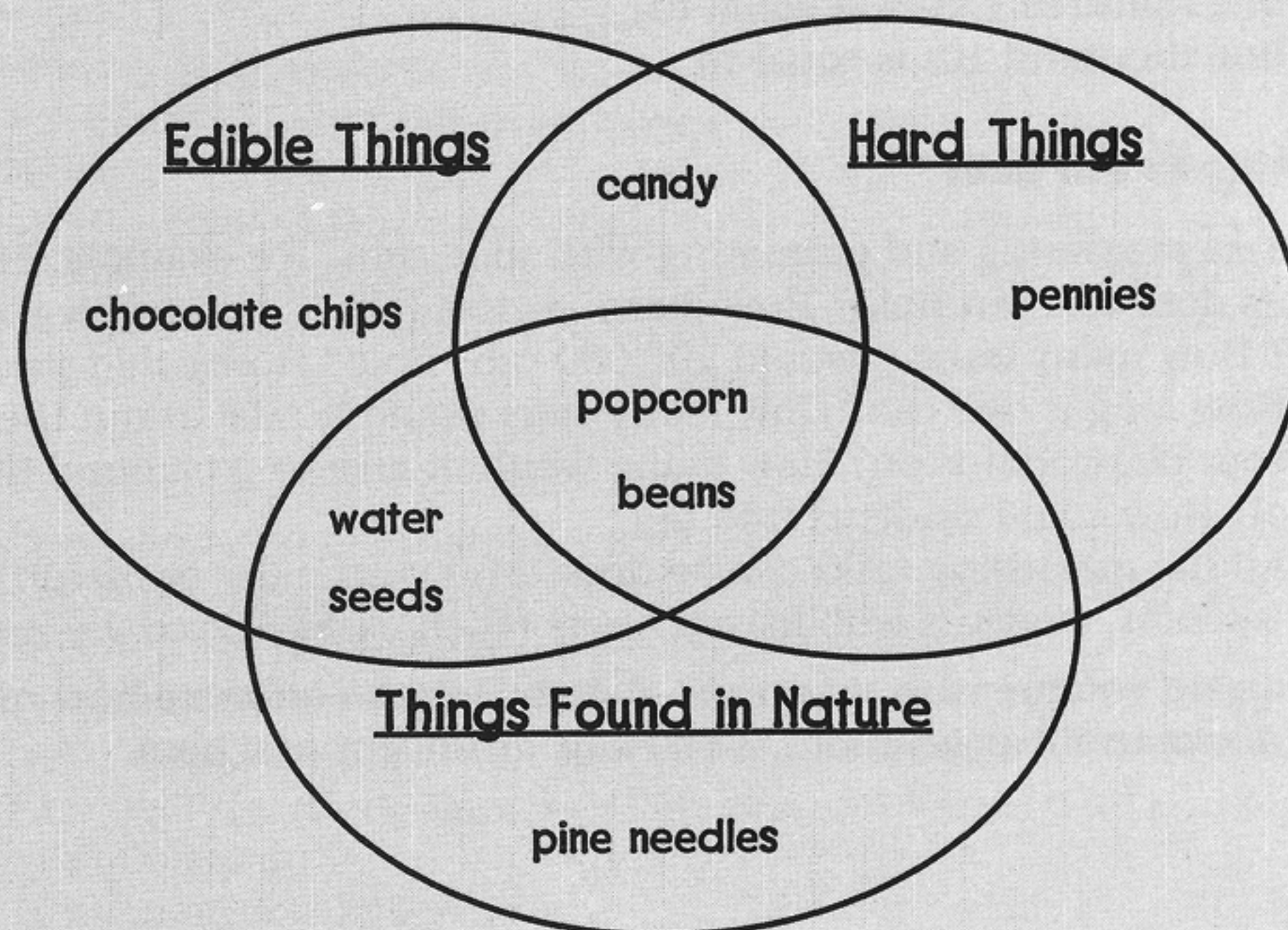
A Motley Hundred Thousand

The children of Silver Lake Elementary in Federal Way, Washington, put together a collection of 100,000 assorted items. Each child was asked to bring an equal number of items. The older students decided to calculate: they discovered that each child in the school was responsible for 173 items. The students all could decide for themselves what to bring, but all 100,000 objects would have to fit on a single large table in the gym.

