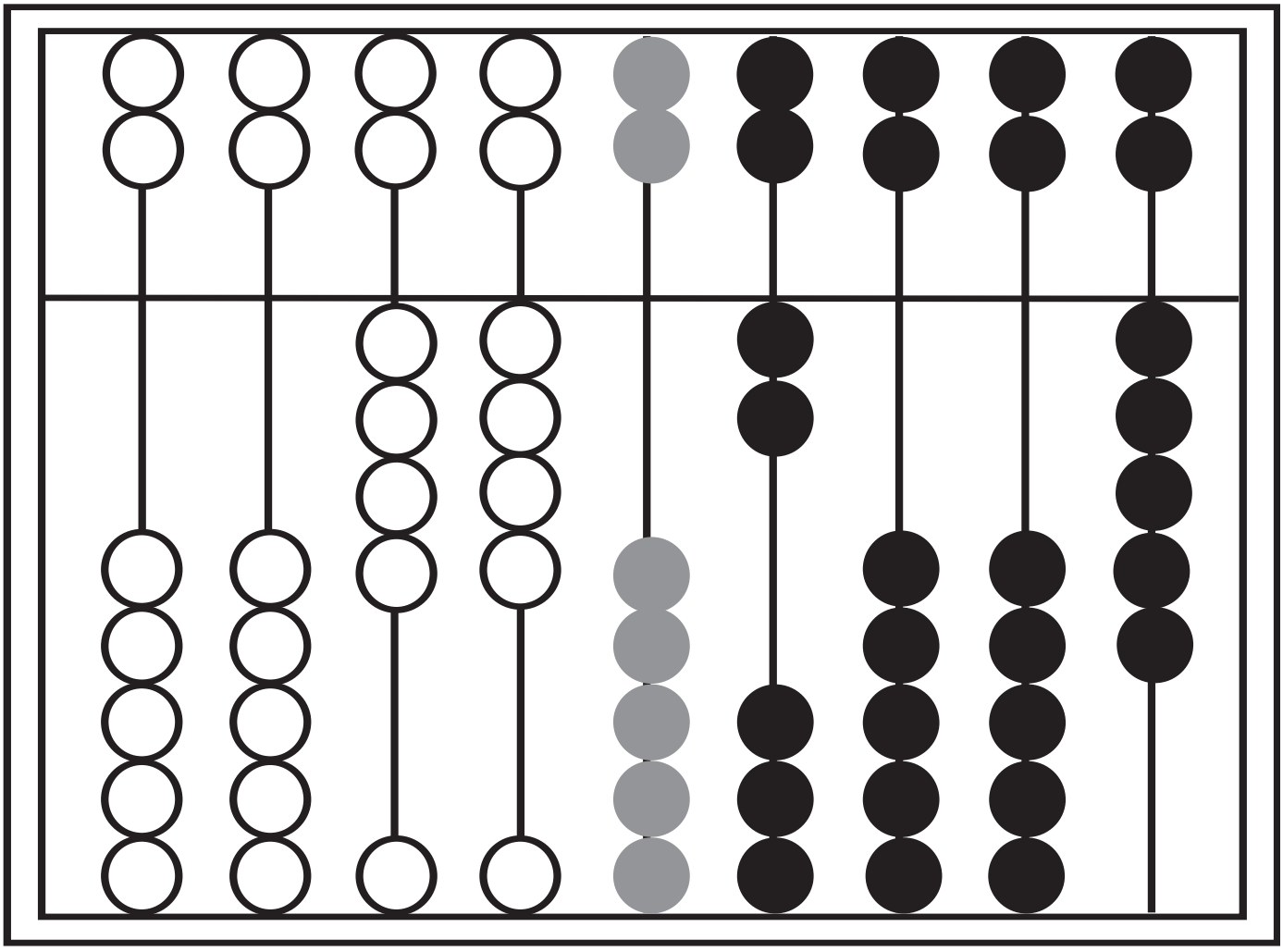
# Abacus

## Volume 44 2005



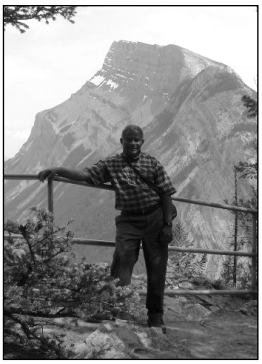
ONTARIO ASSOCIATION FOR MATHEMATICS EDUCATORS

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Edited by Trevor Brown

# ▲ From the Editor's Desk

***Trevor Brown***



*Welcome back to another school year!*

In this issue of *The Abacus*, we are breaking away from our tradition of presenting ready-made tasks for students, we shall be returning to that format in the next issue. In this issue, we shall be featuring two articles which have been submitted by our readers on the important theme of **Mathematics and Literature**. We introduced this topic last year, but we now feel that it would be appropriate to devote one entire issue to such a topic. It is our hope that whatever grade you are presently teaching, you will glean some ideas that can be can be used with your students.

