Counting on Frank

Purpose:

This is an activity based on the picture book ***Counting on Frank.***

Achievement Objectives:

GM2-1: Create and use appropriate units and devices to measure length, area, volume and capacity, weight (mass), turn (angle), temperature, and time.
AO elaboration and other teaching resources

Specific Learning Outcomes:

1. Students will explore and compare the volume of different containers using non-standard and standard units.
2. Students will be able to explain why standard units of volume are necessary when making comparisons.

Description of mathematics:

1. To understand measurement concepts such as length, rate, or volume, it helps to create units from our everyday experience and use these to compare to standard units.
2. Estimation is an important skill in measuring and comparing attributes.

Required Resource Materials:

Counting on Frank by Rod Clement
Containers of different shapes and sizes including large boxes and jars
Objects to fill boxes and jars
Cubic centimeters from place value blocks
Rulers and measuring cups

Activity:

Frank's Units: Estimating and Measuring Volume
This activity is based on the picture book ***Counting on Frank.***

Author: Rod Clement
Illustrator: Rod Clement
Publisher: Angus and Robertson (1990)
ISBN: 0-207-17322-2

Summary:
Frank is a big dog and Frank's owner has a brain and knows how to use it when it comes to numbers. Frank's owner shares his knowledge of the size and scope of things such as the growth rate of a gum tree or the volume of the shopping trolley. It is a humourous look at measurement and comparison.

Lesson Sequence:

1. Prior to reading, make the connection to the story by pointing out the lolly jar on the cover and ask
   Who has tried to guess the number of lollies in the jar?
   What strategies did you use to make your guess?
   Did any of you ever win?
   Do you have to get the exact number?
   What does estimation mean?
2. Share the book with the students drawing their attention to the times when Frank's owner makes an *estimate* (like when he uses the word "about"), when he *calculates* (exact numbers) and when he just *knows* a fact. You can have one student record all the measurements on the whiteboard or modeling book as you read the story so the numbers can be re-visited at the end.
3. After reading ask
   How do you think he KNEW there were 745 jelly beans in the average lolly jar?

4. Show the students a jar and have them estimate and record on scrap paper how many "lollies" will fit inside. Don't show them how big the "lollies" will be. Save the "guesses. Demonstrate filling the jar with extra large "lollies" (such as large beads or tennis balls) and record the number and then with extra small "lollies" (such as counters or beads) and record the number. Introduce the term VOLUME and discuss how the number describes how much space inside the container is filled. Discuss why the volume in large lollies is a smaller number than the volume in small lollies.
5. In partners or small groups ask the students to explore the idea of volume with the containers in the room. Ask them to select two containers and fill them both with the same objects (create a unit) and record their measurements with diagrams of the containers and a description of the volume using their chosen unit.
6. Allow students the opportunity to share their recordings with the class and to compare the measurements.
7. If students are confident with this type of activity you can move on to using standard units such as centimeters. Measure the height length and width of small boxes and then fill them with place value blocks. Compare the count for the blocks and the calculation using the formula: volume = length x width x height.

Frank and Fermi

Hot ideas: a mathematical response to a piece of text.

Link/Page Citation

Hot Ideas for this edition provided by Melinda Grey, a teacher education student from the University of South Australia.

Children's literature can enhance mathematics lessons by providing a meaningful context, demonstrating that mathematics develops from human experiences and contributes and aesthetic dimension to learning mathematics (Reys, Lindquist, Lambdin, Smith & Suydam, 2004). Some children's books provide a particularly rich source of mathematical activities and problem solving tasks. Rod Clement's Counting On Frank (1990) is an excellent example of such literature. Counting On Frank is written as a series of real life inspired snapshots of mathematical thinking. Showcased in words and pictures, the main character is constantly solving problems by considering mathematical concepts such as fractions, scale, volume, measurement, estimation, averages and spatial awareness as they might apply in daily life. For example, he calculates how long it would take to fill the entire bathroom with water, how much of his father would fit into the television and how many years it would take before peas knocked off his plate every dinner time would reach the level of the dining room table.

The book can be linked to various grades and strands in syllabus documents across Australia, including Data, Measurement, Number; Pattern and Algebra; Space and Geometry. The following activities are based on sections from Counting On Frank (Clement 1990). For each activity, read the relevant text to or with the children as a stimulus for solving the accompanying problem.

The main aim of each of these activities is that students collect, analyse and organise information, communicate ideas and information, work with others, use mathematical ideas and techniques, and solve problems.