Before the day appointed for showing the display, classroom discussions focused on the children's plans, leading to calculations and estimations of size and practicality of items the children might bring in.

When the display was completed, the diversity of items, in multiples of 173, was a delight for all to observe. Drops of water, baseball cards, pieces of macaroni, punched holes from colored paper, candy, pennies, popcorn, beans, seeds, a drawing of a dog with 173 lines to represent its fur, straws, cursive letters on lined paper, chocolate chips, and pine needles were but a few of the items students brought in. During the day, the entire school filed past the table to admire the display.

If Silver Lake students had made a Venn diagram for their collection, they might have used these categories: *Edible Things*, *Hard Things*, *Things Found in Nature*.





COLLECTING INVESTIGATION 4

Pop-tab-u-lation!

BIG IDEA: How can we collect one million pop tabs? How can we keep track of and store our collection?

PROCESS SKILLS: counting, collecting, recording, using place value

What to Do

1. Pop tabs, the little aluminum rings from soft drink cans, make a wonderful collectable and are useful as counters in any classroom. Ask students if they think they could collect one million pop tabs. How long would it take? How many ounces of soda or juice would each student have to drink if they used only their own cans? How would they store one million pop tabs?
2. Invite your own class and others, perhaps the entire school, to join in a pop-tab collection. As the collection grows, challenge students to devise ways to count and keep track of the number they've collected. For example, students might string sets of 100 tabs or bag by 10s, 100s, or 1,000s.
3. Using the pop tabs as counters, make piles of tens, hundreds, and thousands. Ask students to find equivalent values for larger numbers by restating them. For example:

ten 10s is equal to _____
ten 100s is equal to _____
one hundred 10s is equal to _____
one hundred 100s is equal to _____
ten 1,000s is equal to _____
one hundred 1,000s is equal to _____
one thousand 10s is equal to _____

Taking It Further

- ★ Do some measuring and estimating with soda cans. For example, how many ounces does one can hold? How many ounces (pints, gallons) would 100 cans hold? How many ounces would 100,000 cans hold? How could students find out?
How long is one can? How many cans would it take to run the length of the hall your classroom is on? How many would it take to go around the entire school? How could students find out?
All the measuring tasks can be done with customary or metric units. By using both systems, students will discover how much easier it is to use metric units.
- ★ Investigate volume with your cans. Ask students to estimate how many cans it would take to fill a classroom, a hallway, or the entire school.

The Math Classroom in Action

Pop-tab-u-lation!

In the fall of 1992, Sybil Sevic introduced *How Much Is a Million?* to her students at Ravenel Elementary School in Seneca, South Carolina. She challenged them to bring one million pop tabs to school.

Children initially responded with boasts: "I'll bring that many in on Monday!" "We have a million cans in our garage!" "It won't take long—we drink that many cans of pop in a couple of weeks."

