Abacus

From the desk of the Abacus editor

Pat Blake, a consultant with the Halton Board of Education, has kindly provided an entire package for the December Abacus. This package stems from her popular workshop, "Problem Solving : Making the Connection", and includes a valuable bibliography.

May all of you have a happy holiday season.

Amy



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PROBLEM SOLVING: MAKING THE CONNECTION!

The major goal of mathematics programs is to provide for the development of problem solving skills. We would like children to approach a task by thinking about it (rather than asking how to do it), to search for alternatives, to test out assumptions, to communicate ideas, and to reflect on the process. Through games, puzzles, literature, everyday experiences etc., children have many opportunities to make connections about the applications of mathematics. Experiences need to be multi-modal; let children act out the problem, build it, bake it, measure it, etc. Children's attitudes towards problem solving are also critical in their attaining success. Problem solving should be as enjoyable as reading a good book! The following activities and the list of resource books provide some sources for both teachers and parents in making this important connection. Enjoy!

Level: Primary or Junior (see individual activities)

Outcomes: Students will

- develop a variety of strategies to solve problems
- choose and implement a viable strategy
- use mathematical concepts related to number, geometry, spatial sense and measurement to reach a solution
- communicate their thinking in a variety of ways (pictures, role playing, models, charts, etc.)
- demonstrate a positive attitude towards problem solving

Assessment and Evaluation

Collect information about the student's attitude, process, and product through observation, conferencing, learning logs, audio tapes, rubrics, and oral presentation.

Can the student restate the problem in his or her own words?

Does the student select an appropriate strategy?

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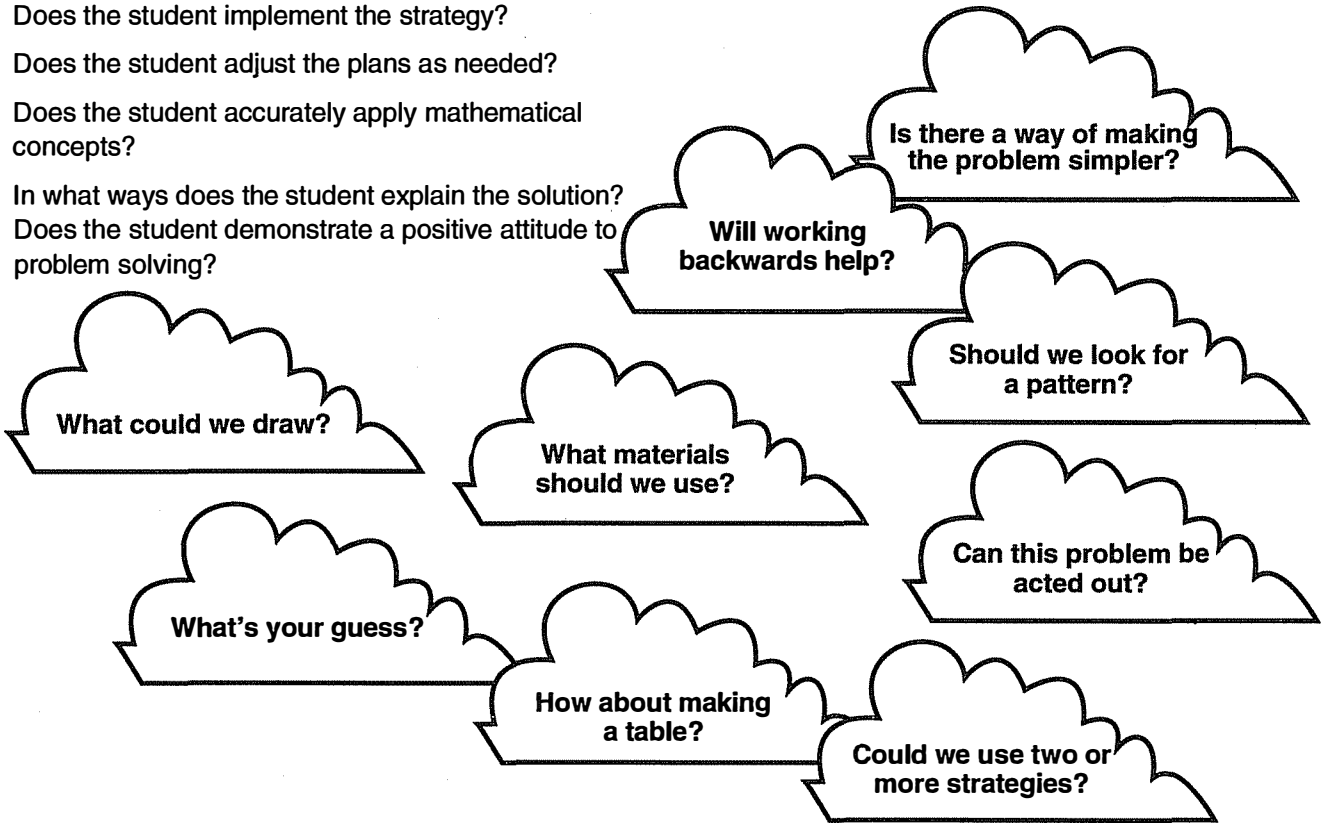
Edited by Amy Parker

