Phases on the moon - essay

What causes day and night (including seasonal changes in the number of hours of daylight)?

When the Earth spins around on its axis, it creates night and day on Earth. The Sun rises in the east and sets in the west, turning day into night. On Earth, the length of day and night usually changes with the seasons. Why are there different seasons? As stated, the Earth spins on a tilted axis about once every 24 hours to create what we know as night and day. This axis is an invisible line through the centre of the Earth. The northern point is the North Pole and the southern point is the South Pole.

The Earth spins anti-clockwise. The Earth orbits around the sun about once every 365 days. As this happens, the tilt of the Earth causes different sections of the Earth to point toward the Sun. This causes different amounts of sunlight to reach the same surface area of the Earth throughout the year. The different amounts of sunlight lead to different weather at this location. In the northern hemisphere, when the North Pole points towards the Sun, the Sun’s light is more directly overhead and it is summer.

When the North Pole points towards the Sun, the South Pole tilts away from the sun resulting in scattered and less direct light. People in the southern hemisphere experience winter while people in the northern hemisphere have summer. The seasons of spring and autumn are created when the Earth’s tilt is neither towards, nor away from the Sun. These seasons usually have milder temperatures.

Why are there different phases of the Moon?

The Moon travels around the Earth in a circle called an orbit. It takes about 28 days to go one time around the Earth. The Sun always lights up half of the Moon at one time. The Moon is not a light source; it has no light of its own. We can only see the Moon because it reflects light from the Sun. The Moon appears to change shape (phases) but what we are actually seeking is the Moon lit up by the light from the Sun in different ways on different days.

What is the science knowledge that supports the teaching of these two ideas?

During the Renaissance, Nicholas Copernicus proposed a heliocentric model of the Solar System. His work was defended, expanded upon, and corrected by Galileo Galilei and Johannes Kelper. Galileo added the innovation of using telescopes to enhance his observations. Kelper was the first to devise a system that described correctly the details of the motion of the planets with the Sun at the centre.

However, it was left to Newton’s invention of celestial dynamics and his law of gravitation to finally explain the motions of the planets. Newton also developed the reflecting telescope. During the nineteenth century, attention to the three body problem by Euler, Clairaut and D’Alembert led to more accurate predictions about the motions of the Moon and planets.

Part 2:

Eliciting the children’s ideas you are to research two different techniques for assessing the children’s ideas in science

The aims of primary science can be broadly divided into two categories:

- To stimulate pupils' curiosity in the world around them and encourage critical and creative thinking;
- To create a foundation for science at secondary school.

To fulfil these aims, pupils need to acquire both factual knowledge and the skills of scientific enquiry, identifying questions that can be addressed scientifically; planning and carrying out experiments; evaluating data; and recognising the limitations of their own and others' work. The National Curriculum was introduced in 1989, with science as a core subject. Before 1989, the science curriculum varied widely between primary schools.

" While the National Curriculum is statutory, schools have the freedom to decide how to teach its content to best meet the needs of their pupils. Children tend to be enthusiastic towards science at a young age, as they explore the world around them. However, attitudes towards school subjects, including science, often becomes less positive when they transfer to secondary school. As a result, the DfES is focusing its attention on secondary science. However, the primary years are seen as crucial in developing pupils' longer term interest in science". (postnote, 2003, p2).

Further, recent research has suggested that pupils' interest in science may start to decline at primary school, which are discussed below in more detail below, include:

- Whether science teaching is adapted by individual schools to reflect the interest of their pupils;
- The focus on preparation of SATs tests in the last year of primary schools;

- Primary teachers’ level of scientific knowledge and confidence in teaching science.

Teaching Primary Science

“ In the 1970s and 1980s, teachers’ lack of scientific knowledge was seen as a major barrier to developing primary science. Primary teaching is largely a female profession and at the time few girls studied science other than biology. Today, primary teachers’ scientific knowledge is widely recognised as having improved but the debate over the level of scientific knowledge needed by a primary teacher in order to teach effectively remains active”. (postnote, 2003, p3).

Some professional scientific institutions argue that factual scientific knowledge is paramount. This view is based on a concern that scientific misconceptions are being taught and reinforced in some classrooms. Misconceptions (for example, that the Sun moves round a stationary Earth) are often formed at a young age and are difficult to change. Ofsted has raised particular concerns over the primary sciences, where it reports that many primary teachers are working at the limit of their understanding).

On the other hand, Ofsted has found that the best teaching often involves scientific enquiry and some argue that the emphasis on factual knowledge distracts from this. The essential aim of scientific enquiry, to develop children’s thinking skills, can be seen as the basis of any good primary teaching. However, there is concern that some teachers are unclear of the purpose of scientific enquiry, which prevents them from teaching effectively.

The Purpose of Assessment

Clarifying the main purpose for which young children are assessed can help determine what kinds of assessments would be the most appropriate. Assessment of individual children might serve one of the following purposes:

- To determine progress on significant developmental achievements;
- To diagnose learning and teaching problems;
- To help in instruction and curriculum decisions;
- To serve as a basis for reporting to parents; and
- To assist a child with assessing his or her own progress.