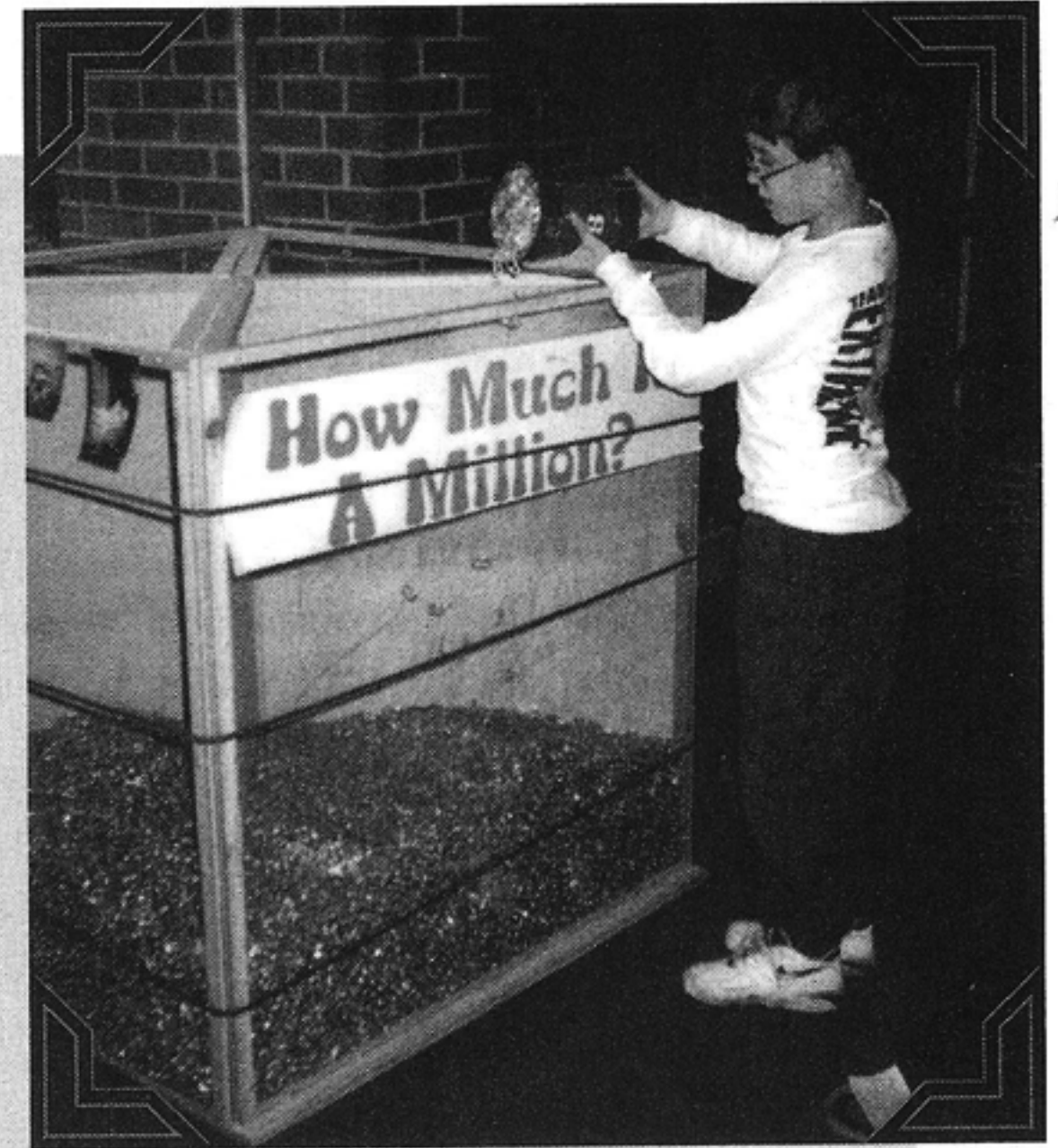
As classes collected pop tabs, the tabs were used for hands-on activities. Older students gathered younger children and led activities, such as skip counting, "subtracting" by counting on to find how many more would make a pile of 100, estimating what several piles put together would look like, and so forth.

As the collection progressed, children reformulated their concept of one million. When they realized it was unlikely that they would achieve their goal within the school year, they enlisted other schools in the district. Parents helped collect tabs at their places of employment. On a Saturday morning near the end of the school year, students and parents held a Pop Tab Fair. At the Fair, students participated in many mathematical activities related to counting pop tabs.