Does the student implement the strategy?

Does the student adjust the plans as needed?

Does the student accurately apply mathematical concepts?

In what ways does the student explain the solution?
Does the student demonstrate a positive attitude to problem solving?



Problem solving begins with lots of opportunities for students to talk together, to ask probing questions and to "play" around with the problem. Thinking about thinking is a critical process. Teaching students to reflect on decisions - to ask questions - requires that teachers model the questions. Try building a visual chart of the process and the "thinking" questions.

THINK ABOUT THE PROBLEM

What is this problem all about?

How will I retell the problem in my own words?

Is this problem like any problem I've solved?

PLAN HOW TO SOLVE

What problem solving strategies do I know how to use?

Which strategy might work best?

Can concrete objects, the computer, or the calculator help me?

(See the clouds above.)

TRY OUT YOUR PLAN(S)

Is my strategy working?

What will I do next?

LOOK BACK

Does my solution provide a reasonable answer for the problem?

How do I know I'm done?

How else can I check?

USE MATERIALS

String Along

Level: Primary or Junior

Materials:

About 4 metres of string tied in a circle (use rope for younger children).

Activity:

Form a circle of 5 to 6 students with 1 circle of string.

Instruct students to hold onto the string with 2 hands. They must use both hands at all times and slide their hands back and forth when necessary. (Younger students may need to keep the string on the floor.)

As a group, complete the task posed.

"Make the string into:

- a shape with 4 sides...a different 4-sided shape
- a shape with 4 equal sides
- a shape with no sides the same length
- a shape with as many sides as you can make

OR

- a square
- a trapezoid
- a rectangle twice as long as it is wide
- a cube

Discuss each shape as it is completed and brainstorm additional words to describe it. "Is there more than one solution? Why?"

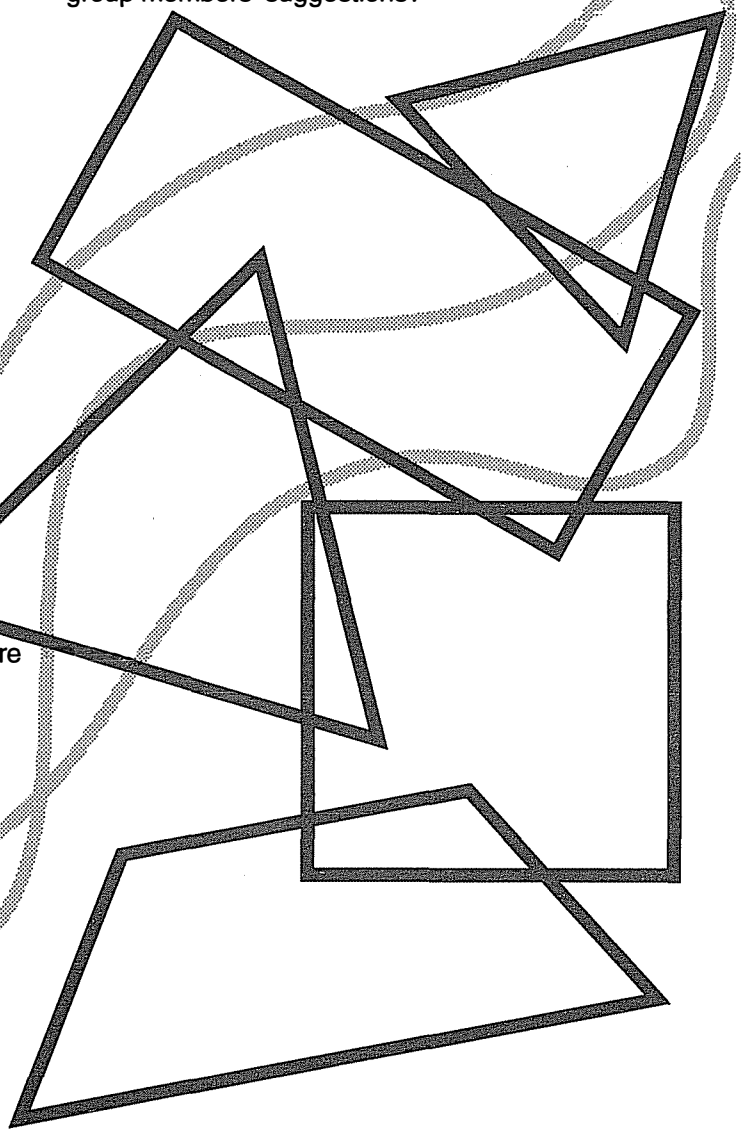
NOTE: Focus on the characteristics of the shape, not just the name.

