



THE TWO SQUARE

Preparation

Before you read the lesson plan do some thinking of your own. Have you ever tried to answer this question before: 'What is a number?' To help you with this, imagine you are speaking to an alien who is exactly like a human in terms of language and understanding but he/she/it lacks a concept of 'number' so the alien will only understand what numbers are if you are able to explain it well. A good way to think this through is to try the above exercise with some colleagues either in the staff room or in the pub!

The Philosophy

The Ancient Greek philosopher Plato (4th century BCE) thought that numbers were a strange entity separate from what we would call 'the real world'. For Plato they were abstract but eternal and therefore even more real than 'the real world': numbers are, were and always will be, for Plato. His student Aristotle, on the other hand, was much more grounded, thinking that numbers are nothing more than a human construct to aid the measuring of quantity in the real world. But if numbers really are just man-made then why does the language of maths describe the universe so well (in physics)? This seems to imply that there may be something mathematical about the universe after all. Before Plato, the Pythagoreans thought that numbers somehow generated the universe.

The Two Square

One aim of this session is to allow the children to explore the concept of number but a second more ambitious aim is for the children to realise that numbers are different from the symbols that represent them: '2', 'II', 'two' all represent the same idea. So, if numbers are not the symbols that we are all familiar with, what are they?

Part One

On a blank board write up four number 2s like so:

2 2

2 2

Then simply ask them the following question:

Task Question:

- ✓ How many numbers are there on the board?

Encourage as many different answers as possible and always ask for their reason for the number they give.

Here is a list of possible contributions:

- Four, because there are four 2s.
- Two, because the number is 2.
- One, because there's only one type of number.
- Eight, because if you add up all the 2s then it equals 8. (There may be a variety of answers using the different operations of multiplication, subtraction etc.)
- Infinity, because you could keep adding up the 2s round and round forever.

One possible answer you may receive is '0' but if this is not offered as an answer then this will form the next part of the lesson.

Part Two

Say something like the following:

Task Question 2:

- ✓ 'I want you to imagine that someone in the class said that there are 0 numbers on the board. Can you think of a reason why someone might say that there are 0 numbers on the board?'

Give the children some paired talk time for a few minutes, then resume the class discussion. If someone did in fact say zero then this debate may have already started. Again, encourage as many different answers as possible to this part of the lesson. For instance, someone may say that there are 0 numbers in between the twos or that there are 0 numbers because it's just ink an ink isn't really a number. This part of the session is designed to get the children to think about what a number is, so, as some point during this part of the session you may want to make this question explicit by setting it as a task question:

Task Question 3:

- ✓ What is a number?

You could do this using the Break The Circle thinking strategy: ask the children to say what a number is but without saying the word 'number' in their answer.

For those that think that there's only one number on the board it is interesting to find out what they think if you write loads of twos on the board. Ask them: 'How many now?' If they are consistent then they should still say 'one' depending of course on their reason.

Extension Activities:

- Tell the children that the 2s seem to make up a square. Ask them: 'Is there a square on the board?'
- Put three identical pens next to each other and ask: 'How many things are here?' [Particularly relevant to contribution c) above]
- If infinity comes up then do the Mobius Strip puzzle: take a piece of paper cut to the shape of a thin ruler and ask them if they can turn this two-sided piece of paper into a one-sided piece of paper. See here for how to do this: http://en.wikipedia.org/wiki/Möbius_strip The Mobius Strip is where the mathematical symbol for infinity comes from (looks like an eight on its side) What do they think will happen if you cut the strip through the centre lengthways with scissors? It's quite surprising.
- Do The Six Wise Men session on part/whole relationships and/or Lucy Looks for a Number. Both sessions are available on this website
- Do the 'Thinking About Nothing' session in The If Machine