The first article, **First There Was the Da Vinci Code, Then Came Casing Vermeer** was submitted by **Pat Margern** of York University. The second article, **Linking Children's Literature and Mathematics**, is by **Dr. Barba Patton**. Our deep appreciation to both authors.

As we begin another school year, we all need to be reminded why we enjoy the teaching of mathematics, to capture those wonderful "AHA" moments when the lights go on, when we hear, "I have got it!". Those moments that we have all witnessed serve as a constant reminder, if ever we need one, that teaching this remarkable subject is not a burden but one that truly makes the "invisible visible", to use Keith Devlin's memorable phrase. The following extract is taken from Alex Bogomolny's column "Cut the Knot", and was written after Keith Devlin had delivered the Commencement address to one of the mathematics graduating classes of the University of California at Berkeley.

### Mathematician:

> You are the prime meme carrier. You know that mathematics is enjoyable. Share it. Spread the right memes. Resist the "Who cares?" infection.

### Teacher:

> You are the prime transmitter. Foster math appreciation. Help students make their own discoveries. Do not shove it down their throats. Utility of mathematics is not the best justification to sweat over it. Thomas Tymoczko explains this the following way: Mathematics must not necessarily be useful to be applicable. A leaf is symmetric without any derived utility for the human beings. In teaching mathematics, they (math teachers) insist on stressing its utility, even when it has none. As a result , they often hide from their students the excitement and intrinsic interest of mathematics; hey hide it behind a façade of utility. It's rather like trying to awaken people to the joy of mountain climbing by trying to convince them that someday they might need to climb a mountain.

[For the full article see: *Cut the Knot* by Alex Bogomolny
http://www.cut-theknot. org/ctk/memes.shtml]

# ▲ Literature Review

## First There Was *The Da Vinci Code*, Then Came *Chasing Vermeer*

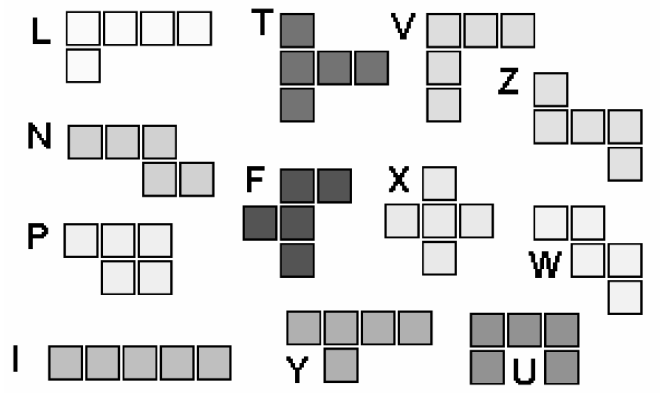



The focus for this article's literature review is the novel, *Chasing Vermeer* by **Blue Balliet**. For those of you who are not familiar with the novel *Chasing Vermeer*, published by Scholastic, a definition constructed from quotes from reviews for the novel might look like this:

> Chasing Vermeer: *a novel about a puzzle, wrapped in a mystery, disguised as an adventure, and delivered as a work of art; a Da Vinci Code for tweens (*Newsweek*); exciting . . .mixes mystery, puzzles, possibilities, and art (*Booklist*)*

One of the potentials of the novel is the very strong connection to mathematics through the fascination of one of the main characters, Calder Pillay, with pentominoes.

For those of you who are not familiar with pentominoes, here is one definition: Pentomino: a geometric shape composed of five (Greek πευτε / *pente*) identical squares, connected orthogonally. Compare this to a **domino** (two squares), **tetromino** (four squares), or **polyomino** (any number of squares).



