Primary Science Teaching Trust

Enquiry Skills Guide

Asking questions
Asking questions that can be answered using a scientific enquiry.

Making predictions
Using prior knowledge to suggest what will happen in an enquiry.

Setting up tests
Deciding on the method and equipment to use to carry out an enquiry.

Observing and measuring
Using senses and measuring equipment to make observations about the enquiry.

Recording data
Using tables, drawings and other means to note observations and measurements.

Interpreting and communicating results
Using information from the data to say what you found out.

Evaluating
Reflecting on the success of the enquiry approach and identifying further questions for enquiry.

What are enquiry skills?

Here we introduce seven science skills which children develop from ages 4 to 11 years:

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

How can I teach enquiry skills?

We suggest that teachers and pupils focus on one enquiry skill during each practical science lesson. Teachers might consider having an enquiry skill as a learning objective, in addition to, or instead of, an objective related to subject knowledge.

During their investigation, children may use all the enquiry skills listed above, but teaching and learning should focus on just one.

For example, if the focus is *interpreting and communicating results*, the planning and any predictions could happen within class discussion, data might be recorded by one pupil working with others in small groups (there is little benefit in children copying tables of data), but all the pupils could have a go at interpreting their results independently, either in written form or orally (both are valid).

How can I assess enquiry skills?

For information on assessing enquiry skills, visit PSTT's **Teacher Assessment in Primary Science (TAPS)** webpage.

The **TAPS focused assessment approach** embeds assessment within classroom primary science activities. There are plans that have a particular focus on the assessment of enquiry skills and there are also focused assessment examples of children's learning.

Taking one focus at a time means that assessing science, including practical work, becomes more **manageable** with a whole class. It increases the **validity** of teacher judgements. As TAPS resources have been developed and trialled by schools, teachers using TAPS materials can feel that their judgements are **reliable**.

Asking questions

Asking questions
Asking questions that can be answered using a scientific enquiry.

Questions children may ask:

What features do animals living at the North Pole have?

Children might use books, websites or watch videos to find out (research).

Do all flowers have five petals?

Children may suggest carrying out a survey of flowers in the school grounds (pattern seeking).

Which shoes have most grip?

Children could investigate the forces needed to pull shoes across different surfaces (a comparative test).

When is the bulb brightest?

Children could investigate the effect of changing the number of batteries or the thickness / length of the wire in their circuit (fair tests).

Making Predictions

Making predictions
Using prior knowledge to suggest what will happen in an enquiry.

Predictions that children may make:

I think that the biggest egg will hatch first.

You could have an egg hatching kit in the classroom for chicks (observation over time).

I think that some objects can be hard and soft.

Children could identify classroom objects as hard and/or soft and place into labelled hoops (Identifying, grouping and classifying). Will the hoops need to overlap because some objects are hard and soft?

I think this is the strongest magnet.

Children could measure the greatest distance that different types of magnet attract a paperclip (fair test).

I think the puddle on the in the sun will evaporate sooner than the puddle in the shade.

Children may investigate by measuring the perimeter of the puddle or taking photographs during the day (observation over time and a comparative test).

Setting up tests

Setting up tests
Deciding on the method and equipment to use to carry out an enquiry.

Planning an investigation with children often starts with a question and then discussion about the equipment needed and the method that will be followed. Sometimes it is appropriate to provide the equipment and let the children decide their method independently. Sometimes you might have a class discussion to plan how the children will carry out the investigation but leave the children to select the equipment they need.

Questions leading to child-led enquiry:

What changes do you notice across the four seasons?

Children may decide to observe one tree across the year and ask to photograph it using a camera or tablet (observation over time).

How do rocks vary?

Children may use hand lenses or microscopes to help them identify whether they have grains, crystals or fossils in them (identifying, grouping and classifying).

How will you separate this mixture of sand, stones and salt?

You may provide a range of sieves, spoons, filter paper and funnels so that the children can explore how to do this most effectively (problem solving).

Observing and measuring

Observing and measuring
Using senses and measuring equipment to make observations about the enquiry.

Children will use a variety of equipment for observing and measuring:

Using different senses

You may use 'feely' bags or smelling pots to encourage young children to use their sense of touch and smell to identify different objects (identifying, grouping and classifying).

Measuring with rulers

Children might investigate what happens to a seed or bulb as they grow into mature plants and measure the length of the stem (observation over time).

Using a thermometer

Children might investigate the effect of temperature on the time it takes sugar to dissolve (fair test).

Using data loggers

Children could record sound made by a ticking clock as the distance from the source increases (pattern seeking).

Recording data

Recording data
Using tables, drawings and other means to note observations and measurements.

Children may record data is several ways:

Using drawings or annotated diagrams

Children investigating the effect of light, water and temperature on plant growth might draw diagrams of the plants every few days (observation over time).

Using tables

Children investigating materials that conduct electricity might record their findings in a table (comparative test).

Using graphs

Children investigating whether people with the longest legs run fastest could plot a scatter graph and draw a 'line of best fit' to see whether there is a direct relationship (pattern seeking).

Interpreting and communicating results

Interpreting and communicating results
Using information from the data to say what you found out.

Pupils may record their findings in oral or written forms.

Note: It is not necessary for primary age children to produce a written scientific report (e.g., method, results, conclusions) every time they carry out an investigation. children could communicate what they found out in one of the following ways:

Orally

Young children could explain to the class which items sink and float after they have each tested some objects (identifying, grouping and classifying). Older children might explain where it is best to dry damp washing and suggest reasons for this.

Drama

Children describe pollination of flowers by insects after watching some film clips (research).

Slideshows

Older children could present a slideshow to their peers after finding out about the life cycle of a chosen animal (research).

Diagrams

Children could create a classification key to identify mini beasts or plants after carrying out a survey in their local environment (identifying, grouping and classifying).

Poster/leaflet

Children could suggest which drinks would be best for your teeth after investigating the effect of different liquids on egg shells (observation over time & fair test).

Sticky note/paragraph

Children could write a short paragraph to explain how to make the best string telephone after testing various pots and threads (pattern seeking).

Evaluating

Evaluating
Reflecting on the success of the enquiry approach and identifying further questions for enquiry.

Pupils may evaluate their practical investigations orally or in written forms:

Informal discussion between pupil and teacher

A pupil may explain that the rocket mouse did not travel far because the bottle was small (comparative test).

Class discussion

Pupils may agree that they did not find many mini beasts when they went out to survey the school grounds because it was a cold/wet day (identifying, grouping and classifying).

Written paragraph

A child may explain an anomalous result on a graph. For example, when investigating the effect of changing the shape of objects falling through a liquid (fair testing), a pupil wrote, 'We found it difficult to start the stopwatch exactly at the time the shape touched the surface of the liquid so the times are not very accurate.'