“ Decisions regarding the purpose of assessment should begin with discussion among all the stakeholders – parents, educators, and other members of the community – as appropriate. The group may want to keep in mind that:

Plans, strategies, and assessment instruments are differentially suited for each of the following potential purposes of assessment;

An overall assessment should include the four categories of educational goals: knowledge, skills, dispositions, and feelings;

Assessments made during children’s informal work and play are most likely to minimise the many potential errors of various assessment strategies”. (Katz, 1995, p67).

The Risks Of Assessing Young Children

Young children are notoriously poor test-takers: perhaps they are sometimes confused by being asked questions that they think the tester must already

know the answers to. There is reason to suggest that the younger the child being evaluated, assessed, or tested, the more errors are made (Shepard, 1994; Ratcliff, 1995). If this principle is sound, then the younger the children: the longer the children live with a label (a true or false one), the more difficult it may become to discard it.

Assessment Technique Number 1 – Earth, Sun and Moon Assessment " Test"

This " test" has 14 questions, which are listed below:

- What shape is the Earth?
- Put the Moon, Sun and Earth in order of size, biggest first.
- Why is it difficult to collect evidence about the Sun?
- Why does the Sun appear to move across the sky?
- Draw the Moon. Explain why you have it in this way?
- How long does it take for the Moon to orbit the Earth?
- How long does it take the Earth to make one complete turn on its axis?
- Where does the Sun go at night?
- What does " orbit" mean?
- Why do we get more hours of daylight per day in the summer?
- Where would you be standing if you got 24 hours of daylight every day in summer?
- If you were still in the same place as in question 11, how many hours per day of darkness would you get in winter?
- Which TWO changes make plants start to grow in the spring?
- What was your favourite part of this topic?

Foundation Stage – 2 children aged 4

As stated, very young children do not perform well in tests. This “ test” is more like a knowledge and understanding “ checklist” and can be used in a variety of circumstances. If children are going to gain scientific knowledge and retain an interest in the subject as they progress through school, then the learning process must be fun, interactive and stimulating.

With the two 4-year olds – the “ test” was used to structure a highly interactive dialogue and to assess their current level of knowledge and understanding of the subject matter. Both children knew quite a lot about day and night, and the shape of the planets. This information had been developed through a variety of sources – from school, mum and dad, play with friends, the TV.

The dialogue lasted approximately 15 minutes and covered about six or seven of the questions on the list. Asking direct questions did not produce positive results. The children become agitated. However, when they become fully engaged in discussion – the “ test” could be used to assess their current level of knowledge. This technique, if used correctly, is a useful and versatile assessment method.

The children’s responses to the “ questions” can be recorded and revisited at a later date to determine how much new learning has occurred. This technique is also useful when used in conjunction with a variety of learning resources about the subject matter.

Year 2 – 2 children aged 7

In this situation – the teacher used less “ prompts” to engage each child in discussion about each of the questions in the “ test”. Again the technique proved for assessing the children’s current level of knowledge and understanding of the subject matter. This session lasted 30 minutes and nearly covered all of the questions. When the children became particularly animated about some aspect of the subject matter – then it was more productive to let them express their ideas and opinions for some time – rather than simply passing onto the next question.

Assessment Technique 2 – “ Concept Cartoons”

These are a new approach in teaching, learning and assessment in science. They were created by Brenda Keogh and Stuart Naylor in 1991. They feature cartoon-style drawings showing different characters arguing about an everyday situation. They are designed to intrigue, to provoke discussion and to stimulate scientific thinking. They may not have a “ right” answer. They are available with background science notes for teachers.

A typical Concept Cartoon has the following:

Visual representation of scientific ideas

Minimal text, in dialogue form

Alternative viewpoints on the situation

Scientific ideas are applied in everyday situations

The scientifically acceptable viewpoint in the alternatives

The alternatives

With both sets of children, concept cartoons, proved to be very popular. With the 4 year-olds they obviously needed more assistance to help work through each situation that was a portrayed in each cartoon. The 7 year-olds needed less help and were more able to freely express their ideas and opinions about different aspects of the subject matter.

Part 3:

Foundation Stage – 2 children aged 4

What the children got right:

There is night and day

There are 4 seasons, which are caused by the relationship between the Earth and the Sun

The Sun is a star and not a planet

Misconceptions:

The Moon is made of cheese

The Sun goes round the Earth

The Earth “ stands still”

As stated, the 4 year-olds got their ideas about the Moon, the Sun and the Earth from a wide variety of sources. A major problem with developing scientific knowledge is that the children cannot relate to, many of the concepts in the daily lives. Yes – they understand there is night because they

go to sleep at night – it is physically black. They wake up when it is day. However, the Earth spinning on its axis and orbiting around the Sun is something you can tell them – but because they cannot go home and find something to relate to – they tend to forget this information. If you simply feed them more facts – they end up being more confused.

Year 2 – 2 children aged 7

The 7 year-olds are generally more clued up about many of the concepts that were discussed. However, when probed about their level of curiosity about the subject matter – they said that they did not really like the subject. Yes – they agreed that it was important to understand basic scientific facts – but they said they were pre-occupied with other things. They could not easily relate to scientific knowledge in their everyday lives.