Activity 1

I calculate that only one Dad would fit inside our big television, but only one-tenth of him would fit in Mum's portable. Mum said she would prefer the top part because Dad's feet smell. (Clement 1990, p.7)

Problem

A life-size manikin of yourself is being shipped overseas to be used as a shop model. Due to international regulations, your manikin cannot be shipped already assembled. You need to disassemble your manikin and store it in a minimum of three boxes, ready for shipping. Working in pairs, investigate the following:

* How many parts will you break your manikin into and why?

* How would you describe these parts as fractions of your manikin's body?

* How would you describe these parts as percentages of your manikin's body?

* What sizes and shapes will your boxes need to be in order to accommodate your manikin?

Hint: Remember that the less space your manikin takes up, the more manikins can be shipped at once.

Resources

* Photocopies of the problem for reference

* Measuring equipment (tapes, rulers etc)

* Textas, pens, pencils

* Butcher's paper, working paper

* Calculators

Further activities

For those who are not sure where to start: Consider which materials you might use to measure your partner from head to toe:

* What would you use and why?

* What else might you use?

* How would you record your findings?

Measure the length of your arms, legs and torso. Now measure your knee to your foot and your elbow to the tip of your fingers.

* What do you notice?

* Are there similarities and differences between your measurements and your partner's measurements?

For those who finish quickly

Further points to consider:

* How much space does your disassembled boxed manikin take up?

* What size cargo hold would you need to fit a class of manikins like yours?

* What about a school of manikins like yours?

Some Fermi Questions

In a Fermi question, the goal is to get a reasonable idea of the answer quickly, by making some reasonable assumptions about the situation. You will not have the absolute knowledge to get an "exact" answer.

1) Can you live to be a million seconds old? A million hours old? A million days old?

2) Could you put $1 000 000 worth of $1 coins in a pile under your desk? What about a billion dollars' worth of $2 coins?

3) How many people could you cram into the classroom? How many balloons? How many ping-pong balls?

4) How many maths lessons are taking place in Australia today?

5) How much money is spent in the school canteen each day?

6) If all the people in the world joined hands and stretched themselves out in a straight line, how long would it reach? Could you go around the world?

7) How many hairs are there on your arm?

8) Ignoring oceans and such, how long would it take to walk entirely around the world?

9) How much water per year flows in the Yarra under the Princes Bridge?

10) How many semi-trailer loads would it take to move Mt. Kosciusko? How long would it take?

11) If I had a billion drops of water, how much water is that? Would it cover the MCG? How deeply?

12) How fast is the earth travelling as it orbits the sun?

13) How big is a 1:1 000 000 scale map of Australia?

14) If all the people in the world moved to Victoria, how crowded would it be?

15) How long would it take you to drink all the water in an Olympic pool?

16) How many grains of rice are in a 10 kg bag?

17) How many people do you know? How many people do they know?

18) How high are a million kids standing on each other's shoulders?

19) How large a bowl would you need to hold a million goldfish?

20) How many pages would be needed to show a million stars?
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21) How long would it take to count to a million?

22) How many grains of sand are there on St Kilda beach?

23) How many Ford Falcons are equal in mass to the mass of the water in an Olympic-sized swimming pool?

24) How many jelly beans fill a one-litre jar? What about a bucket?

25) What is the mass in kilograms of the student population of your school?

26) How many litres of petrol are used by cars each year in Australia?

27) What is the weight of solid garbage thrown away by Australian families every year?

28) How many individual frames of film are needed for a feature-length film?

29) How many hot dogs or meat pies will be eaten at AFL games during a one year season?

30) How many revolutions will a wheel on the bus make during a trip from Sydney to Melbourne?

31) How many pizzas will be ordered in Victoria this year?

32) If you had a stack of $2 coins as tall as Mt Kosciusko, what would it be worth? Could you fit it in your bedroom?

33) How far do you walk in an average week?

34) How much water does your household use each week? Can you answer this without using a water bill?

35) How many maths lessons will you have in a lifetime?

36) Spend exactly $1 000 000 using things for sale in the newspaper

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Some useful information:

Radius of the earth: about 6400 km
Distance of the earth from the sun: about 150 million km
Distance of the moon from the earth: about 380 000 km
Population of the world: about 6 billion
Population of Australia: about 20 million
Population of Melbourne: about 3.5 million
Area of Tasmania: about 68 000 square km
Area of Victoria: about 228 000 square km
Area of Australia: about 7 700 000 sq. km
Height of Mt Kosciusko: 2230m

Pose your own question ...