

# PARADOXES: FUN WITH LOGIC!

## THE PHILOSOPHY

A paradox is a very strange thing: it is an anomaly of reasoning, and, whereas good reasoning is thought to produce sound conclusions, paradoxes can challenge this assumption. With paradoxes the reasoning may appear good but the conclusion that follows absurd. The word comes from Ancient Greek: para meaning 'distinct from' and doxa meaning 'opinion'. A paradox is found when sound reasoning leads to absurd conclusions. Consider the following:

The statement below is false.

The statement above is true.

What would it mean if the statement below were false, as the statement above says? (Try to think about this). Then think about what it would mean if the statement above were true, as the statement below says. (Now think about it). It should make your head hurt trying to work it out, but you should also begin to see that it is infinitely contradictory. Philosophers call this an infinite regress. Children are able to spot an infinite regress: see *Saving Yourself in The If Machine* for an example of an infinite regress possibility arising from a time travel scenario, when you are saved by yourself who, in turn, needs to be saved by another version of yourself etc ad infinitum...

This session is different from many of the others in that it does not follow the same enquiry-method but instead presents the arguments of the paradoxes directly to the children for them to engage with. Notice, for instance, that the Socratic-leading-question-method is not the sort of questioning that would normally be considered appropriate in a session but here has a special purpose: to help bring them to see the strange consequences of a paradox. As with the previous session this is designed to inspire a sense of wonder and fascination and it therefore makes a good follow-up to the previous session. Expect lots of consternation and puzzlement in this session.

## THE STORY

Read or say the following:

Zeno was a philosopher and follower of Parmenides and he came up with some reasons why he thought things were not as they seem. He even thought that nothing moves – it just seems like it does. Here's why he thought that nothing really moved.

I want you to pretend that I am Zeno with my toga and my beard and my bold head. So now I am speaking as Zeno:

### **A Paradox of Motion**

Imagine you are firing an arrow at a target and let's say the target is 10 metres away. Draw this on the board. (See attached files.)

Now (thought Zeno) before it can travel 10 metres it will have to travel half that distance won't it? What's half of 10 metres? [Mark this on the board]

Before it can travel 5 metres it will need to travel half that distance won't it? And what's half of 5 metres? (Mark this on the board also and carry on in this way until you decide to stop – this is good for their decimalisation.)

When you are ready say the following:

- ✓ How long do you think this will keep going? Well, I think [speaking as Zeno] that it will go on forever which means that it must be impossible for the arrow to reach the target because it has to travel through infinity before it can reach the target and that's impossible.
- ✓ Invite those that do understand to explain to those that don't what they think is going on (see box below).

Another of Zeno's paradoxes that is good to do with them is the Liar's paradox. Become Zeno once more and say the following:

### **The Liar's Paradox**

Imagine one of you [for example a Year 6 child, though you should simply replace this with which ever year group the children are] goes into the Year 5 classroom and then announces that

A) "All Year 6 children are liars!" [Write this up clearly for all to see]. For the paradox to work the statement A means that 'everything the Year 6 children say is a lie'.

### **Task question:**

- ✓ If you are a Year 6 child then what would this mean?

A Socratic leading question method for navigating them through the paradox:

Q1: If it is true and you are a Year 6 child then you must be what? Answer: a liar!

Q2: And if you were a liar then would this be true? (Point to A above) Answer: no.

Q3: So, if it's not true then you must be telling the truth and if this is true (point to A) then you must be what? Answer: a liar

Q4: But if you are a liar then... (Notice that Q4 has returned to Q2 and this will keep happening ad infinitum)

Try this instead:

Q1: If it is false and you are a Year 6 child then you must be what? Answer: telling the truth.

Q2: And if you were telling the truth then would this be true? (Point to A above) Answer: yes.

Q3: If it is true, and you are a Year 6 child then you must be a what? Answer: a liar.

Q4: If you are a liar then this (point to A) must be false and if it is false you must be what? Answer: telling the truth. (Notice that Q4 has returned to Q1 and this will keep happening ad infinitum)

With this method of questioning you will have forced the conclusions on them so, the next thing is to ask them what they think about these arguments. Do they agree with them or disagree with them?

Set them the following task for homework: to explain the paradoxes they have heard in the session to someone else such as a friend, teacher or parent and if they can get the person to see how weird the paradox is then they have succeeded to explain it; but if the person doesn't see what's weird about it then they should try to explain it again in different words.

## **The Understanding Virus**

When someone in the class has a eureka moment and suddenly 'gets it' ask that person to explain the paradox in their own words. It may take them a few times but it should result in someone else 'getting it' and when they do ask them to explain it in their own words. Carry on in this fashion and watch the understanding spread like a web through the class. Even if it results in confusion and perplexity the shared grappling that goes on is of enormous value and some children may not get it for some days or even weeks.

## **Adopting Voices**

In order to engage them more fully, and in a lively and fun way, with the arguments you could role-play the character or Zeno. Describe his attire, his beard and sandals and maybe even create a characterful voice to speak with to distinguish Zeno from you. This can be a lot of fun and it is a good test of how well you understand the idea yourself.