Singapore Maths

Children can under perform in mathematics because they find it boring or they can't remember all the rules.

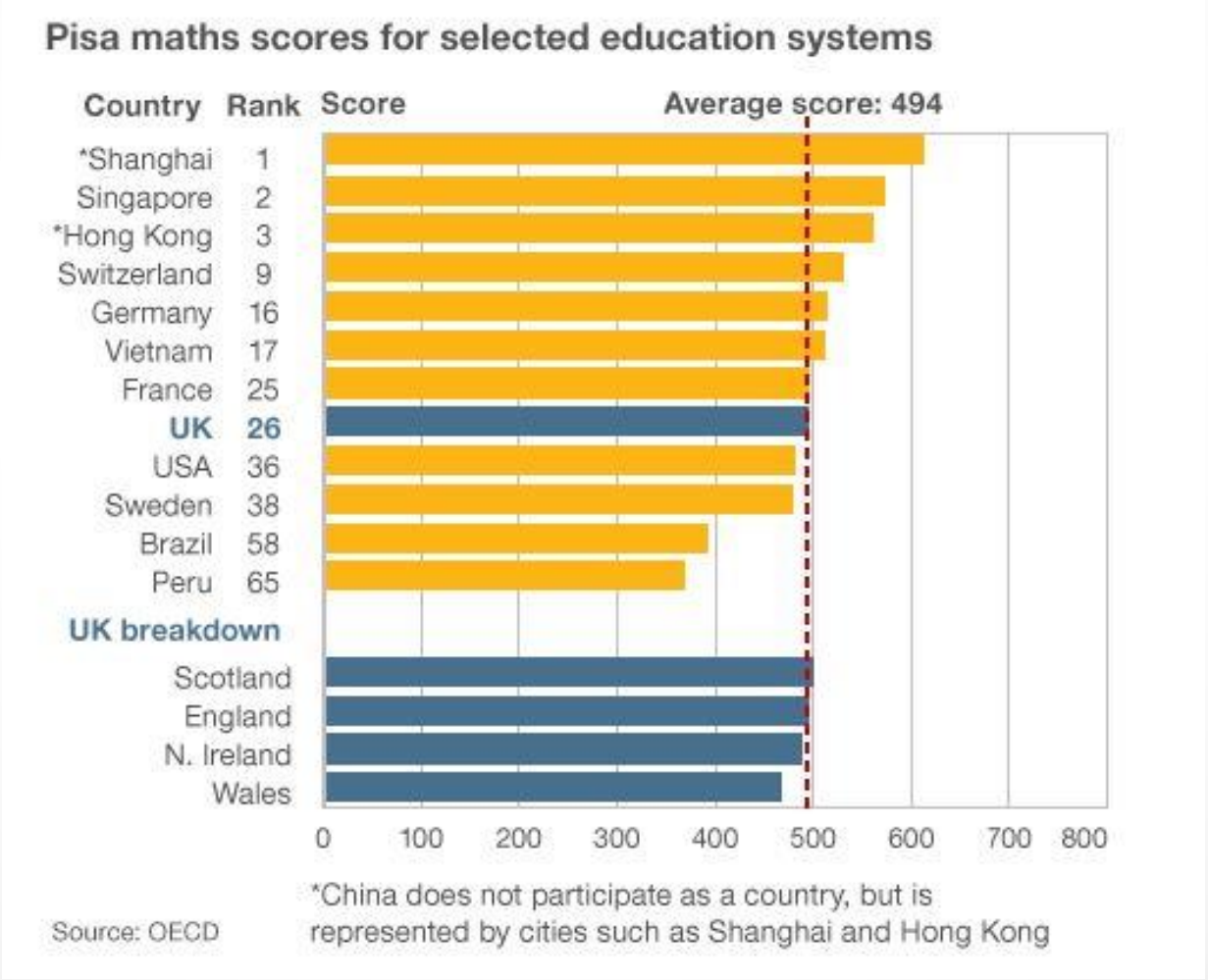
The Singapore method of teaching mathematics develops pupils' mathematical ability and confidence without having to resort to memorising procedures to pass tests - making mathematics more engaging and interesting.

All in agreement...

Ofsted, the National Centre for Teaching Mathematics (NCETM), the Department for Education, and the National Curriculum Review Committee have all emphasised the pedagogy and heuristics used by Singapore. This method is now being used successfully in the UK by the Ark academies, the Harris Federation, Primary Advantage as well as numerous state, free, and independent schools.

Results...

Singapore Maths has produced a world-class level of achievement for years. Singapore students scored first in the past three "Trends in International Mathematics and Science Studies" (TIMSS).



Features of Singapore Maths:

- Emphasis on problem solving and comprehension, allowing children to relate what they learn and to connect knowledge
- Careful scaffolding of core competencies of :
  - visualisation, as a platform for comprehension
  - mental strategies, to develop decision making abilities
  - pattern recognition, to support the ability to make connections and generalise
- Emphasis on the foundations for learning and not on the content itself so students learn to think mathematically as opposed to merely reciting formulas or procedures.

The Perfect Model: CPA

One of the key learning principles behind Singapore maths is the concrete pictorial abstract approach, often referred to as CPA.

The concrete-pictorial-abstract approach, based on research by psychologist Jerome Bruner, suggests that there are three steps necessary for pupils to develop understanding of a concept.

Concrete representation

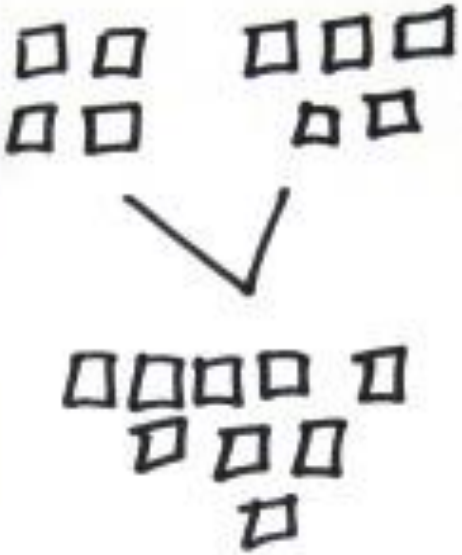
A child is first introduced to an idea or a skill by acting it out with real objects. In division, for example, this might be done by separating apples into groups of red ones and green ones or by sharing 12 biscuits amongst 6 children. This is a 'hands on' component using real objects and it is the foundation for conceptual understanding.

