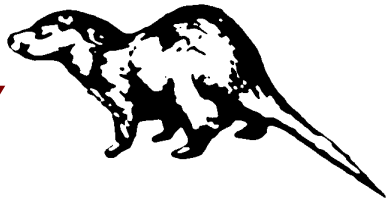
NUFFIELD PRIMARY HISTORY



ANCIENT GREECE: GREEK SCIENCE

TEACHERS' NOTES

This was the third lesson with a mixed ability and gender Year 3/4 class of 30 pupils in a small rural primary school. The head, Laura Austin, and I had worked together for years. Laura's brief was to teach the literacy hour using the context of history.
We had done two lessons on Archimedes' solving of problems:
• Was the King's crown made of pure gold?
• How could Archimedes help defend Syracuse against an overwhelming Roman naval force?

I was going to repeat a lesson on a third problem – the invention of a water-lifting machine [Archimedes' screw], plus how the Greeks measured the circumference of the Earth. Then I thought that this was a bit too repetitive, so why not try and repeat a lesson that John Fines had taught on Greek Science? (This is described in the Nuffield Primary History book *Ancient Greece* published by Heinemann).

I took John's Anaximander document and split it into two, a sensible idea as it turned out, as when I arrived to teach the lesson I discovered that we only had time for the first half of the document. Each half deals with different but linked ideas: the origins of the universe and the origins of life. I found working off John Fines' text, transferring his ideas, absolutely fascinating. Even more to the point, it worked.

Literacy context

The focus of the lesson was oracy, that is using speaking and listening as a medium for developing understanding. Because the lesson was truncated, lasting 45 minutes instead of 90, the oracy element is highlighted.

Year group/class

Mixed Year 3/4; 30 pupils in the class.

Teaching time

Approximately 45 minutes. When I arrived the class was busy doing a SATs writing task. This meant that the original 90-minute lesson had to be halved and that we were unable to complete the planned written elements, which was fine, as the children had spent the previous session writing solidly.

Learning objectives

For the children to:

- develop insights into how the Greeks went about 'doing' science within the context of their society
- consider how well they had managed to think about problems, bearing in mind their context
- develop skills of listening, questioning and presenting ideas orally.

Key questions

- What equipment might the Greeks have used in science lessons?
- What questions might the Greeks have asked about science?
- How successful were the Greeks at 'doing' science?

Resources

The Anaximander text, divided into Sources A and B. [Source B was not used]

Source A has been broken into numbered sentences to make it easier to read.

The teaching

Episode 1

Focus: Production of a class list for a scientific experiment today.

I started off by telling the children that Mrs Austin and I had a problem. We had to teach about science, and we knew nothing about it! We had to try and do some experiments. So, what equipment would we use? Could the class help us?

We split the class into pairs so they could discuss our problem. Each pair had to come up with two or three things they would use in a science lesson. The class had one minute for this task.

The feedback from each pair drew from the few experiments they had done involving electricity and, interestingly, our earlier lesson on Archimedes and the king's crown. I loved Dom's contribution: 'brains'. Things we listed on the board were:

battery, brains, computer, electricity, levers, measure, newtons to measure force, paper aeroplane, observation, pencils, plants, scales, science books, springs, table, video, water, weights, tape measure, thermometer.

How could I expand the list to include things the Greeks would not have had? I suggested to the children that they talked about things that scientists investigate on television. An animated, lively whole-class discussion and feedback then followed, producing a splendid expanded list:

magnets, medicine, gravity, friction machine, position of stars, Mars – using telescopes, microscopes, computers, rocket launcher, rockets and stuff, satellites, pushing and pulling, all sorts of liquids, gas, steam, magnifying glass, solids.

Episode 2

Focus: Going back to Ancient Greece to think about carrying out a scientific experiment.

I told the class we were going back in time to the time of the Ancient Greeks. The children shut their eyes as we whizzed back to the Greece of Archimedes. Quickly we passed the Normans, Romans, Jesus and year 0, back to 500 BC. We landed in Syracuse, and met our old friend Archimedes.

In their pairs, the pupils had to think of all the things on the board that Archimedes would NOT have had. We had a wiping-off game, where in turn each pupil came to the front to wipe off one thing, telling the class why.

We started with Kuiper who said 'battery' and rubbed it out. Then Kuiper chose a girl, as we insisted on the alternate boy/girl pattern. Harriet came up and chose 'computer'. The game finished with us looking at the remaining non-Greek word, 'gravity'. The class decided, after a discussion, that it was a concept the Greeks did not use/know. So, it was rubbed out.

A very thin list was left on the board:

medicine, pushing and pulling, liquids, gas, steam.

I decided the class could add things that they thought the Greeks might have used. So, we went round the pairs, adding new objects:

wood, containers, chalk, blackboard, bows and arrows.

Episode 3

Focus: Working in pairs to come up with questions for the Greek Science Curriculum.

We then split the class up into new pairs that they chose for themselves, as they all claimed to be good readers! (We had intended to pair strong with weak readers.)

The next thing was to present the task:

Archimedes has been asked by the King of Syracuse to make up or invent or create or write out a Science Curriculum – a set of lessons in Greek schools to look at questions Greeks would want to have answered about the world they live in.

We want each pair to come up with two or three questions that you, as if you were Ancient Greeks, would want answers to about the Universe. Science is about finding out about the world you live in and all the questions you want to ask about it.

