

NUFFIELD PRIMARY HISTORY



ANCIENT GREECE

ARCHIMEDES AND THE KING'S CROWN

TEACHERS' NOTES

This was the first lesson with a mixed year 3/4 class in a small rural primary school. The head, Laura, and I had worked together for years. Laura's brief was to teach the literacy hour using the context of history. Laura told me that the children had already had all the standard Greek stories, so I thought Archimedes might be a good addition. Indeed, Archimedes is an excellent subject, as he covers science, mathematics and a range of other subjects, including cunning plans to defeat enemy armies and navies.

The immediate appealing idea was to investigate how Archimedes solved the king's problem, that is, had the goldsmith swindled him by mixing silver with gold in making his crown? An article on the internet argued that Archimedes probably used a highly sophisticated way of solving the problem as opposed to the normal story. The traditional story says Archimedes had a brainwave while in the bath, his body having displaced an equal volume of water. Metals of different density displace different amounts of water for the same weight of metal, so he could work out if the crown was pure gold. The internet article pointed out that this is a facile solution and would have been useless for Greek crowns, which were wreaths made of a very small amount of metal, so the difference would be very hard to spot. If you want to know more, visit this wonderful website where I found the information I needed – it is great fun. Keep the Claw to the end!

<http://www.mcs.drexel.edu/~crorres/Archimedes/contents.html>

My own brief from Laura was to stress storytelling, building on an idea that Liz Raybould, a Shropshire teacher, had developed and was happy for me to adapt.

Year group/class

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

Teaching time

Literacy time: 45 minutes with mixed class; 30 minutes with remaining year 4 pupils.

Learning objectives

For the children to develop:

- insight into how to structure a story, and ability to write a well-structured story
- ideas for solving problems using a scientific approach
- language around the concepts of experimentation, displacement, volume.
- an understanding of the Archimedes story

Key question

How did Archimedes solve the problem of the crown?

Resources

Set of lead weights or pieces of lead, enough to balance the metal object

Scales with two balance pans

Metal object with a complex shape (e.g a statuette)

Jug or small bowl (large enough for it to be possible to immerse the metal object in it)

Large bowl (large enough to stand the jug or small bowl in it)

Measuring cylinder (suitable to measure the water displaced by the metal object)

Source of water (enough to fill the jug several times)

Mopping up cloths

Place to pour away the water

A written version of the story of Archimedes and the king's crown (Source A)

Template for children's own stories (Source B)

The teaching

Episode 1

Focus: Setting the scene and choosing a title.

Before the lesson started we had rooted around for the equipment we needed, including lead weights, a set of scales that worked and something to represent the crown. At first we had only a tin of soup for the crown, but we later found a metal statuette that did the business better.

The lesson started with me settling the class and telling them that we were going to listen to a story about a king. I told them I wanted them to draw the story on a piece of paper.

So, each child folded an A4 sheet of paper into four neat rectangles, with a small space at the top to write the date, their name and the title.

We came up with the title: *The King's Crown*. This we chalked on the board. I also told the class that they would give each scene a title and write a caption beneath it, saying what the scene was about.

Now for the story.

Episode 2

Focus: Telling the story; getting the pupils to translate the story into pictures with titles and captions.

I split up the story deliberately into four scenes so the pupils could draw one picture for each. Source A is a written version of the story for copying and sticking into the pupils' books.

I opened the story with the scene at court. The king is having his dinner, drinking wine from a large goblet. A messenger arrives to tell the king that his goldsmith has been caught adding silver to gold in his metal furnace. The king loses his temper, screams and shouts and hurls his goblet to the floor.

The second scene describes the goldsmith's arrest, the third tells of Archimedes' brainwave in the bath. The final scene is of Archimedes carrying out his scientific experiment to discover if the crown is pure gold or gold with silver in it.

The drawing session went well, with the children getting the story down in pictorial form, with titles and captions for each scene.

Episode 3

Focus: Looking at Archimedes' experiment – weighing the crown, displacing the water.

Our question: 'Is the statuette made of the same metal as the weights?'

We looked at Archimedes's experiment using the equipment we had found or brought with us. The metal statuette represented the crown. Our lead weights stood in for the gold that Archimedes used.

This is what we did.

1 We used the balance to find the quantity of lead that exactly balanced the statuette.

2 We filled the jug up to the brim with water and stood it in the large bowl. We then added the lead we had used to balance the statuette. The displaced water flowed over the brim and collected in the bowl.

We then lifted out the jug and poured the displaced water into the measuring cylinder. We found that the lead had displaced 15 cubic centimetres (millilitres) of water.

3 We removed the lead from the jug and again filled it up to the brim with water and stood it in the large bowl. Then we carefully immersed the statuette in the water. This time it was obvious that more displaced water flowed over the brim and collected in the bowl.

Again we lifted out the jug and poured the displaced water into the measuring cylinder. We found that the statuette had displaced 40 cubic centimetres (millilitres) of water.

Bingo! This proved conclusively that the statuette was not made of the same metal as the metal (lead) used to weigh it. Great fun, with everyone on task.

If the statuette and the metal used to balance it were made of the same material they would have the same volume and displace the same quantity of water.

Episode 4

Focus: Using the story-writing frames to plan the story.

I wanted the class to be able to use the story-writing frames and their pictures as the basis for writing their own stories about the problem. So, we worked through the frame elements (Source B), explaining how stories are constructed. We built up collective ideas on the board.

First we identified a list of characters who might have been present: Archimedes, the king, the goldsmith.

Then we worked upon what the scene might have been like at the point where Archimedes began the experiment.

As a class we considered the problem and worked out how Archimedes had solved it.

The children later wrote their stories.

Learning outcomes

The children:

- gained insights into how to structure a story
- wrote well-structured stories which showed understanding of the scientific principles involved
- developed and understood appropriate language to describe concepts such as volume and displacement.

Reflection

On the whole we were happy with the lesson. The problem-solving frame is a good idea, but I have since revised and simplified it (see Source B). I would like to teach the lesson again, this time having all the right stuff in place at the right time so that the weighing and measuring go smoothly first time. Fun, though! The golden moment occurred as I was leaving the school. One of the children came up and said, 'Excuse me, Sir, are you a teacher of technology?'

Nuffield Primary History project

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