Pictorial representation

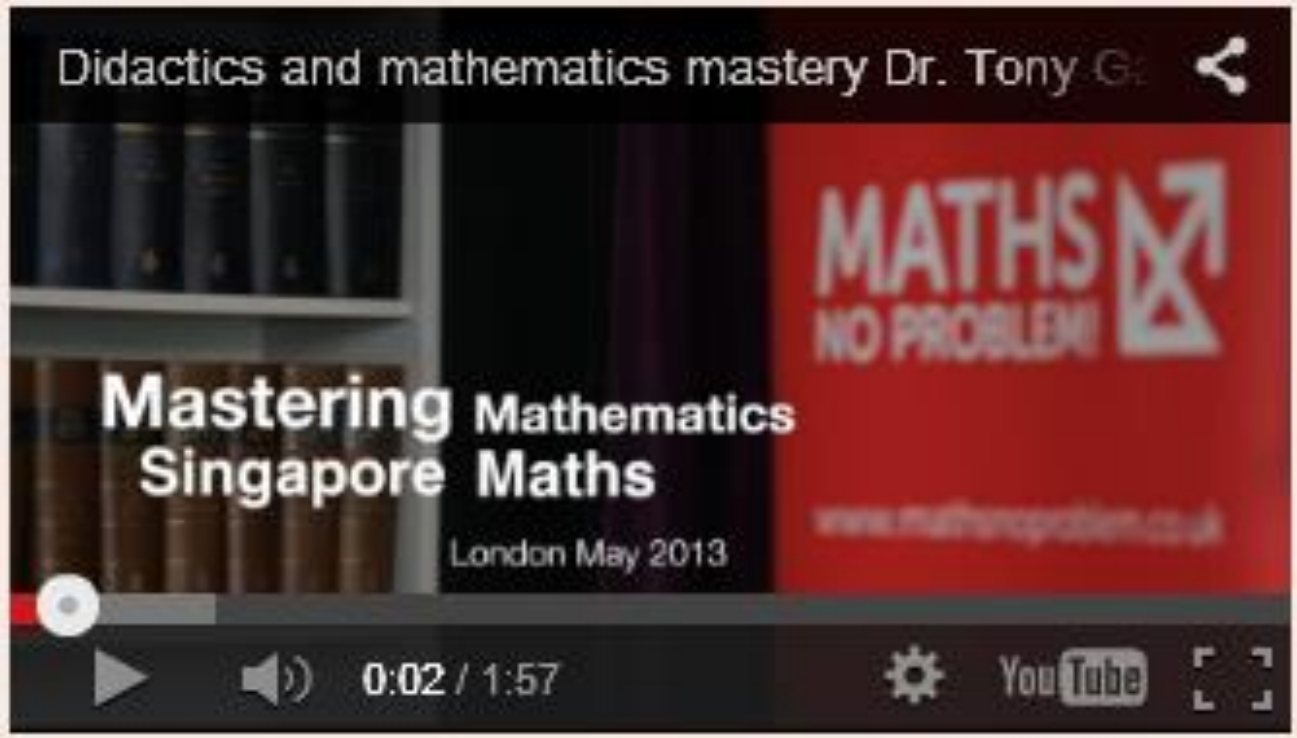
A child has sufficiently understood the hands-on experiences performed and can now relate them to representations, such as a diagram or picture of the problem. In the case of a division exercise this could be the action of circling objects.

Abstract A child is now capable of representing problems by using mathematical notation, for example: 12 ÷ 2 = 6 This is the ultimate mode, for it "is clearly the most mysterious of the three."

- CPA Video

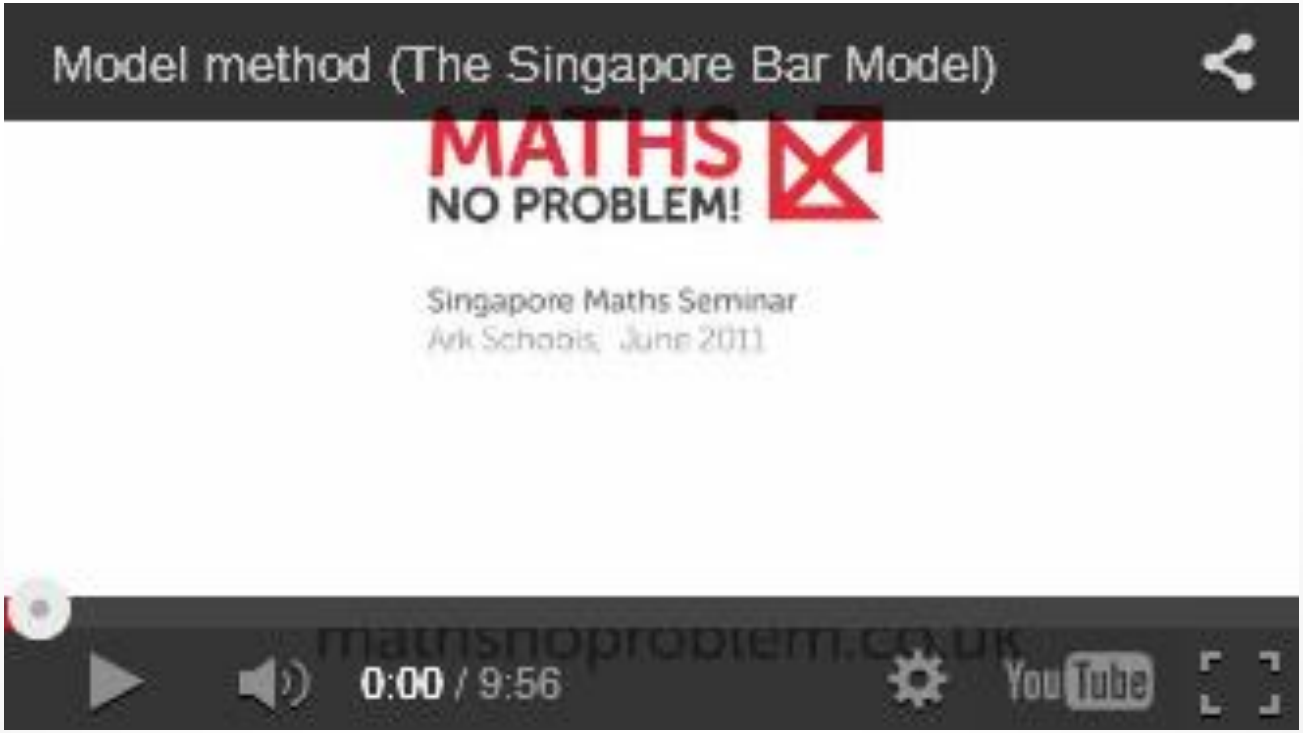
concrete	Representational	Abstract
① 		4+5=9
② 		

Think about this...