The class worked intensely for a couple of minutes, framing their questions. Then I told the children to stand up and form new pairs. The new pairs had to pool their questions, so each pupil would have four or more questions to ask.

Episode 4

Focus: Questions the pupils wanted to have as the basis for their Greek Science curriculum.

We cleaned the blackboard, with Mrs Austin poised and ready to write the questions as they came tumbling out of the children. In fielding the questions we deliberately alternated boy / girl answers. Overleaf is the list of the pupils' questions:

Why are we here?

Where did Zeus come from?

Why don't we float about?

What glues things to the ground?

How many planets are there?

How did Earth begin?

How many stars are there?

Who made us?

Why are we floating around in Space?

Who invented the Earth?

What will the future be like?

Why is the Earth so hot?

How can we attract things with a magnet without touching them?

Why isn't there air in Space?

Who made God?

Who made water?

How did we get here?

Why is rain wet?

Why does the Sun go down?

Who made the Sun?

Why do we have day and night?

Who made the gods?

Who made the Moon?

How does the World go round?

How do rivers keep going on and on?

What is science?

Why are wheels round?

Who made the clouds?

How is the weather controlled?

Episode 5

Focus: Shared reading of an Ancient Greek scientist's answers.

Our goal was to gradually build up understanding of the Anaximander text, and relate it to the previous episodes. Note that we used an unsimplified translation. We helped the pupils break into the text from their own starting-points. The first step in the process was to develop an understanding of the text's sentences and their nuances.

I told the children that we had two documents that told us what a Greek scientist thought: **Sources A** and **B**. Archimedes would have known this scientist's work and would have used it in a science lesson. We would read Source A first, bearing in mind four questions:

• Which questions had this scientist looked at?

• Which questions had he answered?

• How had he worked out his answers?

• Had he worked them out convincingly?

Making sense of the sentences:

Mrs Austin asked seven good readers to read out one numbered sentence each.

After the pupils had heard each sentence, we asked them to say which words they found difficult.

Then we asked if any of the class could define the difficult words as we came across them.

For example, in sentence 2 the word 'separated'. Andrew said, 'You have a whole piece of chocolate, you have one bar, and if you had a brother who wanted to share it, you break it apart.'

I then confirmed the definition. A round of applause was called for and given.

As we encountered them in the text, we discussed other difficult words that the class was unable to define, teasing out their meanings.

Finally, I translated each sentence into children's English, using the synonyms we'd come up with.

Episode 6

Focus: Using expressive movement to explain a concept.

Sentence 4 of Source A reads:

When this had been torn off and shut up in certain rings, the sun, the moon, and stars came into existence.

It occurred to me spontaneously that this was an excellent opportunity for some class enactment, that is, developing meaning through involving the pupils in some expressive movement. The children could represent the bodies in the Greek universe. So I asked for volunteers, and a sea of hands went up. We picked out eight pupils. One pupil in the middle of the room represented the Earth, a second the air, a third the Sun, a fourth the Moon and the rest the Stars.

The pupils now circled around the Earth.

Episode 7

Focus: Visual learning – diagrammatic illustration of the Greek universe.

On the board we worked out with the children a diagram of the Solar System according to the Ancient Greeks.

I told the class that the Greeks thought the Sun, Moon and Stars were all fixed in giant spheres of glass [crystal] that moved around the Earth. The pupils asked how they would cope with rockets – they would smash through the spheres. We pointed out that the Greeks did not have rockets.

Episode 8

Focus: Working on the sentences; using discussion, debate and questioning to develop understanding.

We worked on the remaining sentences in order, discussing, arguing, questioning, and pooling ideas so as to develop our understanding. A key element was that Laura and I were also grappling with making detailed sense of the text, involving the pupils in our own sense of discovery and deepening awareness. For example:

JN The Earth's shape is hollow and round – they know it is round, and hollow in the middle. Why do you think they thought that? Ha, ha, ha. How did you explain things like earthquakes, and rumbling of the ground? What happens when your stomach rumbles?

Ione It is empty.

JN So why did the Greeks say the Earth was hollow?

We were now in the last five minutes of the lesson, so time to call a halt, trying to produce an overall idea of what **Source A** was about.

JN What is it about ?

Pupil Science.

JN What is Anaximander trying to explain?

Pupil Greek worlds, galaxies, the universe, astronomy.

Learning outcomes

The children:

• developed their oracy through brainstorming, listening, discussing, questioning and presenting ideas orally

• read a difficult and challenging text

• learned enactively through expressive movement and also through analogy

• developed insights into how the Greeks approached science within the context of their society.

Reflection

I found this a fascinating lesson, in that it was an attempt to transfer another person's teaching into actuality in a different context. As such, it does seem to have worked. The key ideas of starting with a modern-day science experiment, and then going back to what the Greeks would have been able to use worked very well. The document work led logically on from the pupils' listing of things for use in an Ancient Greek scientific experiment and their list of questions that the Ancient Greeks might have asked. The depth and sophistication of their list is

most impressive, and compares well with the questions John Fines' original class developed.

In terms of pupil involvement within an oracy context, this was good. The whole ability range was involved, the use of pairs to start with, the mixing of pairs, the forming of groups of four or five from the pairs all contributed to involvement. There was nowhere to run or hide. Class feedback and discussion was informed and positive. The lesson had pace, and the pitch seemed appropriate.

Nuffield Primary History project

General editors: Jacqui Dean and Jon Nichol
Author of this unit: Jon Nichol