Extension:

Have each group work cooperatively to create its own challenge. The group should first draw a shape, eg.,◇. Then, using the cooperative strategy round table, each person writes a word or phrase to build a "rich" description of the group's shape. When complete, the group invites another group to listen to its description and try to create the shape.

Evaluation:

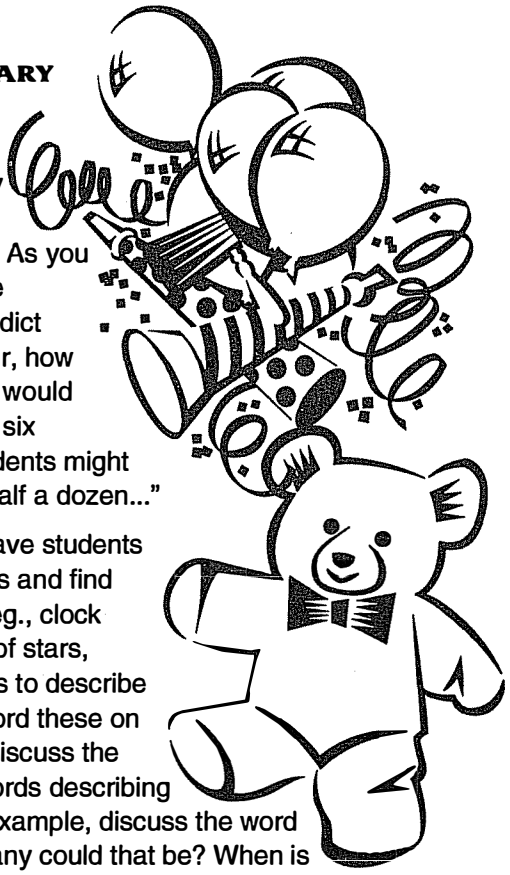
Do the students relate the characteristics to the appropriate shape? Do the students use appropriate language to describe the shape? Do the students refine their language as other groups respond to their descriptions? Do the students respond positively to their group members' suggestions?



USE LITERATURE

P. Bear's New Year's Party

by Paul Owen Lewis
Silvia Mattacchiane & Co.,
Pickering, Ont.
ISBN #09692640-8-9



Level: Primary

Activity:

1. Read the story to the children for enjoyment. As you read, allow the children to predict after each hour, how many animals would arrive, eg., "at six o'clock..." Students might reply "6", or "half a dozen..."
2. Reread and have students look at pictures and find connections, eg., clock face, number of stars, animals, words to describe number. Record these on chart paper. Discuss the meaning of words describing number. For example, discuss the word "lots". How many could that be? When is "a lot" a lot? When is "a lot" not enough?
3. Brainstorm and record all the different ways to find the answer to the question on the last page: "How many guests came to the party?" (Provide calculators too.)
4. Have small groups take the guest list or book and find the solution.
5. Share strategies and solutions with the whole group.
6. Discuss other ways to solve this problem.

Extension:

1. Have students pose their own questions to solve, eg., "How many guests were there at 4 o'clock?", or "How many more goats than zebras were there?"
2. Have students create their own party book following this pattern.
3. Act out the story with finger puppets.