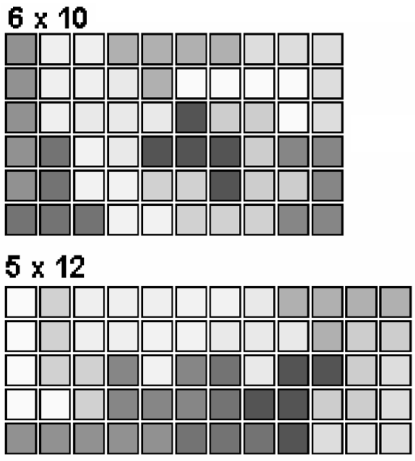

**http://en.wikipedia.org/wiki/Pentomino**

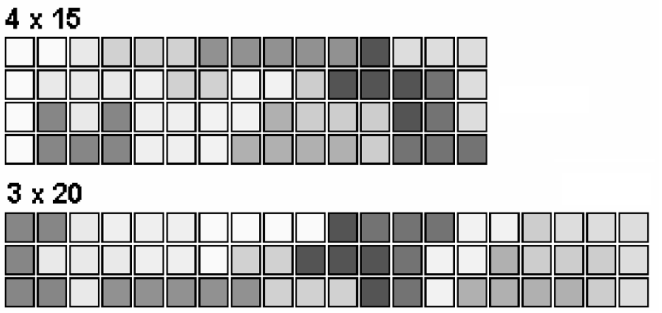
There are twelve different pentominoes, and they are named after letters of the alphabet. (The mirror image of a pentomino does not count as a different pentomino.)

Calder Pillay's fascination with pentominoes began when he received his first set as a twelfth birthday present from his cousin. He sees pentomino shapes in the hinges of the cabinets in his kitchen, creates a code based on pentomino letters for secret communication with his friend, Tommy, dresses up as a pentomino for Hallowe'en, keeps a set of pentominoes in his pocket and pulls out one of the pieces to prompt thinking when confronted by a problem and challenges himself to use pentominoes to make rectangles.

The novel can be used as a context for providing experiences with the revised curriculum expectations and processes. Composing and decomposing shapes is identified as a big idea in the Foundations of Learning support materials for Geometry. Composing and decomposing is also a strategy that is identified in the curriculum expectations (e.g., Grade 6 Measurement) for identifying geometric relationships and applying them to the context of measurement. Students can engage in Calder's challenge of making rectangles to experience composing shapes.

The following are some examples of rectangles that are composed of pentominoes:






**http://www.snaffles.demon.co.uk/pentanomes/pentanomes.html**

A set of printable pentominoes and a grid for making rectangles can be downloaded from the following website: **http://www.scholastic.com/titles/chasingvermeer/pentominoes.pdf**

Pentominoes can also be valuable learning tools for experiencing dilatations, an extension to investigations of similarity and congruency that is described in the following expectation from the Geometry and Spatial Sense strand for Grade Seven:

- distinguish between and compare similar shapes and congruent shapes, using a variety of tools (e.g., pattern blocks, grid paper, dynamic geometry software) and strategies (e.g., by showing that dilatations create similar shapes and that translations, rotations, and reflections generate congruent shapes) (**Sample problem**: A larger square can be composed from four congruent square pattern blocks. Identify another pattern block you can use to compose a larger shape that is similar to the shape of the block.)

Students can investigate the concepts in this expectation through challenges such as the following:

# ▲ Pentomino Challenges

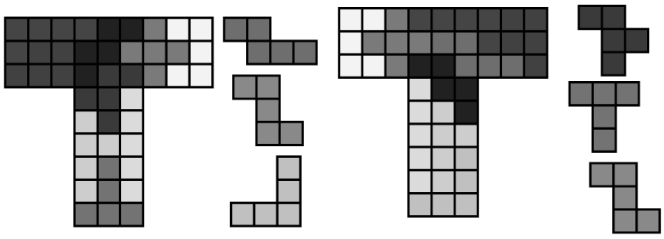
## Enlarging Pentominoes

All the pentominoes, except V and X, can be enlarged by a factor of 2 by using 4 of the other pentomino pieces. The piece you are enlarging will not need to be used in this. Each pentomino can be enlarged by a factor of 3 by using 9 of the other pentomino pieces. The piece you are enlarging will not need to be used in this.