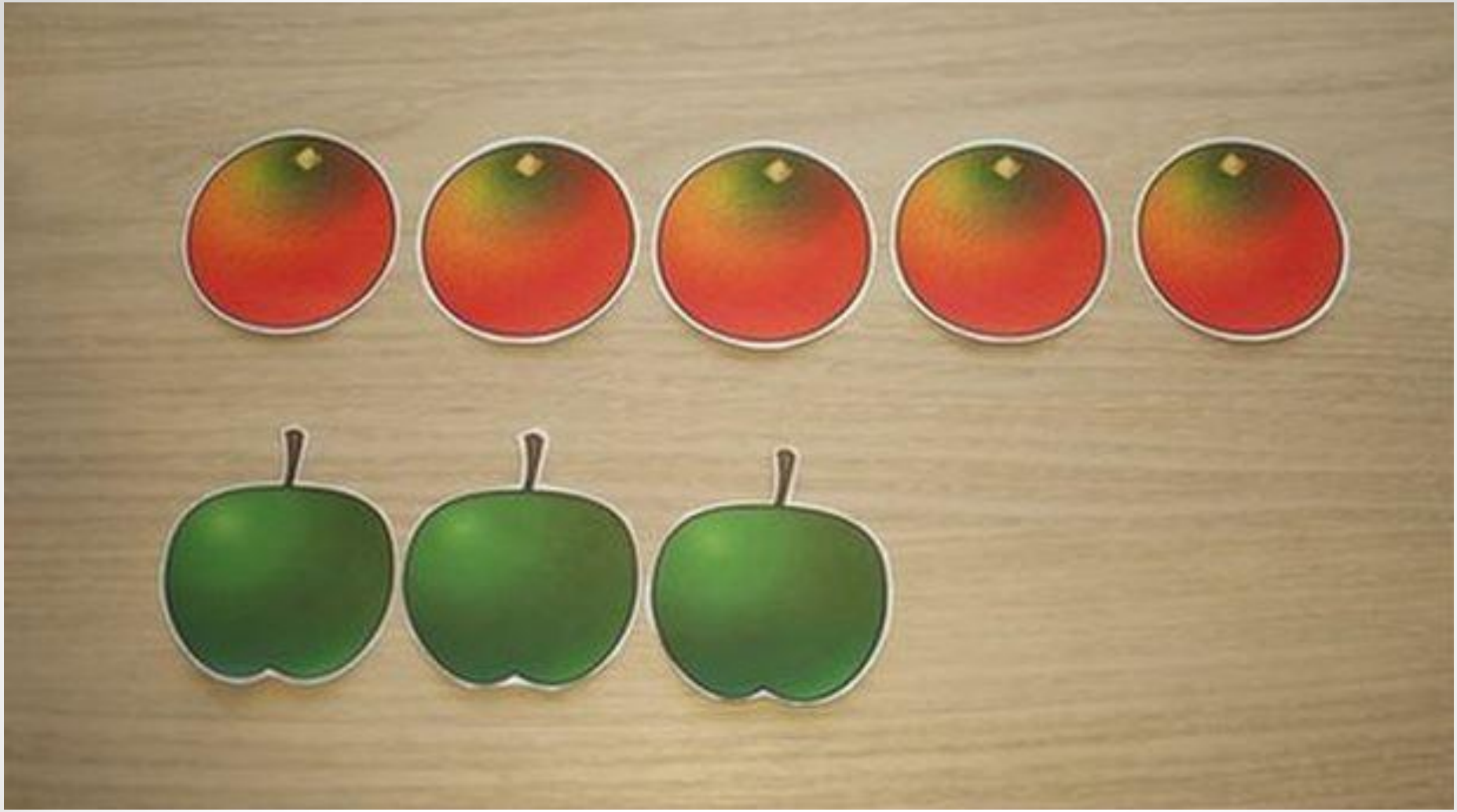


Bar Model

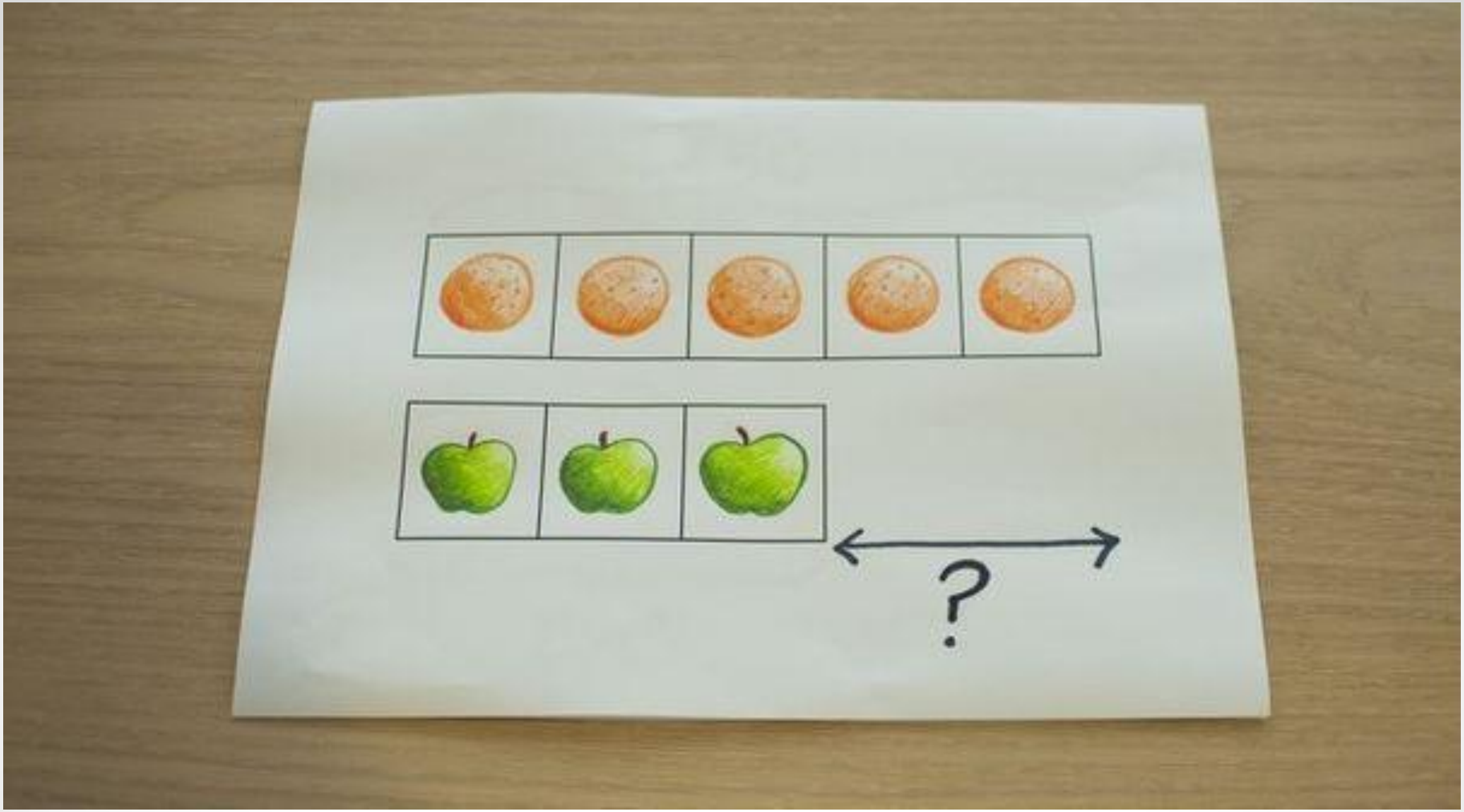
'A picture is worth a thousand words'