What it Feels like to be a Building

by Forrest Wilson
Preservation Press,
Washington D.C., 1988
ISBN #0-89133-147-6

Level: Junior

Activities:

1. Read the title and respond in writing or with movement.
2. Through pantomime, tableau, or with physical objects, eg., cubes, 3-D shapes, blocks, popsicle sticks, geoblocks, lego, create your own visual representation of building words, eg., column, brace, arch, gables.
3. Find examples of the "building" words in your environment, magazines, and/or resource books.
4. In a group, build using junk (boxes, paper tubes, plastic containers). Do not use any tape or glue. How can you use the knowledge you gained in the book to help you?

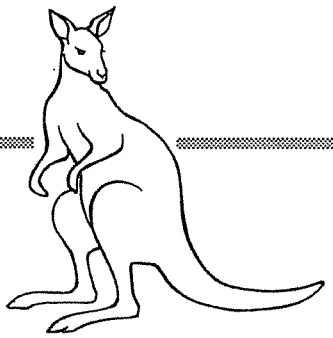
See if your structure can withstand the hurricane test. (Wave a piece of heavy cardboard back and forth 6 times over and beside your building.)

Write a learning log to tell about your experiences.

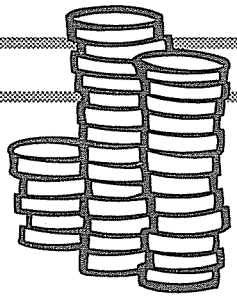


USE PROPS, MANIPULATIVES, ROLE PLAYING...

Level: Primary



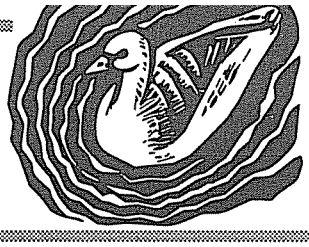
A rabbit, a kangaroo, an iguana, and a cow decided to have a race. The iguana was the slowest. The rabbit was faster than the cow but slower than the kangaroo. Who won the race? Who came in second, third, and fourth?

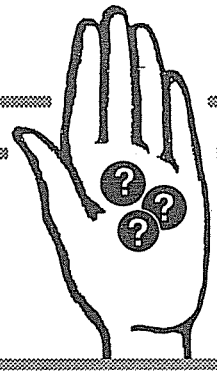


If you have a column of coins 10 centimetres high, how rich are you? (What do you need to consider?)

(What if you had a handful of coins?)

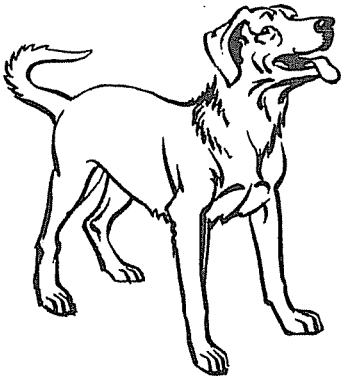
There are 4 animals in a pond. Some are frogs and some are ducks. There is a total of 10 legs. How many animals are ducks and how many are frogs?





You have some pennies, nickels and dimes in your pocket. If you put three coins in your hands, how much money could there be? How many different combinations could you have?

Level: Junior



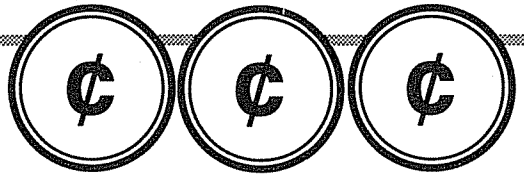
Suppose you had 64 metres of fence with which you were going to build a pen for your large dog, Bones. What are some different pens you can make if you use all the fencing? What is the pen with the least play space? What is the biggest pen you can make - the one that allows Bones the most play space? Which would be best for running?

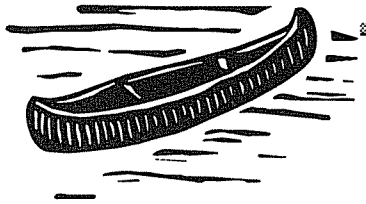


Cindy has a pocketful of change. She would like to buy a gift which costs 75¢. How could she pay for the gift so she could eliminate the most change from her pocket?

(What are all the things you need to consider?)

"$500.00 worth of pennies laid side by side would make a line 1 kilometre long." Do you agree or disagree?





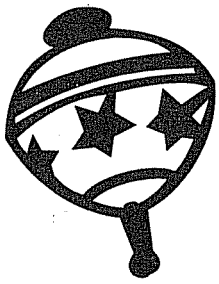
A man and two boys want to cross a river and only one small canoe is available. The canoe can hold either the two boys or the man. What must they do in order for all three of them to get across the river?

