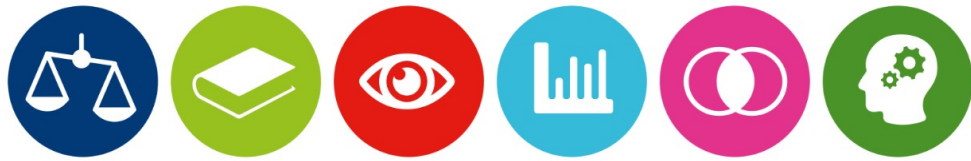


Science through School

Scientific Enquiry Approaches



pupils should carry out several investigations which involve different types of enquiry:

- **comparative / fair testing**
- **research**
- **observation over time**
- **pattern seeking**
- **identifying, grouping and classifying**
- **problem solving**



<https://pstt.org.uk/resources/curriculum-materials>

Scientific Enquiry Skills



pupils should have the opportunity to carry out practical investigations in science that help them to develop their scientific skills. These skills are sometimes referred to as a cycle or 'PLAN, DO, REVIEW'. We know these skills as *working scientifically* skills.

- **asking questions**
- **making predictions**
- **setting up tests**
- **observing and measuring**
- **recording data**
- **interpreting and communicating results**
- **evaluating**

Scientific Enquiry Approaches

Comparative / fair testing

Changing one variable to see its effect on another, whilst keeping all others the same.



We might start talking about comparative or fair testing with children by first talking about what can be changed (the 'variables') and whether this might make a difference to the outcome.

Example - What will affect how far the car travels?

Possible variables: the height of the ramp, the surface of the ramp, what the wheels of the car are made from, the shape of the car, the mass of the car, whether the car is pushed.

Comparative test: If I change the car (the independent variable), what will happen to the distance the car travels (the dependent variable)?

Fair test: If I change the surface of the ramp (the independent variable), what will happen to the distance the car travels (the dependent variable)?

Scientific Enquiry Approaches

Research

Using secondary sources of information to answer scientific questions.



Pupils might use pictures, books, websites or information sheets that have been pre-prepared to help them to find out answers to questions about any area of science. They may visit a museum or talk to a visitor in school or parent about science.

Examples

Why is drinking salt water bad for humans? Children could watch a film clip showing the effect of a salt solution on living cells.

How do some animals manage to live in salty water? Children could use a website to find out which animals are able to drink salt water and how they are able to do this.

Can you explain some notable features of some of the bizarre creatures that can be found in the deep-sea? How do these features help them to survive? Children could look at pictures in books or images easily obtained from the internet.

How does skin change as you grow older? Children could take pictures of family members and compare them.

Scientific Enquiry Approaches

Observation over time

Observing changes that occur over a period of time ranging from minutes to months.



All sorts of questions can be answered through observation over time. The period of time might be seconds, minutes, days or even months depending on the question asked.

Examples of observation of time:

How do some materials change when they are heated? Children may investigate what happens to chocolate when it is heated for a few minutes and then cooled.

How do shadows change throughout the day? Pupils might observe the shadow they cast at different times of the school day.

Which drinks are bad for your teeth? Pupils might observe egg shells in different liquids for a few days.

What happens to frog spawn? Children might observe tadpoles developing for a few weeks.

What changes happen to a tree? Pupils might visit the same tree every month for a complete year.

Scientific Enquiry Approaches

Pattern-seeking

Identifying patterns and looking for relationships in enquiries where variables are difficult to control.



Pattern seeking often starts with a question about a possible link between two events or phenomena (variables). You may start by asking the children 'I wonder whether the smallest ...' or 'I wonder if the largest....'

Examples of pattern seeking:

Where do daisies grow? Children could count the number of daisies growing inside a hoop in different parts of the school grounds.

Do the biggest apples have the most seeds? Children could measure the mass or circumference of an apple and record the number of seeds inside.

Where do we find the most woodlice? Children could record the number of woodlice they find in different habitats.

Can children with the longest legs run fastest? There is often a child in the class who is smaller than average but can run faster than his/her peers. It is useful to find anomalies to these kinds of patterns and to discuss what other factors might be responsible for the effect. For example, this child may have more efficient muscles, larger lungs, do lots of sports.

How do musical instruments produce low notes? Is there a pattern? Pupils could look at the width of strings on a guitar, the number of holes covered on a recorder, or the volume of water in a glass bottle.

Scientific Enquiry Approaches

Identifying, grouping and classifying
Making observations to name, sort and
organise items.



Young children (ages 4 -5 years) perform simple grouping tasks, sorting items by simple observable features such as colours, shape and size. As children develop their knowledge of plants, animals and materials, they will sort and classify living things and materials using specific criteria. Older children may make charts or keys to help identify different animals and plants according to their observable features, and materials according to their properties.

Examples of identifying, grouping and classifying:

Can you sort these materials? Explain how you have grouped them. Young children may identify simple observable properties of materials such as hard/soft, rough/smooth, shiny/dull, whereas older children could compare and group materials according to transparency, electrical or thermal conductivity or solubility.

How are sounds made by musical instruments? Pupils could explore sounds made by string and wind instruments and identify and group the ways in which sounds are made. They could identify patterns, such as the thicker strings on a guitar produce the lower notes or shorter strings produce higher-pitched notes.

How can we sort animals into groups? Younger children may group animals according to their appearance (e.g. number of legs, presence of fur or scales), their habitat (e.g. live in nest or a burrow), or their diet (carnivore, herbivores, omnivores). Older children with a greater knowledge of the features of vertebrate and invertebrate groups could identify and classify animals as fish, amphibians reptiles, birds, mammals or snails, slugs, worms, spiders and insects.

Scientific Enquiry Approaches

Problem-solving

Applying prior scientific knowledge to find answers to problems.



To help children develop independence in scientific enquiry, pupils should be encouraged to use their own initiative in problem solving. You might challenge your pupils directly with a question or show a particular phenomena and ask them to explain it. Often, posing problems with a real life context will stimulate children's interest and thinking.

Examples of Problem Solving:

How do chemical rockets work? This problem allows children to investigate a chemical reaction which produces gases.

Design a device that creates a mechanical chain reaction. This problem allows children to explore forces and is described in

What would you do next? This questions is asked to challenge children to consider what further questions they may want to ask and research after learning about a topic.