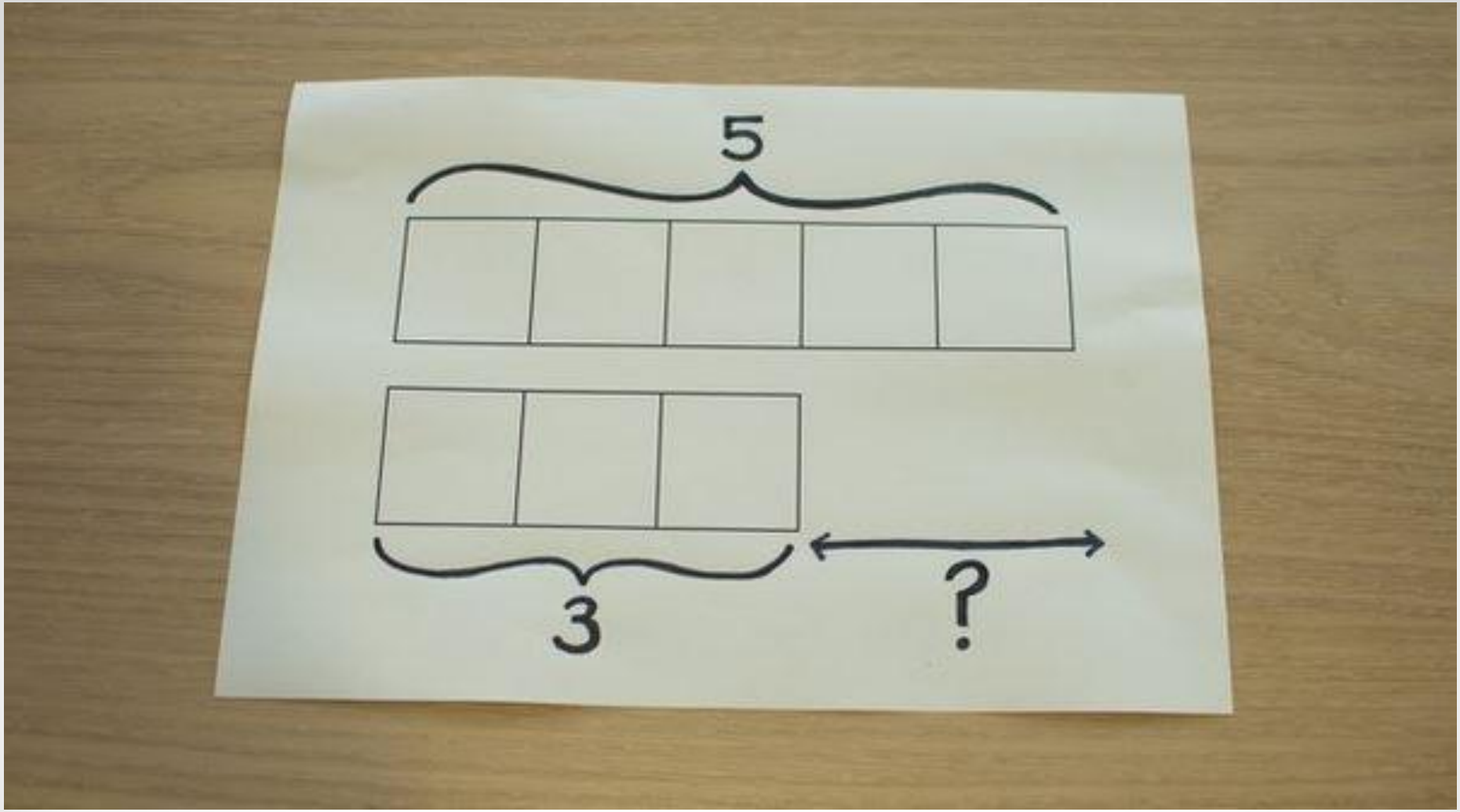
Imagine you have five oranges and three apples.
How many more oranges than apples?