USE DESIGNING

Design a Spinning Top

suitable for gift giving in the holiday season!





Level: Primary or Junior

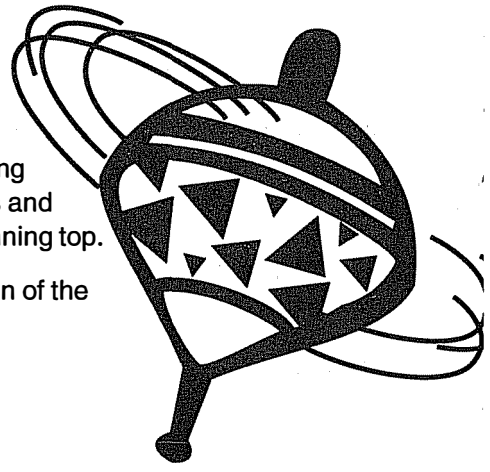
Materials:

a collection of spinning tops

bristol board, scissors, markers, straws, skewers, screws (different lengths), paper cups, plasticine, pencils, yogurt lids, compass, egg cartons plus any other pieces of beautiful junk.

Activity:

1. Provide students with a collection of spinning tops to play with.
2. Brainstorm about what makes a top spin. Develop appropriate language related to shape, balance, length, etc.
3. In pairs, have students use a collection of "beautiful junk" to create a spinning top. Share the creations.
4. Brainstorm what changes might be made to affect the spinning. (What if I change the length of the shaft, the shape of the spinner, the material, the height of the spinner, the way it is launched, etc.?) Investigate and discuss the findings.
5. Have students look back at what has been learned and design a top that will spin for a long time. Record the number of seconds various tops spin. Think about why!



Extension:

1. Investigate the effect of combining different patterns and colours on a spinning top.
2. Find out the origin of the "dreidel".

Resources for Problem Solving

Primary-P, Junior-J

Burns, Marilyn and Tank, Bonnie, *A Collection of Math Lessons* Grades 1 through 3, (also, Grades 3 through 6), Math Solutions Publication, 1988

Burns, Marilyn, *About Teaching Mathematics,* A K-8 Resource, Math Solutions Publications, 1992 **(P.J.)**

Burns, Marilyn, *Math for Smarty Pants*, Little Brown and Co., 1982 **(J.)**

Burns, Marilyn, *The Good Time Math Event Book.* Creative Publications, 1977 **(J.)**

Burns, Marilyn, *The I Hate Mathematics Book*, Little Brown and Co., 1975 **(J.)**

Clyne, Margaret and Griffiths, Rachel, *Books You Can Count On, Linking Mathematics and Literature,* Heinmann, 1991 (Irwin) **(P.J.)**

Cook, Marci, *Domino Math*, Creative Publications, 1988 **(P.J.)**

D'Angela, J. and Lessard, P, *The Geoboard Collection* (Grades 4-6)(Grades 7-9), Exclusive, 1990.

Graham, Noel and Blinko, Janine, *Mathematical Beginnings, Problem Solving for Younger Children*, Claire Publications, 1988 **(P.)**

Hyams, S., Challenges for Children, *Problem Solving For Young Children,* Claire Publications, 1989 (P)

Jones, Grant, *Problem Solving: What You Do When You Don't Know What to Do*, Grades 4 to 9, Exclusive, 1991

Roper, Ann, *Cooperative Problem Solving with Pattern Blocks* (Gr. 4-6), Creative Publications, 1989 **(J.)**

Roper, Ann, *Primary Cooperative Problem Solving with Pattern Blocks*, Creative Publications, 1990 **(P.)**

(See other cooperative problem solving titles which use a wide variety of manipulatives from Creative Publications.)

