Junior Fractions

With reference to the work of Peter Hughes, the late Richard Skemp, Van de Walle and other researchers.

- Fraction rope activity
- Information about teaching fractions
- Hands on - Bits and Parts
- Language of Fractions
- Reflection

Are fractions difficult?

- Students around the world have difficulties in learning about fractions.
- In many countries, the average student never gains a conceptual knowledge of fractions.
- Why? Discuss in your thinking groups.

- Fractions offer students their first lesson that many properties that are true of whole numbers are not true of fractions. (They cannot treat fractions as they do whole numbers).

- Fractions, (perhaps with the exception of a half), are much more difficult for students to understand than whole numbers because they are essentially very different. …….Therefore teachers should expect student understanding of fractions to emerge very slowly. This is a major challenge.

- There are an infinite number of fractions - even between any two fractions.

Why are fractions important?

- Research indicates that “early experiences with physically partitioning objects or sets of objects may be as important to a child’s development of fractions concepts as counting is to their development of whole number concepts” (Behr & Post, 1992)

- Fractions are essential for learning algebra, geometry and other aspects of higher mathematics.

The Initial Teaching of Fractions is very important.

Teachers should be aware that they need to create a sound basis for later when students come up against very challenging fraction ideas. Great care is needed in the teaching of fractions.

"Research has shown that if fractions are approached in a developmental manner, students in the junior school can be helped to construct a firm foundation of fraction concepts, preparing them for the skills that are later built on these ideas" (Van de Walle).

- Young children understand the concept of equal sharing. Research has shown that they can distribute a set of objects among a small number of people such as 12 biscuits shared among 3 people. By the age of 5, they can share a single object (candy bar) among several people. This early knowledge needs to be built on.
- The first goal should be to help them construct the idea of fractional parts of the whole - the parts that result when the whole has been partitioned into equal sized portions or fair shares.

Models of Fractions:

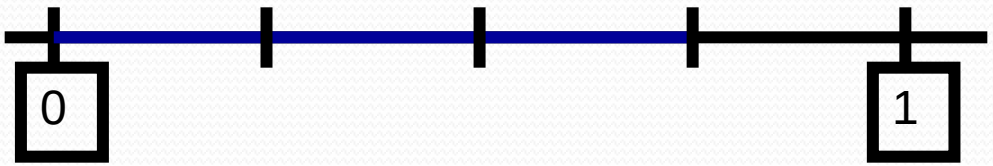
- There are two main models of fractions.

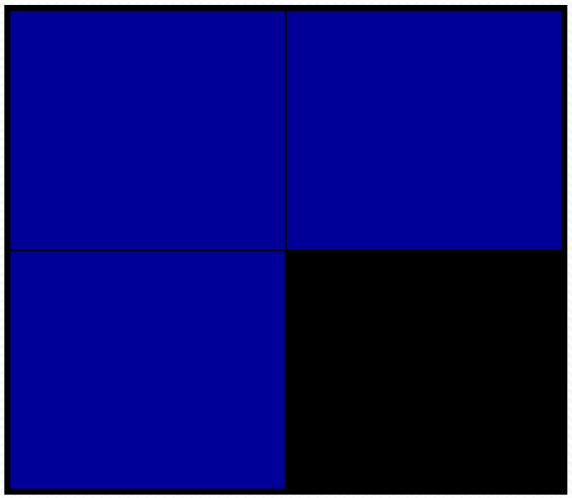
- If I was to ask you to show 3 quarters using any of the materials on your table, what could you come up with?

Continuous Model:

- Models where the object can be divided in any way that is chosen.