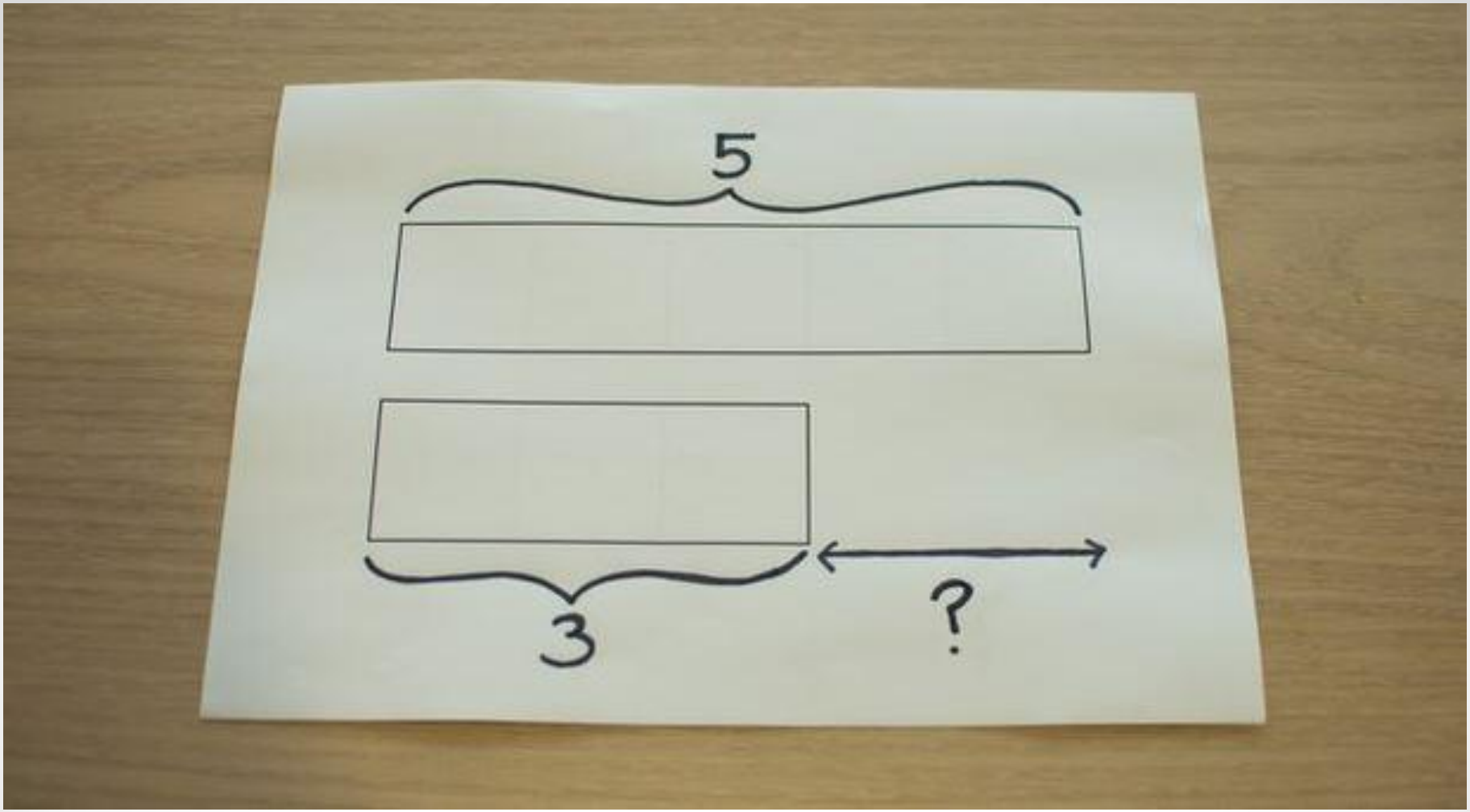
At first children model the problem with physical objects they can move around: like these cut-out pictures.



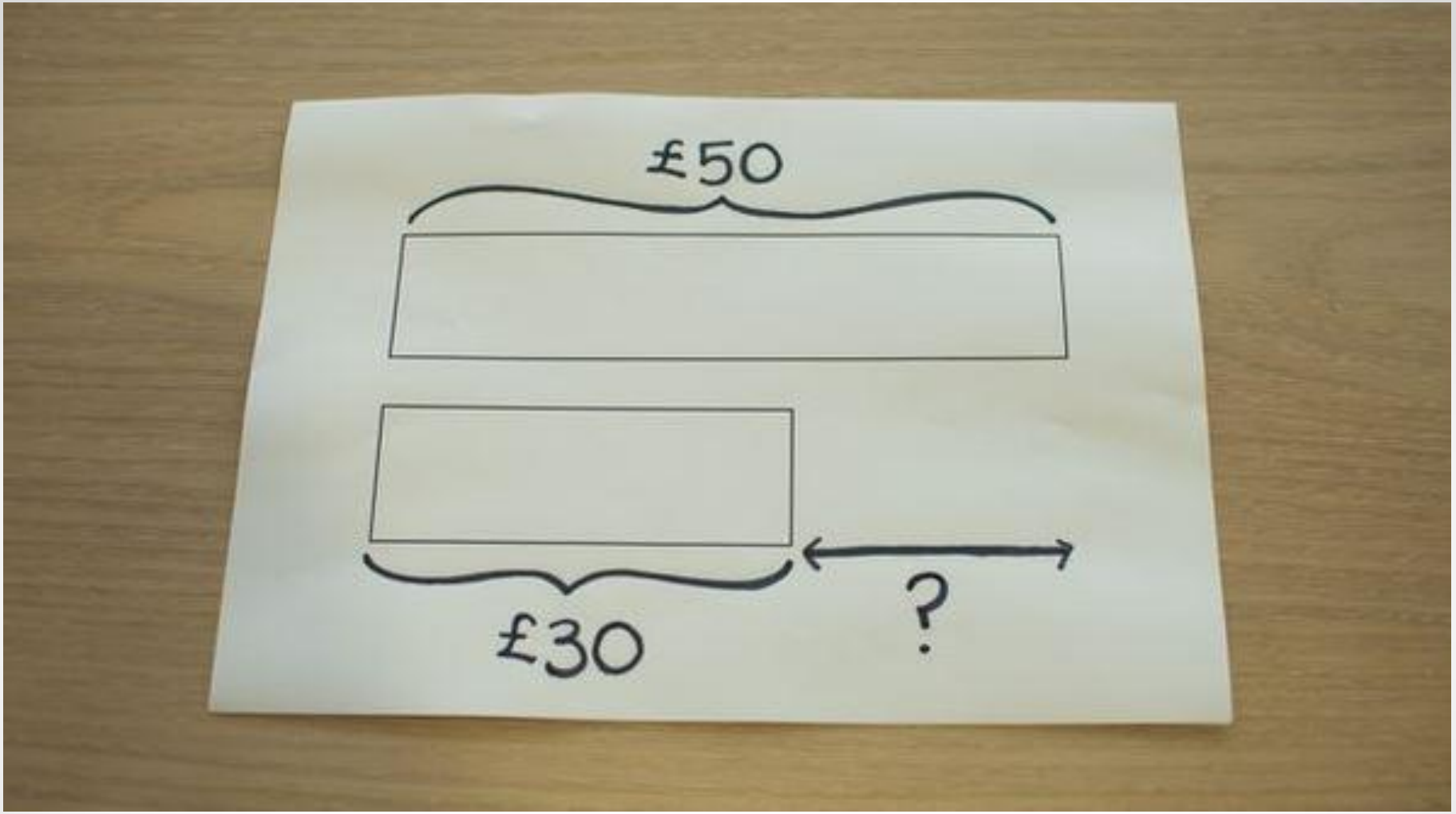
After a few months they start to draw pictures of the problem to help them think about it.