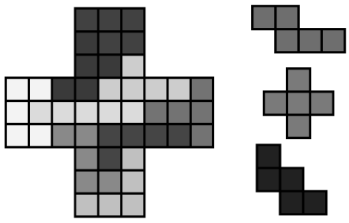
## Magnification Problems

Pentominos with triple magnification:

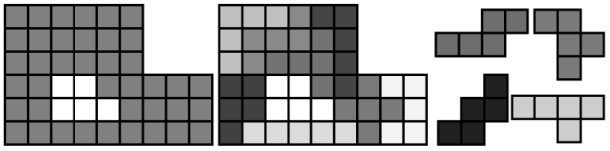
You build a pentomino with triple magnification. You need nine pieces. Three pieces are left.



It is more difficult not to use the pentomino concerned.

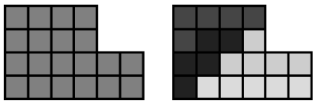


You can skip one pentomino in a triple pentomino and fill up the rest with eight pentominos. Four Pentominos are left.



**Double Pentominos:**

You can imitate some compact pentominos in double size. You need four pieces, eight ones are left.



**http://www.mathematische-basteleien.de/pentominos.htm# Magnification%20Problems**

There are several websites that provide additional ideas for learning activities based on the novel including:

1. "On this website you will find all kinds of activities to do while we are reading Chasing Vermeer."
**http://adifferentplace.org/vermeer.htm**

2. *Chasing Vermeer's* homepage with interactive pentomino puzzles
**http://www.scholastic.com/titles/chasingvermeer/**

The following quote from the preface to the book seems to summarize the author's intent in using pentominoes as a central focus of his book:

> *"This book begins, like a set of pentominoes, with separate pieces. Eventually they will all come together. Don't be fooled by ideas that seem, at first, to fit easily. Don't be fooled by ideas that don't seem to fit at all. Pentominoes, like people, can surprise you."*

This seems to be an authentic connection between mathematics and literature.

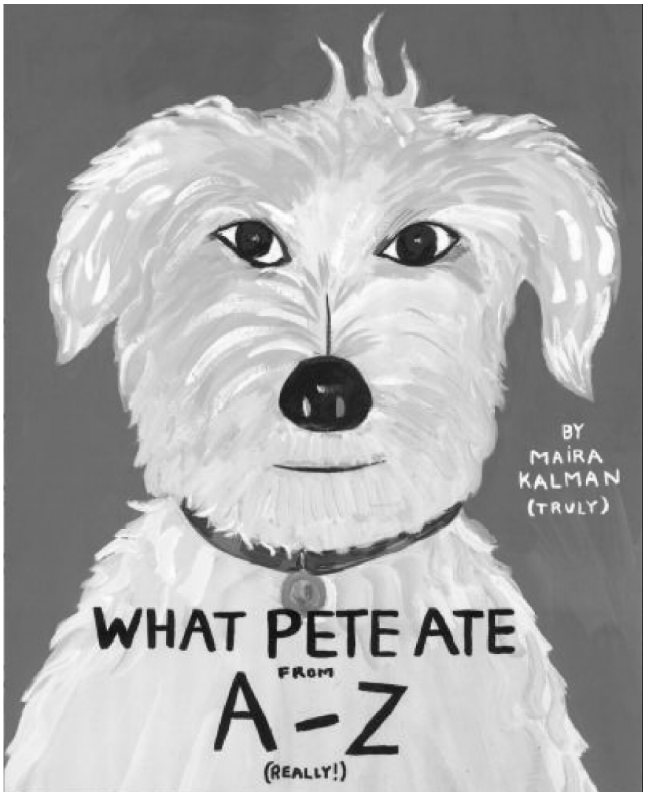
# ▲ Measurement and Fraction Activities: Linking Children's Literature and Mathematics

Children's literature and mathematics are an unadulterated fit for today's curriculum. Simply stated, books and students should be brought together to make learning more purposeful in all content areas, not just reading and language arts. Many textbooks become an encyclopedia packed with huge amounts of facts and details such that the subject matter is unbearable and un-enjoyable for the learners. According to Richgels, Tomlinson, and Tunnell (1993), unflattering representations of incomprehensible textbooks flood many of today's classrooms. Teaching and learning does not need to be this way. Alternatives exist for teachers who are inclined to use supplementary text materials. One example of such material would be children's literature. Children's literature provides students of all ages opportunities to interact with a human element that traditional textbooks just do not have (Ravitch and Finn, 1987). Children's literature is not meant to be the omnipotent answer to reading and learning, but it can be brief and meaningful text that is not academically insulting. It is a tool for sparking children's interest in reading while providing a foundation for working within the various content areas. One such content area is mathematics.