But when the total was announced, only 225,000 tabs had been collected. As the next school year began, students launched their collection efforts anew. Ravenel students went to other schools to solicit additional contributions, designed and built collection boxes for offices and stores, wrote articles for the school newspaper, and contacted the local newspaper to publicize their project.

At the second Pop Tab Fair, the collectors again found they were short of their goal. The final tally was 790,000, but the decision to continue the project was unanimous.

On November 6, 1993, students, teachers and parents gathered for their third Pop Tab Fair. To everyone's delight, the tabulation was a seven-digit number: 1,075,632!





COLLECTING INVESTIGATION 5

Pile Up the Books


BIG IDEA: How many books would one million pages fill? One million words? One million letters?

PROCESS SKILLS: counting, collecting, finding averages, calculating, recording, explaining methods

What to Do

1. Can students estimate how many pages are in a typical book in your classroom? Have students work in small groups, each group with a different book. How many of their books would it take to get one million pages? Encourage students to pick different kinds of books. Have groups report their findings.
2. Next, invite the groups to explore how many words are in a typical book in your classroom. How many books would it take to reach one million words? Again, ask students to suggest ways they could estimate, then try it, and then report to the class. Discuss possible reasons for the variety of answers, based on the type of book students used.
3. With the information of how many words there are in a typical book, suggest that the groups explore "collecting" one million letters. Ask students to estimate how many letters are on one page, and then to check by counting. They can use several pages of their book and calculate an average number. Once they have an average number of letters per page, ask them to suggest ways to find out how many pages they'd need in order to have one million letters. Why might some books have more letters per page than others?
4. For all of the above bookworm activities, encourage groups to record and report their findings, using Data Sheet 10 on page 72.

COLLECTING ONE MILLION	Name _____	Date _____	RECORDED
How many books would one million letters fill?			
Fill in the information below. Be ready to report the information for your book.			
1. Title of book:	_____		
2. Type of book:	_____		
3. Number of pages:	_____		
4. Number of books needed to make 1,000,000 pages:	_____		
5. Average number of words per page:	_____		
6. Number of pages needed to make 1,000,000 words:	_____		
7. Average number of letters per page:	_____		
8. Number of pages needed to make 1,000,000 letters:	_____		
9. Here are some other interesting facts I've discovered about books, pages, words, and letters:			



Taking It Further

Introduce concepts of averages by working with the class to determine the "average" number of pages, words, or letters in the books your groups have chosen. Find the *mean* by adding all the numbers and dividing. Find the *range* by looking at the books with the most and least pages, words, or letters. Find the *mode* by listing all numbers, in numerical order, and noting the most frequently occurring number. Find the *median* by listing all numbers, in numerical order, and noting the number in the middle of the list.