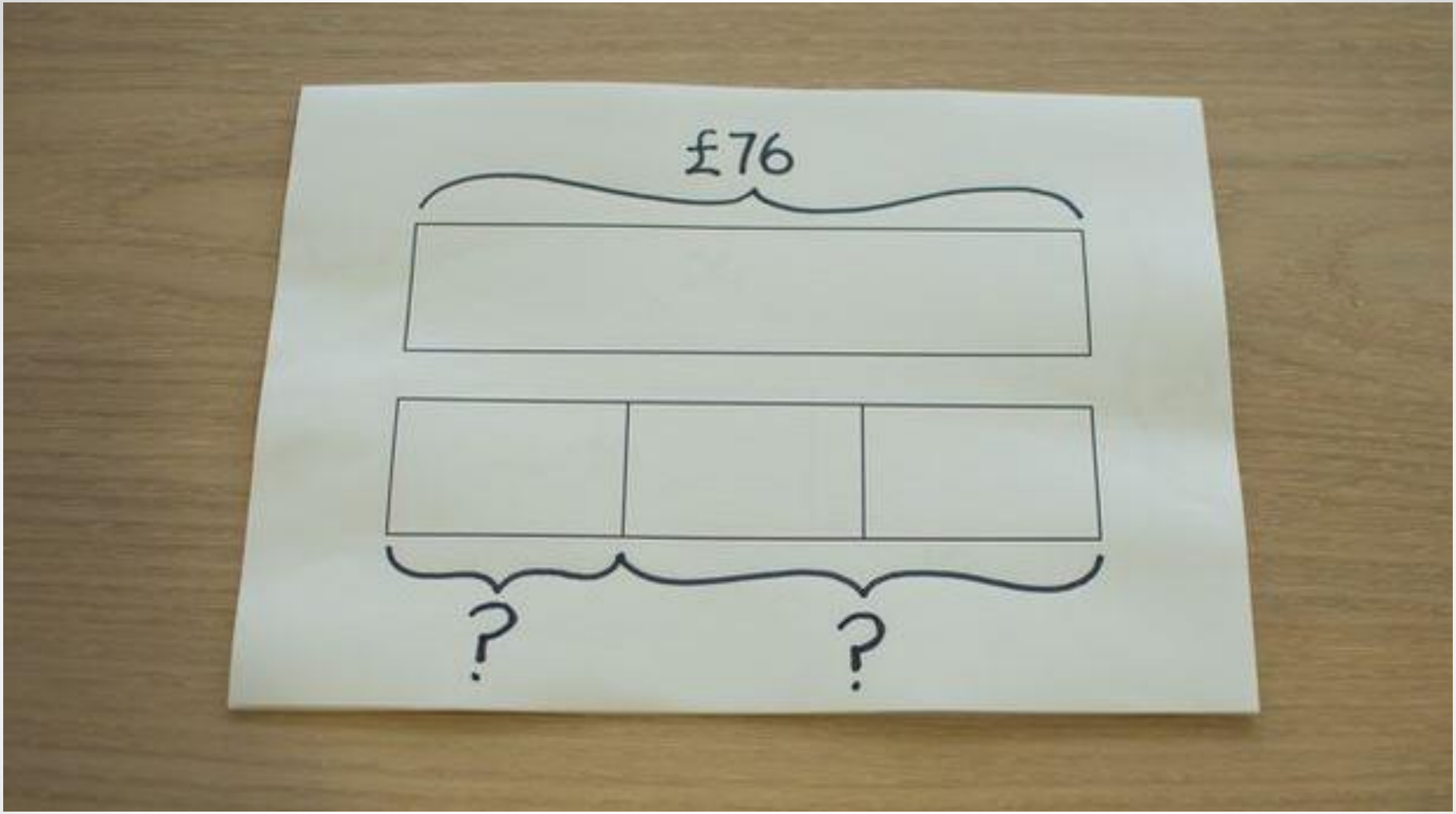
Over time children drop the pictures and just draw boxes. Then they start adding numbers as labels.