Seymour, Dale, *Problem Parade* (Grades 4-6), Dale Seymour Publications, 1984

Whitin, D. and Wilde, S., *Read Any Good Math Lately?*, Heinmann, 1992 **(P.J.)**

Arithmetic Teacher magazine, National Council of Teachers of Mathematics **(P.J.)**

Resources for Parents to use with Children

GAMES

Abalone (Exclusive)

Board Games - Monopoly, Junior Monopoly

Card Games - Uno, The Klutz Book of Cards

Computer Software - Tetris

Chess

Dominoes

Memory

Puzzles

Tangram Puzzles (Tangoes)

Backgammon

Harvest Time

Checkers

Connect Four

Jenga

Number Jumbler (Discovery Toys)

Ready or Not (Exclusive)

The Twenty-Four Game (Exclusive)

Triominoes

BOOKS

Blum, Raymond, *Mathemagic*, Sterling Publishing Co. Inc., 1991

Burns, Marilyn, *I Hate Mathematics*, Little Brown & Co., 1982

Burns, Marilyn, *Math for Smarty Pants*, Little Brown & Co., 1982

Haines, Max, *Mystery Challenge*, Wasn't That a Party Inc., 1992, Vol. 1-4

Metzner, S. and Sharp, R., *The Sneaky Square and 113 Other Activities for Kids.* Tab Books, 1990

Pinkney, John, *Big Book of Puzzles, Riddles and Muddles,* 5 Mile Press Ltd., 1992

Stenmark, Jean, *Family Math,* Addison Wesley, 1986

Townsend, Charles Barry, *World's Most Baffling Puzzles,* Sterling Publishing Co., 1992

Wells, David, *The Penguin Book of Curious and Interesting Puzzles*, Penguin Books, 1992

The Dell Book of Logic Problems #1, Dell, 1986

The Dell Book of Logic Problems #2, Dell, 1986

CHILDREN'S LITERATURE

COUNTING BOOKS

Anno, M., *Anno's Counting House,* Philomel Books, 1982

Anno, M., *Anno's Flea Market,* Harper & Row, 1984

Crossley, K., *Under the Sun and Over the Moon*, Doubleday, 1987

Crowther, Robert, *The Most Amazing Hide and Seek Counting Book*, Viking Penguin, 1981

Gretz, Suzanna, *Teddy Bears One to Ten*, Ernest Benn, 1969

Hutchins, Pat, *1 Hunter*, Greenwillow Books, 1982

Johnston, Tony, *Whale Song*, G.P. Putnam's Son, 1987

Lottridge, C., *One Watermelon Seed*, Oxford University Press, 1979

Macdonald, Suse & Oakes, Bill, *Numblers,* FitzHenry & Whiteside Ltd., 1989

Ockenga, Starr, *World of Wonders: A Trip Through Numbers*, Houghton Mifflin, 1988

Sendak, Maurice, *One Was Johnny*, Harper & Row, 1962

Twinn, M., *There Were 10 in a Bed*, Child's Play, 1979

NUMBER BOOKS

Anno, M., *Anno's Mysterious Multiplying Jar*, The Bodley Head, 1983

Birch, David, *The King's Chessboard,* Dial Books, 1988

Bogart, Jo Ellen, *10 for Dinner,* Scholastic, 1989

Burningham, John, *The Shopping Basket*, Collins Publishing Group, 1980

Carle, Eric, *The Hungry Caterpillar*, Scholastic, 1981

Carle, Eric, *The Rooster Who Set Out to See the World*, Franklin Watts Inc., 1987

Hutchins, Pat, *The Doorbell Rang*, Mulberry Books, 1986

Schwartz, David M., *How Much is a Million*, Scholastic Inc., 1989

GEOMETRY BOOKS

Anno, Mitsumasa, *In Shadowland*, Orchard Books, 1988

Anno, Mitsumasa, *Upside Downers*, Putnam & Grosse Group, 1971

Hoban, Tana, *Circles, Triangles, and Squares*, MacMillan, 1974

Hoban, Tana, *Look Again*, MacMillan, 1971

Hoban, Tana, *Shapes and Things*, MacMillan, 1970

Hutchins, Pat, *Changes, Changes*, MacMillan, 1973

Jonas, Ann, *Round Trip*, Greenwillow, 1983

Tompert, Anne, *Grandfather Tang's Story, a Tale Told with Tangrams*, Crown Publishing, 1990

MEASUREMENT BOOKS

Carle, Eric, *The Very Hungry Caterpillar*, Putnam Publishing Group, 1969

Caldone, Paul, *The Little Red Hen*, Seabury Press, 1973

Krauss, Ruth, *The Carrot Seed*, Harper & Row, 1945

Lionni, Leo, *Mouse Days*, Pantheon Books, 1980

Lotteridge, Celia, *Name of the Tree*, Greenwood Books, 1989

Marshall, James, *Yummers!*, Houghton Mifflin, 1973

Sendak, Maurice, *Chicken Soup and Rice,* Harper and Row, 1962