According to Guiett (1999), students are threatened by the rules and regulations that mathematics impose upon them. However, this feeling of intimidation need not be cause for alarm because many possibilities exist for alleviating this fear be it real or imagined by the students. One such possibility is the incorporation of children's literature into the

mathematics classroom. In order for students to connect the abstract language of math, they must be able to engage with this subject in the most natural of means; their personal world (1996 Klages, Patton, and Nagel 2005; Patton, Klages and Nagel, 2005; Whitin and Whitin,1996). Children's literature is the vehicle to make this personal connection.

Using the children's literature written by Maira Kalman, *What Pete Ate from A-Z*, the authors developed and utilized a number of activities to help children learn math. A few are included in this paper.




**BOOK:** *What Pete Ate From A-Z*

**AUTHOR:** Maira Klaman

**PUBLISHER:** Puffin, New York

**SUMMARY:** *What Pete Ate* is an example of children's literature that is both educational as well as humorous. Pete is the author's dog and the book describes the many adventures Pete ate various valuables that belong to the author's family. The illustrations fully support the text with bright colors and whimsical drawings.

## Objectives:

- The students will be able to measure objectives accurately.
- The students will be able to divide groups of objects into groups to illustrate ½, ¼, ¾, ⅓, ⅔, ⅕, ⅖, ⅗ and ⅘.

First we had some activities that would deal with things that are needed to care for Pete. The later ones involve some of the things that Pete ate.

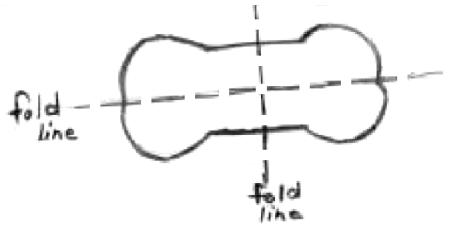
## Activity 1

Often children only read the last number on a ruler and do not fully understand that they are trying to determine the number of units that the object covers. This activity just places the paper bones at random places on the floor chart and has the children determine the number of units it covers. These can be prepared by simply placing rulers on a copier, make a copy on heavy paper i.e. index paper, cut out then tear off the end. Be sure to make a number of rulers and have the children to use a different ruler for each task in order to become more proficient with the broken ruler.



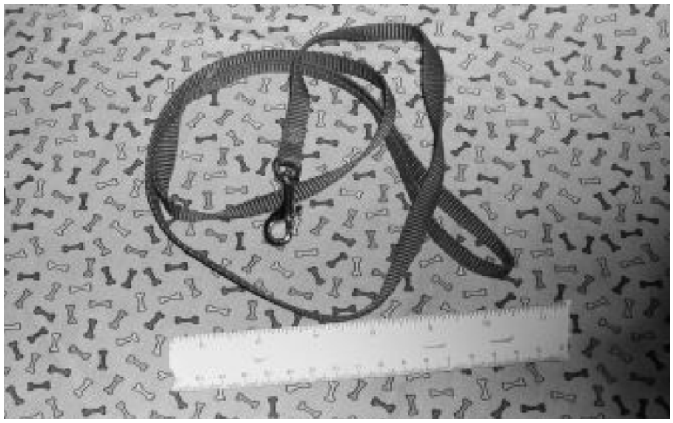
The floor chart is prepared by using the back a piece of vinyl wallpaper approximately 8" by 13'. Mark one foot intervals on the chart as 0, 1,2,3, … using a permanent marker.

The paper dog bones where prepared by folding large pieces on paper in fourths and then cutting in the shape of a dog bone. One was about 2' and the other was about 3'.



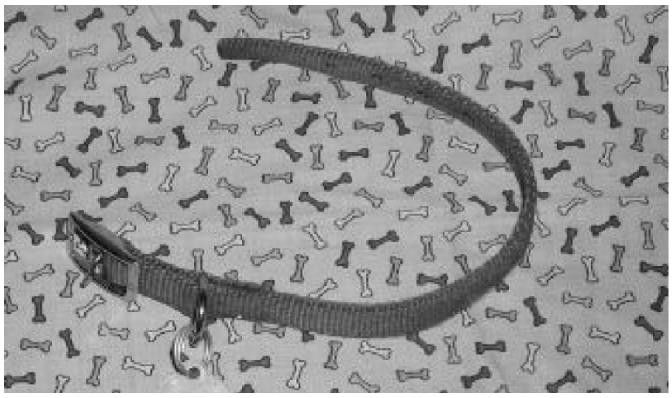

## Activity 2

Measuring leashes is fun and will provide practice for the children to measure. For this activity you will need several different leashes or ones prepared from ribbon if the real ones are not available and rulers. The children used both the broken and the standard ones successfully.