Misconceptions come from a variety of sources but perhaps a loss of interest in the subject matter was the major cause of this incorrect information. The 7 year-olds were not interested in finding out the correct information. Perhaps the biggest problem with teaching primary science is that the pupils find it extremely difficult to apply scientific knowledge to their everyday lives.

There are three key aspects to learning something new:

Knowledge – i. e. facts e. g. the Earth spins on its axis every 24 hours.

Comprehension – putting the facts into a context, which the pupils understand – there are lots of learning resources, which can be used to achieve comprehension.

Application – this is when the pupils can apply this new knowledge to some aspect of their daily lives.

Application is a major weakness in many of the strategies that are used to teach primary school pupils science. Where schools spend a lot of time relating science to other areas of the curriculum and the children's everyday environment at home and at the school – then the children's knowledge and understanding of science dramatically increases.

Part 4 – A Strategy To Improve The Quality of Teaching Primary Science

Science at Key Stage 1 – Planning For One Child's (Aged 7) Response

Section 1 – Introduction – The activity for this section involved asking " Tom" to draw and explain a picture showing how these would look to a traveller in space. He was asked the following questions:

Is the Earth flat?

Is the Sun bigger than the Moon?

Does the Sun move?

Knowledge / Comprehension / Activities – These questions were used to ascertain Tom's current level of knowledge and understanding. Tom knew that the Earth is not flat. He knew that the Sun was bigger than the Moon. He was not quite sure whether the Sun moved. This is an area, which requires further investigation.

ICT – The Paint software package was used to allow Tom to paint the Earth, Moon and Sun.

Section 2 – Flat or Spherical – Children Should Learn:

That the Sun, Earth and Moon are approximately spherical

That it is sometimes difficult to collect evidence to test scientific ideas and that evidence may be indirect

Knowledge / Comprehension

Children recognise that the Earth, Sun and Moon are spheres

Describe some indirect evidence that the Earth is spherical e. g. ships appearing and disappearing over the horizon

Activities – Using photographs of the Earth, Sun and Moon taken from space, Tom was asked to confirm whether the aforementioned bodies were flat or spherical. It was explained to Tom that it is only within recent times (i. e. the last 40 years) that we have had access to photographic evidence from space about Earth being spherical.

Tom was asked why people at an earlier time thought that the Earth was flat. Some ideas were explored. In the Middle Ages for example, people could travel far and far as they were concerned the Earth was flat. In those days – for the vast majority of people – their eyesight and their ears were the primary source of information. “ Science” as such did not exist.

ICT – The Internet was used to look for additional photographs of the Earth taken from space.

Section 3 – Size and Distance – Children Should Learn:

About the relative sizes of the Sun, Moon and Earth

Knowledge / Comprehension

Children select three spheres to represent the Earth, Sun and Moon recognising which is largest and which is smallest and making a reasonable match to relative size

Activities – The drawings that Tom had made earlier and the images he had made using Paint were used for the next activity. He was presented with a range of spherical objects: tennis ball, ball bearing, table tennis ball etc – and was asked to select three of the objects, which he considered represented the relative size of the Earth, Moon and Sun.

ICT – Instead of asking Tom to select from a range of spherical objects – he could have used Paint to produce spherical images of varying sizes to represent the Earth, Moon and Sun.

Section 4 – The Changing Position Of The Sun – What Children Should Learn?

That the Sun appears to move across the sky over the course of a day

That evidence may be interpreted in more than one way

Knowledge / Comprehension

Children describe how the apparent position of the Sun changes over the course of a day and clarify that this does not mean that the Sun is moving

Activities – Tom was asked about where the Sun shines into the school and his home at different times of day. He was asked to consider what happened to his shadow during the course of the day. This activity could be extended to looking at shadows in the playground at different times of the day.

ICT – Tom was provided with assistance to use the Internet to search for websites, which showed different lengths of shadows.

Section 5 – The Movement Of The Earth – Children Should Learn:

That is the Earth that moves, not the Sun, and the Earth spins on its axis once every 24 hours

That it is daytime in the part of the Earth facing the Sun and night-time in the part of the Earth away from the Sun

Knowledge / Comprehension

Children illustrate (e. g. using drawings etc) that different parts of the Earth face the Sun during the course of the day and where it is day and night

Explain that the movement of the Sun is a result of the Earth rotating or spinning

Activities – Tom was asked to view a short excerpt from a video, which showed the Earth spinning on its axis. A short discussion ensued about how the content of the video and the concepts that were illustrated. A table lamp and a tennis ball were used to illustrate the concepts of day and night.

ICT – Websites which demonstrate the aforementioned concepts and which are interactive.

Summary

Whilst the outlined strategies were effective at helping Tom to increase his knowledge and understanding of the Earth, Moon and Sun – it is likely that his retention of this information would be increased by linking these studies to other aspects of the curriculum. For example, green issues, how does the Sun affect Eskimos, people who live in Africa etc. This approach would should to increase the comprehension of the pupils with regard to sections 1 to 5.