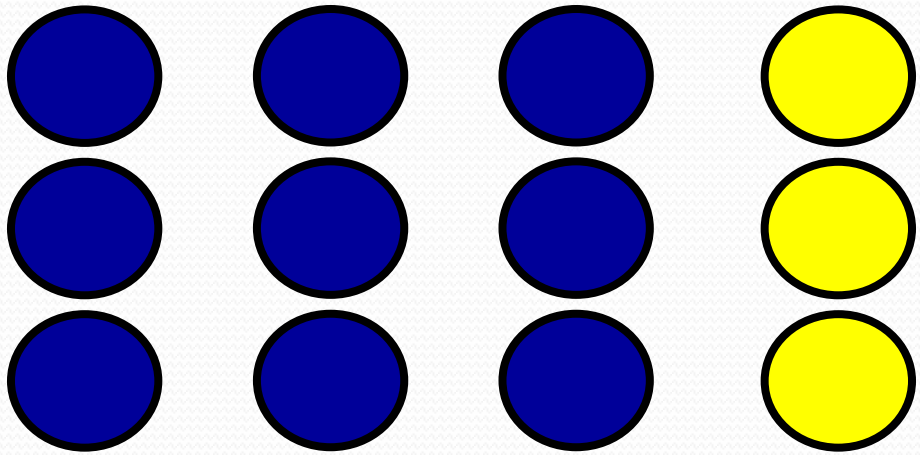
  e.g. ¾ of this line and this square are blue.





Discrete Model:

- Discrete: Made up of individual objects.
  e.g. ¾ of this set is blue



Sharing activities - using discreet models

- These can be used to help students understand the relative sizes of fractions eg.
- Sharing 12 lollies between 2 people - each get 6
- Sharing 12 lollies among 3 people - each get 4
- Sharing 12 lollies among 4 people - each get 3
- Sharing 12 lollies among 6 people - each get 2
- Sharing 12 lollies among 12 people - each get 1

- This can later be linked to fractional notation where students can learn that 1/4 is less that 1/3.

Sharing - using continuous models

Early on it is suggested that initially students have multiple opportunities to model a half of a region.

The equality of halves needs to be emphasised.

Young children will understand the injustice that “my brother got the big half of the cake” without realising that a “big half” is a contradiction.

Students need experiences with equal regions. At this stage students will typically see “halves” as two identical regions. Frequent exposure to problems involving drawing and colouring in halves is important. Cutting to produce halves would be good (as long as children have the fine motor skills to do this).

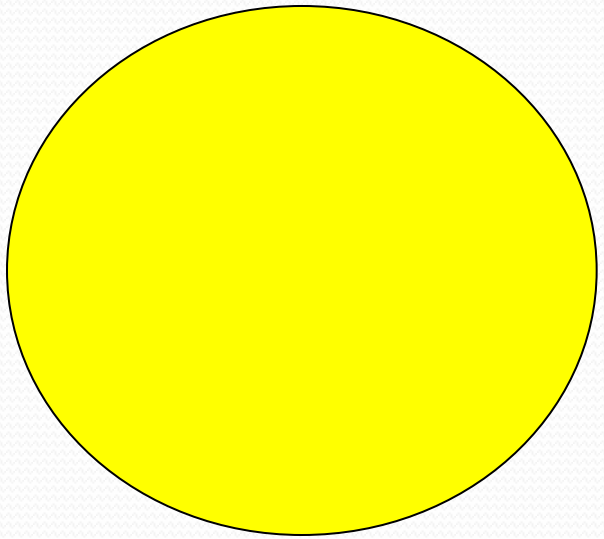
Whole to Part - Part to Whole

- A more challenging, but worthwhile, view of halves, is to give students a region representing a half and ask them to make a whole.

Whole to Part:

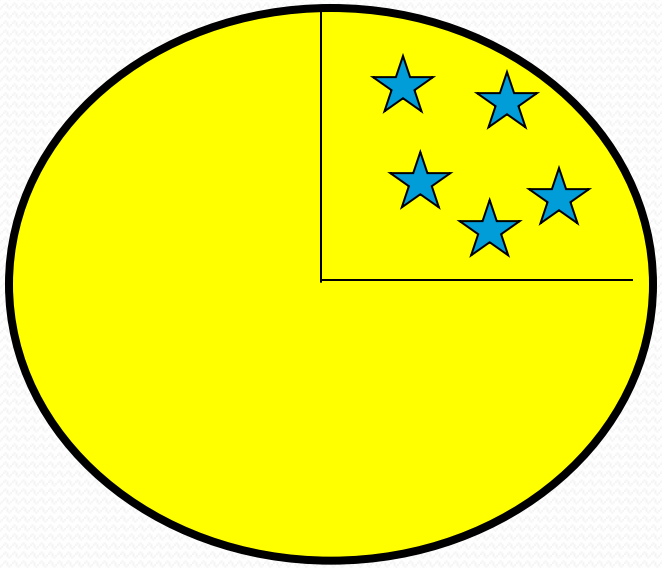
- Most fraction problems are about giving students the whole and asking them to find parts.