## Activity 3

Measuring the collar and tag can be a challenge for some children. Of course, collars range in size. Using either real collars or make simple ones with ribbon and buckles, let the children practice using their broken ruler as well as standard ones to gain more accuracy with the task.



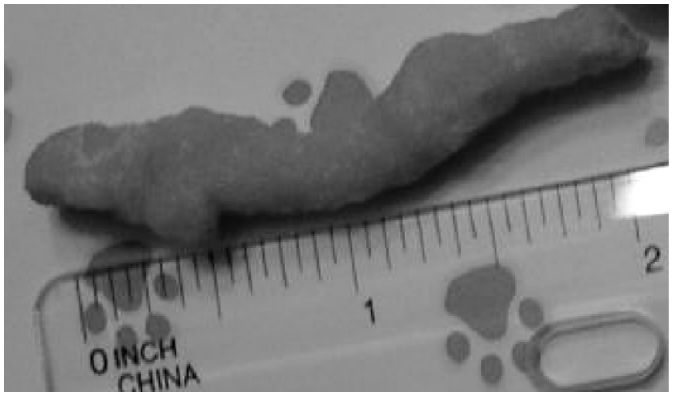
## Activity 4

Dog bowls come in all sizes therefore it can be an endless supply of items for the students to measure. Again using the broken ruler or a standard one, the children were asked to measure different dog bowls such as below. If actual bowls are not available various plastic dishes could be substituted.



## Activity 5

Using cheez snacks similar to the ones that Pete ate, the children were able to measure the length of each to the nearest ¼ inch.



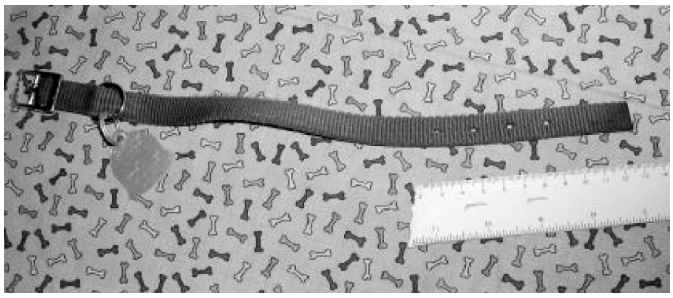
## Activity 6

For a different approach to fractions, the students were able to count the number of cheez snack pieces in a bag, then divide them into two groups to determine what is one half. They were also able to determine ¼ and ¾ of a bag as well as ⅓, ⅔ and ⅕, ⅖, ⅗ and ⅘. Of course, it was not possible to determine all fractions with every bag. This is a great activity to introduce factors and divisors.



## Activity 7

For some of the more proficient children, use collars with adjustable sizes. They can measure the different sizes. If a variety of sizes is not available use ribbons and buckles to make a few in order for the students to have a range of sizes.





## References:


Guiett, D. (1999). From alphabet to zebras: Using children's literature in the Mathematics classroom. *Ohio Media Spectrum, 51*, 32-36.

Klages, C., Patton, B., & Nagel, A. (2005) *Gone to the Dogs presentation presented at the Hawaii International Conference on Education, Jan 6, 2005*, Honolulu, HA.

Patton, Klages and Nagel, (in press). *Measuring Penny*. Texas Mathematics Teacher.

Ravitch, D., & Finn, C.E. (1987). *What do our 17-year-olds know?: A report on the first national assessment of history and literature.* New York: Harper and Row.

Richgel, D.J., Tomlinson, C. & Tunnell, M.O. (1993). Comparision of elementary students' history textbooks and trade books. *Journal of Educational Research, 86*,161-171.

Whitin, D.J. and Whitin, P.E. (1996). Fostering metaphorical thinking through Children's literature. In P.C. Elliott (Ed.), *Communication in mathematics: K-12 and beyond, 1996 yearbook of the National Council of Teachers of Mathematics* (pp.60-65). Reston, VA: National Council of Teachers of Mathematics.