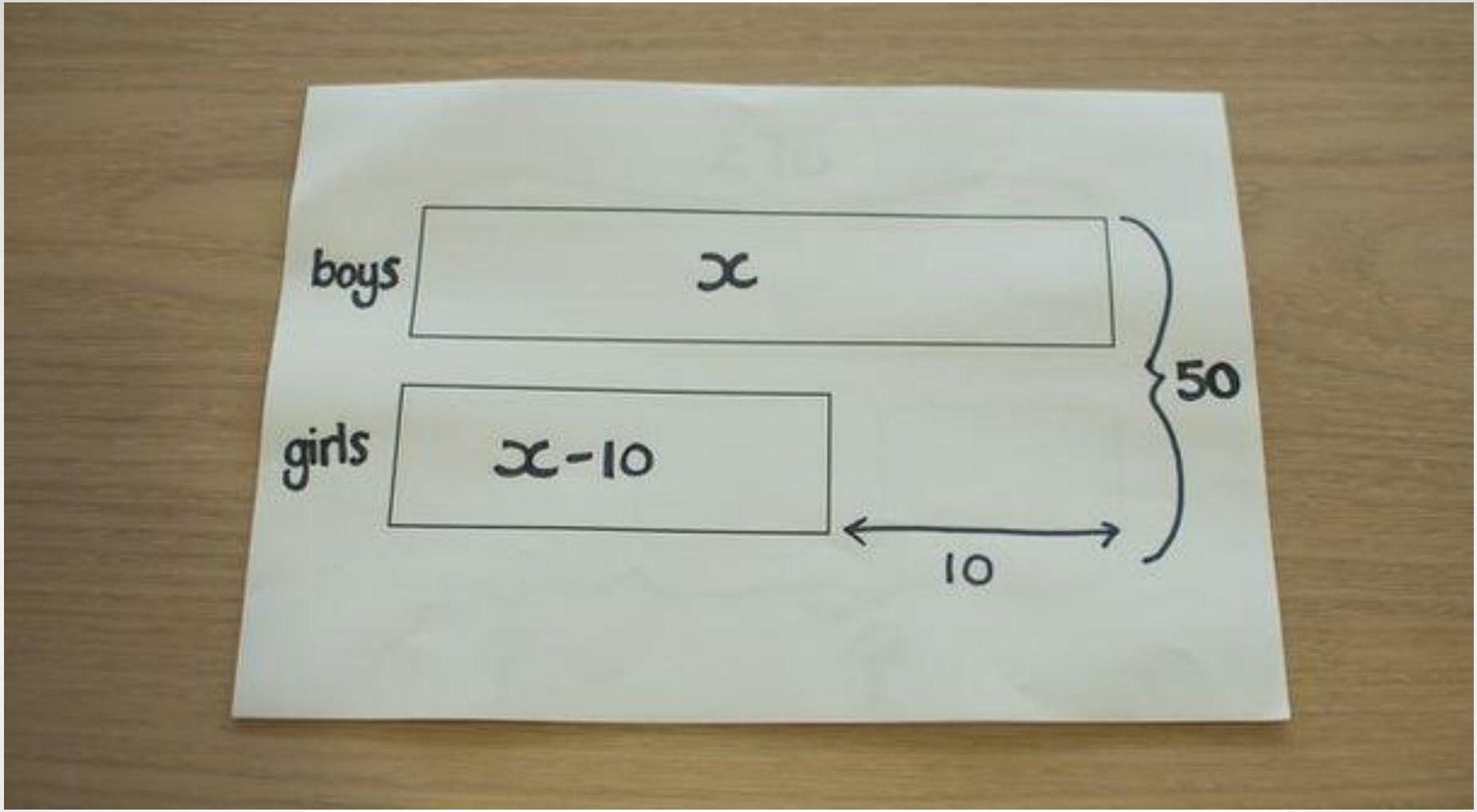
Once children are confident with the meaning of the number symbol they no longer need to draw all the boxes. However they know they can always draw the boxes in again if they need to convince themselves.



How much change if you pay for a £30 shirt with a £50 note? The model can be used to help visualise almost any maths problem.



Three people want to split a restaurant bill of £76. How much for a couple who want to pay together? The model helps break the problem down. First divide £76 by 3. Then times the answer by 2.



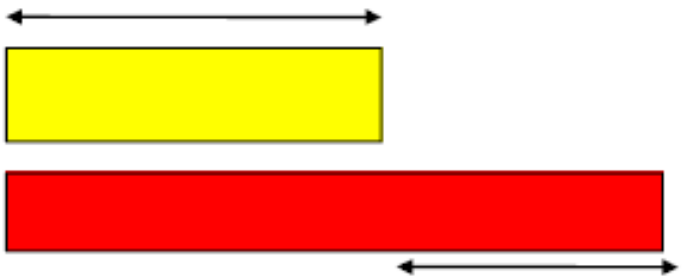
In a year group there are 50 children. There are 10 fewer girls than boys. How many boys? The model can help visualise the unknown quantity. You can see that x + x - 10 = 50. If you add the 10 you get x + x = 60. So x = 30.

Benefits to Bar Models

- Help focus students on *comprehension* of the problem's *situation,* rather than just finding numbers to crunch or just looking for an isolated "key" word or phrase.

- Shows explicitly the problem structure along with the known and unknown quantities

- Visual tool to help students determine the operation needed to solve



Problems to Solve

Tom has a bag of 64 marbles, his friend gives him 28 more, how many does he have now?

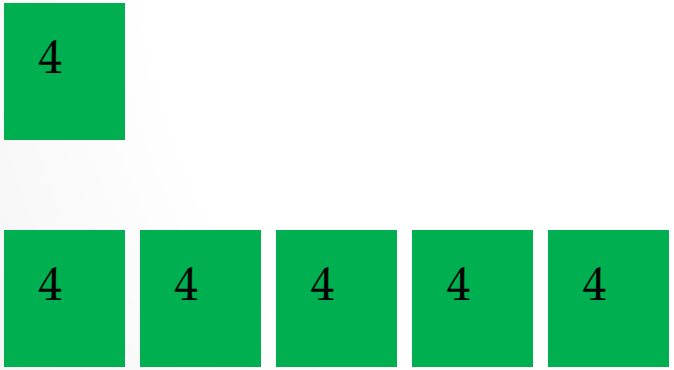
Kelsey was running a 26 mile marathon, after 18 miles she felt very tired. How many more miles did she have to run?

Carly bought an apple for 17p and a banana for 26p, how much has she spent?

Ali had £10, he bought a DVD for £6.70 and a CD for £2. 90, how much money did he have left?

Peter has 4 books

Harry has five times as many books as Peter. How many books has Harry?



Multiplication

- Henry ate 10 meatballs at the Christmas party. Shane ate 3 times as many meatballs as Harry . How many meatballs did they eat altogether?

- Helen has 9 times as many football cards as Sam. Together they have 150 cards. How many more cards does Helen have than Sam?

- The sum of 2 numbers is 60. One number is 9 times as big as the other. What is the bigger number?

- The sum of 2 numbers is 64. One number is 7 times as big as the other. What is the smaller number?

Sam had 5 times as many marbles as Tom. If Sam gives 26 marbles to Tom, the two friends will have exactly the same amount.