- Show me one quarter of this circle?



Part to Whole:

- We also need to give them part to whole problems, like:



- 5 is a quarter of this number.

What is the number?

“What I cannot create, I do not understand.”

Richard Feyman, physicist.

- It is important for students to ‘mess around’ and become active participants in the process of learning/knowing and to construct their own models and ideas.
- The need and desire to understand (making sense) is a fundamental human activity.
- The lens through which the world is filtered is unique for each learner. How and what a student understands is connected to their personal experiences.
- With this in mind, knowledge can only be generated by the learner.

The Story

- Tane and his brothers and sisters are at their Poua's tangi and although they are sad they are looking forward to the hakari because eel (tuna) is always on the menu. Tane is planning to go early to the marquee because he wants one eel all to himself. He is given one whole eel. Tane doesn't know it but he is going to be one sick boy! The twins appear and they are told they have to share one eel evenly between the two of them. There are now two half parts. The triplets come next and Aunty Wai says we will have to cut another eel into three equal parts. There are now three third parts. Tane's sister has come with her three friends. Aunty Wai says that they will have to cut the eel into four equal parts. There are now four fourth parts. Aunty Wai says they are also known as quarters. Hoepo's five baby cousins are only allowed to eat small portions so Aunty Wai cuts the last eel into five equal parts. There are now five fifth parts.

The language of fractions

Initially, fractions should be written in words and the whole explicitly referred to. For example, students should be encouraged to say or write “one half of an orange” rather than simply “one half”

This does two things:

- it encourages student to always think about what the “whole” is and
- it avoids the confusions that arise from reading 1/2 as “one out of two” or “one over two’, or “one divided by two” or “the ratio one to two”.

So it is not a good idea to introduce the fraction symbols, too early.

Fractions and Stages (Peter Hughes)

At Stage 2: Counting from One on Materials

Given wholes, students can draw and cut halves of regions – halves are identical

- Given identical halves of regions, draw and construct wholes
- Describe halves in words either orally or written, and always include reference to the whole

Stage 3: Counting from One by Imaging

As above and the following is optional

- Given wholes draw and cut identical shaped thirds and identical shaped quarters of regions. Include two thirds of, say, an orange, two quarters of a cake, three quarters of a pie
- Describe thirds and quarters in words whether orally or written, and always include reference to the whole.

Stage 4: Advanced Counting

- Given wholes draw and cut identical shaped thirds and identical shaped quarters of regions. Include two thirds of an orange, two quarters of a cake, three quarters of a pie
- Given identical thirds or quarters of rectangular regions draw and/or make wholes with material
- Describe thirds and quarters in words, and whether orally or written, and always include reference to the whole.

Stage 5: Early Part-whole

- So far, the use of fraction symbols has been avoided. This is deliberate. It helps students avoid incorrectly constructing inadequate concepts of fractions. Even after symbols are introduced, it is important to still say the words correctly - 3/4 said as three quarters.
- Fractions are compared eg 2/11, 2/15, 2/7.
- Up till this stage, most work has been done with continuous models - fractions of regions. Now work on fractions of sets, using unit fractions.

In addition

- Teachers need to understand fractions themselves ie. have a firm conceptual knowledge of fractions themselves, and, along with knowledge of students' common errors and misconceptions will be able to improve students' learning about fractions.

Summary of key ideas:

- Fractional language - emphasise the “ths” code.
- Fraction symbols - use symbols with caution. Combine language, symbols and a visual representation to consolidate understanding.
- Continuous and discrete models - use both.
- Go from Part-to-Whole as well as Whole-to-Part.
- Fractions are always relative to the whole.
- Begin to teach fraction when children are at stage 2!!
- Use the teaching model to develop conceptual understanding.