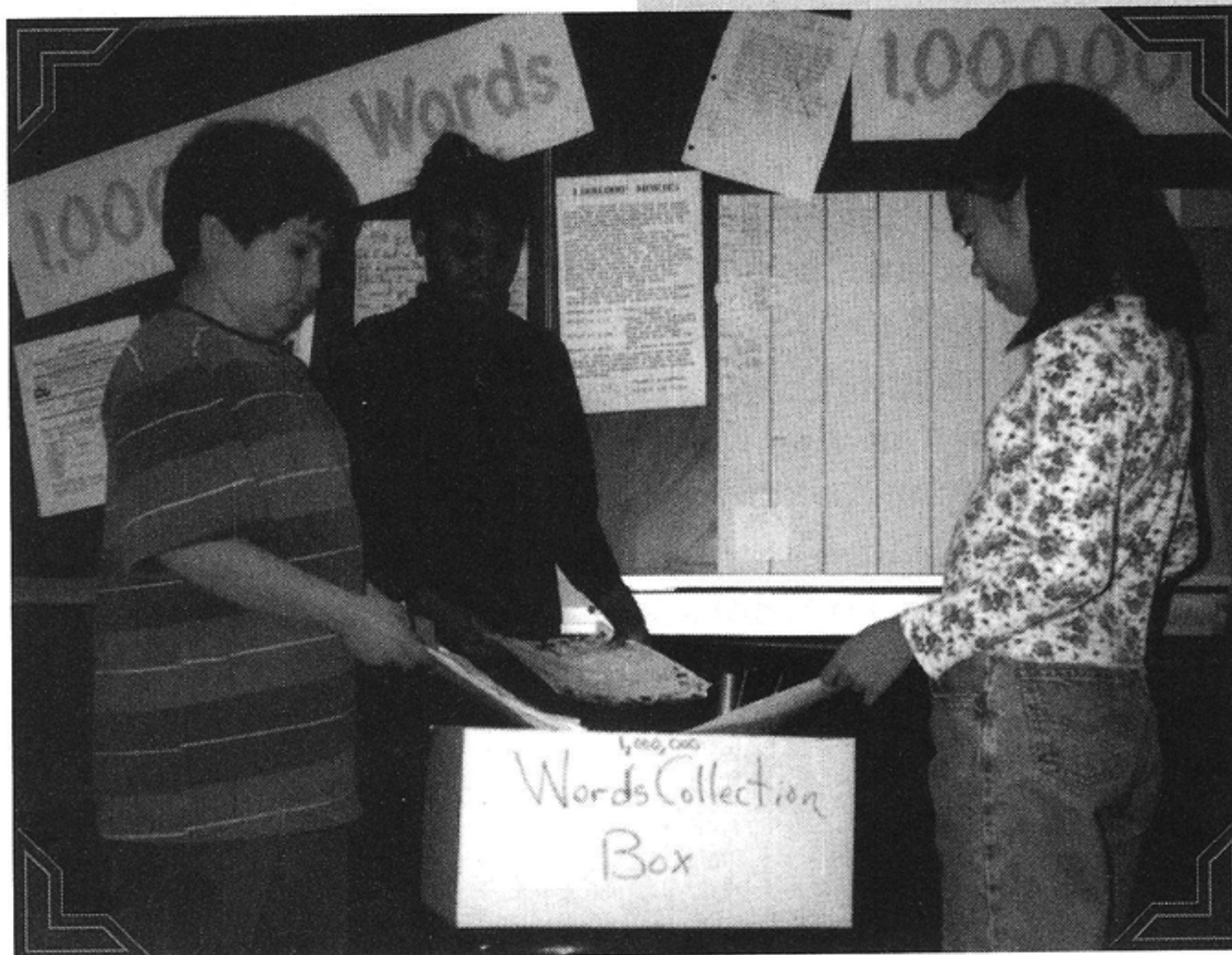
The Math Classroom in Action

Pile Up the Books

A few weeks before Christmas in 1994, students in Deb Marciano Boehm's class at Oak Lawn Elementary School in Cranston, Rhode Island, were having a classroom discussion about how lucky they were to own books. The class decided to initiate a campaign of collecting "gently used" books to donate to a local home for foster children. When other classes heard about the collection, they decided to contribute.

As the boxes of books piled up at the back of the classroom, the students wondered how many there were. Someone suggested a million. When students discovered that they had 438, and that they'd need 999,562 more books to make one million, they were dismayed. Then someone suggested they might have a million pages.

Since most of the books were primary picture books, the class decided to call all of them 32 pages long. With calculation, students saw they still weren't even close to one million pages. After reading *How Much Is A Million?*, another suggestion emerged. Perhaps there were one million words! Since no one wanted to count every word, the class determined the average number of words on a page and multiplied to find the number of words per book. When they summed the totals for each book, they were elated to find they had passed the one million mark.



Students at Yokota East Elementary School at Yokota Air Base in Japan had a twist on the idea of finding one million words: "What if we actually wrote a million words?" Participants entered their writings in a collection box, and some students took on the job of tallying up the words. Students' writings were also proudly displayed.