How many marbles do they have altogether?

Division

- 108 Year 3 children are going on a field trip to the art museum. Each bus must carry 12 children. How many buses are needed?

- Mr Smith had a piece of wood that measured 36 cm. He cut it into 6 equal pieces. How long was each piece?

Solving Proportional Problems

- Peter has ten sweets he eats half of them how many does he have left?
- Ali has 30 sweets, she eats 1/3 of them, how many does she have left?
- Stacey has 30 sweets, she eats 2/3 of them, how many does she have left?
- A dress costs £32, it is reduced in price by 50%, how much does it cost know?

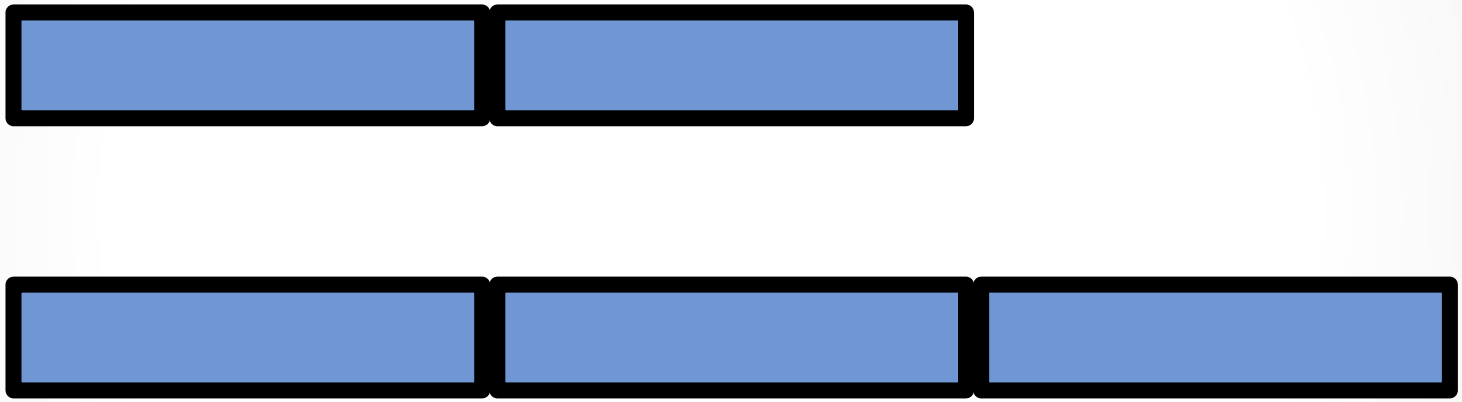
- $^{3}/_{8}$ of the sweets in the tin were chocolates. $^{1}/_{4}$ were toffees. The rest were strawberry creams. There were 36 strawberry creams. How many sweets were in the tin?

- Annie answered $^{4}/_{5}$ of the questions on the test. She answered 32. How many questions were on the test?

- A pair of jeans was reduced in a sale by 25%. They now cost £48. What was the original price?

- A Super Mario Game costs £45, it is reduced in price by 25%, how much does it cost now?
- A computer game was reduced in a sale by 20%, it now costs £40, what was the original price?
- A computer game was reduced in a sale by 40%, it now costs £60, what was the original cost?
- Laura had £240. She spent 5/8 of it. How much money did she have left?

Ratio



Tim and Sally share marbles in the ratio of 2:3
If Sally has 36 marbles, how many are there altogether?

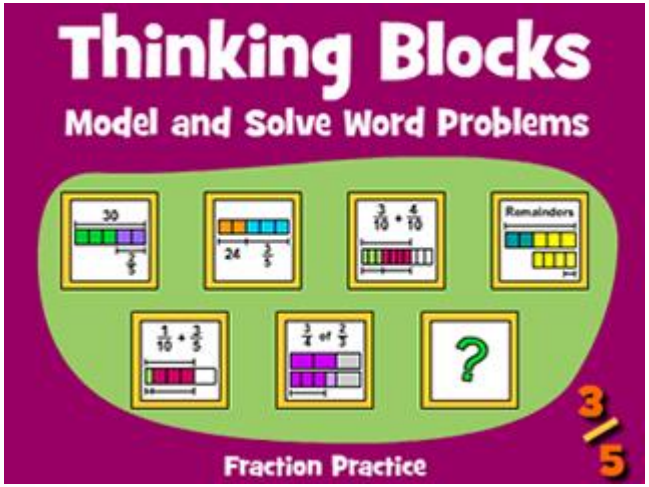
A herbal skin remedy uses honey and yoghurt in the ratio 3 : 4. How much honey is needed to mix with 120 g of yoghurt?

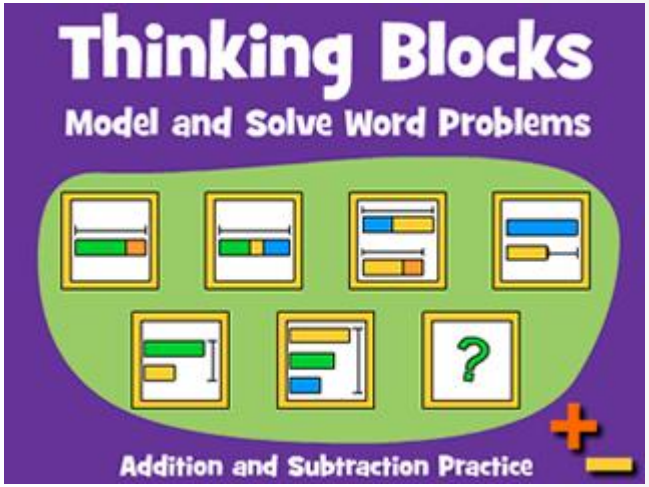
A health bar sells desserts with chopped apricot and yoghurt in the ratio 2 : 5. How much chopped apricot will be mixed with 150 g of yoghurt?

At peak times my mobile phone costs 1 times as much as it does off-peak. A peak call costs 90p. What would it have cost off-peak?

Bar Method Modelling

1. www.mathplayground.com
   - Thinking Blocks





2. www.thesingaporemaths.com

Years 5 and 6

- http://www.greatmathsteachingideas.com/2014/12/26/bar-modelling-a-powerful-visual-approach-for-introducing-number-topics/