

Zero

Age Range: 9 - 18

Subjects: Maths

Stage One: Identify the concept

The concept of culture is often used in two senses with two overlapping but different meanings:

- The arts and learning: the special processes of discovery and creative effort
- A way of life including common meanings, attitudes, values, beliefs, hierarchies, material objects and possessions, modes of perception, and habits of thought and activity

Records show that the ancient Greeks seemed unsure about the status of zero as a number. They asked themselves, "How can nothing be something?" leading to philosophical and, by the medieval period, religious arguments about the nature and existence of zero. Interestingly, though the concept of zero as a number was used widely in India by the 9th century, it wasn't until the 12th century that it was introduced into the Western world.

In school, zero is a fascinating concept for children and adults. Not only is it problematic to define, but it is further complicated by children using almost interchangeably the term 'nothing'. This of course is what makes it a suitable concept to stretch!

Problems within the concept

There are a number of problems associated with zero, including:

- Is zero a number and, if so, is it odd or even?
- Does zero represent something or nothing?
- What happens to numbers when you divide by zero?

Stage Two: Problematising the concept

The following example dialogue is used to illustrate how a stretching of the concept zero might begin.

TEACHER: What is zero?

CHILDREN: It's a number

TEACHER: So it is something, not nothing then?

CHILDREN: No it's nothing and something

TEACHER: How can zero be something and nothing?

CHILDREN: Um ...

TEACHER: Well, let's have a think about zero. Is it a positive or negative number?

PATRICK: It isn't either

TEACHER: So it's not a number at all then?

CATHERINE: Yes it is. You can still do maths with zero

TEACHER: Can you? Well, can you add zero to a number?

CHILDREN: Yes, you'd still have the original number

TEACHER: But can you divide a number by zero? For example, what is $2 \div 0$?

Various answers (encourage use of calculators)

TEACHER: What do we know about zero then? Is it, for example, an odd or even number?

CHILDREN: Um ...

TEACHER: Well, is it a number or a digit or both?

CHILDREN: It's both

TEACHER: Could we do maths without zero?

CHILDREN: No

TEACHER: But for many generations they did do maths without zeros. For example, the Romans used only the numerals I, V, X, C, D, M. They had no concept of zero. And the ancient Greeks were unsure whether zero was a number or not.

Deepening the learning pit

- Is zero a number?
- If zero is a number, is it odd or even?
- What's the difference between zero and nothing?
- If zero is not a number then how can computers use the binary code (a mix of 1's and 0's)
- If someone were to go 'from a hero to a zero' would that mean they'd ceased to exist?
- Are dead people zeros?
- Does 'zero tolerance' mean you tolerate nothing?
- Is there anything in the world where there is nothing?
- Some theorists believe that much of the universe is made up of nothing, referred to as black holes (vacuums). Could we call this zero?
- Why do you think the site of the former twin-towers is called 'Ground Zero'?
- What is meant by 'add another zero and then we might have a deal'?
- What does 'she zeroed in on her target' mean?
- Is there any difference between zero and nought?
- Can you get smaller than size zero?
- What is meant by zero gravity?

Stage Three: Construct understanding

Suggested Activities

1. What's the difference between 'zero' and 'nothing'?

If a farmer found one day that all of his cows had escaped from their field, what would be the most accurate thing to say?

- "All the cows have escaped; now we're left with nothing."
- "All the cows have escaped and now we have precisely zero cows"
- "All the cows have escaped so now there are none left."

Or, does it really matter? Perhaps he could say any of these things. In which case, what's the point of 'zero'? Could we live without the concept? Could we do maths with zeros?

2. The Smashing Pumpkins song 'Zero'

The Smashing Pumpkins, an alternative rock band from the USA popular during the 1990's, sang a song entitled, 'Zero'.

The opening lines were:

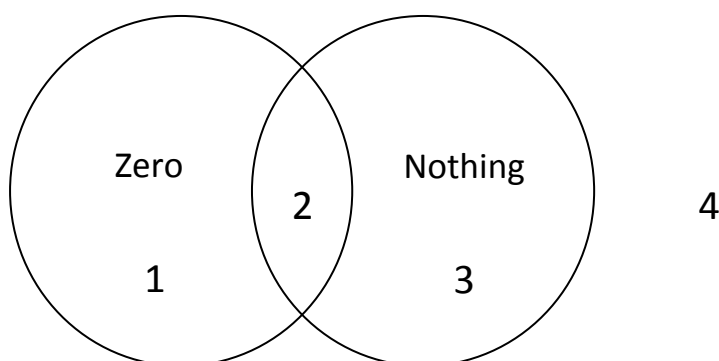
My reflection, dirty mirror
 There's no connection to myself
 I'm your lover, I'm your zero
 I'm the face in your dreams of glass
 So save your prayers
 For when you're really gonna need 'em
 Throw out your cares and fly
 Wanna go for a ride?

3. What do you think 'I'm your zero' meant in this song?

The lead singer of Smashing Pumpkins, Billy Corgan, often wore a black t-shirt with the word 'zero' printed across it. Why do you think he did this?

4. Venn diagram of zero and nothing

Think of examples for each of the four categories represented within the following Venn diagram



Stage Four: Reviewing the learning journey

Possible metacognition questions

- Is zero always a number?
- Does zero represent something or nothing?
- Is there a difference between zero and nothing?
- What other words are used to mean 'zero'?
- How does your idea of zero differ from the beginning of the lesson?
- What questions about zero are you left with?

Notes