The Ogden Trust

making physics matter

Age 5-11 years

Working scientifically

Developing children's skills in comparative tests

Introduction

Enquiries that are comparative tests have many similar features to fair tests in that one variable is changed, another variable is measured, and any other variables are controlled. The difference is that in a comparative test the variable that is changed is discrete rather than continuous, so children are comparing different cases/situations. Children regularly ask questions that lead to a comparative test, and these types of enquiries provide lots of opportunities to measure and collect data.

Big questions

Here are some examples of 'big questions' that pupils can explore through comparative tests in KS1 and KS2. There is at least one for every area of the curriculum, so it is easy to plan opportunities for children to revisit this type of enquiry and develop their skills.

Year 1	Year 2	Year 3	Year 4	Year 5	Year 6
Which type of compost grows the tallest sunflower?	Do cress seeds grow quicker inside or outside?	Which conditions help seeds germinate faster?	How does the average temperature of the pond water change in each season?	Which seed shape takes the longest time to fall?	Which is the most common invertebrate on our school playing field?
Which tree has the biggest leaves?	Do amphibians have more in common with reptiles or fish?	How does the skull circumference of a girl compare with that of a boy?	In our class, are omnivores taller than vegetarians?	Who grows the fastest, girls or boys?	Which type of exercise has the greatest effect on our heart rate?
Is our sense of smell better when we can't see?	Do bananas make us run faster?	Which soil absorbs the most water?	Does seawater evaporate quicker than fresh water?	Which type of sugar dissolves the fastest?	What is the most common eye colour in our class?
In which season does it rain the most?	Is there the same level of light in the evergreen wood compared with the deciduous wood?	Which pair of sunglasses will be best at protecting our eyes?	Which material is best to use for muffling sound in ear defenders?	How does the length of daylight hours change in each season?	Which material is most reflective?
Which materials are the most flexible?	Which shapes make the strongest paper bridge?	Which magnet is strongest?	Are two ears better than one?	Which shoe is the most slippy?	Which make of battery lasts the longest?
Which materials are the most absorbent?	Which material would be best for the roof of the little pig's house?	Which surface is best to stop you slipping?	Which metal is the best conductor of electricity?	Which shape parachute takes the longest to fall?	Which type of fruit makes the best fruity battery?

Working scientifically skills

Comparative tests tend to involve some sort of data collection; KS1 children may use tally charts to record their observations but, as children move through KS2 they should be using an increasingly wide range of equipment to make measurements. They should learn what it means to measure accurately and check for reliability. Children will learn to independently plan how to record and analyse the data, using tables, pictograms, and bar charts to compare the measurements they make. Children can then use the bar charts to draw conclusions about what they have found out to be the answer to their 'big question' using the PEE model (see 'observing over time'guide **https://www.ogdentrust.com/assets/general/working-scientifically-observing-over-time.pdf**).To promote higher order thinking, children should be challenged to evaluate the procedure they used and the quality of their data, suggesting ways they could improve their test.

Resources

Here is a range of equipment that schools will find useful to support comparative tests.

Stopwatches/timers	Thermometers	Measuring cylinders
Data loggers	Light sensors	Temperature sensors
Sound sensors	Clipboards	Newton meters
Tape measures/rulers	Scales/balances	Graph/squared paper

Reporting learning

Comparative tests are a good opportunity for children to focus on writing different aspects of a lab report in a more formal reporting style, organising their writing with subtitles, and, as they move into upper KS2, learning to use the passive voice in their writing. On occasion, children can practice describing the method they planned to collect their data; it is important to note that it is not essential to write a full report but, rather, focus on a key area of reporting in which you would like children to develop their skills. An excellent way to test how well children have described their method is to group them in pairs and ask them to directly follow their partner's written instructions (with no other information). The observing partner will be able to note which important steps and details they have missed in their reporting, and therefore improve their instructions.

In KS1 books you would generally expect to see a tally chart, pictogram, or block chart when reporting a comparative test, but older children in KS2 should be learning to independently draw a bar chart. The aim should be that by the time those children are in Year 6, they will be able to use their table of data to plan the best scale for the axes on their chart, and select sensible labels for the axes and a meaningful title for their bar chart with no support. Children should then use their data to support them in writing a conclusion and evaluation to complete their lab report.

Additional information

A great example of a comparative test from history that you can share with your pupils is James Lind's controlled experiment aboard two ships (the first ever clinical trial). He gathered two identical populations and provided one with citrus fruit and not the other. This led to the scientific understanding on how to prevent scurvy.

Planning

Curriculum mapping	Identify a potential comparative test enquiry in every science unit.	Aim for each class to revisit comparative tests five to six times over the academic year.	Plan to include scenarios where children get to suggest their own comparative test enquiries.
Progression planning	Using National Curriculum documents, map out age-related Expectations (ARE) for comparative test enquiries.	Establish age specific success criteria for comparative test enquiries.	Develop a collection of exemplar outcomes to support consistent expectations (WAGOLL).
Resource audit	Take stock of science and maths resources, making a comprehensive list of items that would support this type of enquiry.	Provide teaching staff with a list of resources that their pupils should get the opportunity to use over the year.	Put procedures in place for teachers to alert senior leadership when resources are broken, faulty or missing.
Support and challenge	Ensure that teachers are aware of ARE for the academic years before and after the one they are teaching.	Teachers develop support materials for children working below ARE in their class. Examples include classroom displays, writing frames or sentence starters.	Teachers develop extension tasks for gifted and talented science learners that extend their working scientifically skills.
Quality assurance	Review children's work to look for coverage of all enquiry types as well as progression and challenge across year groups.	Carry out a 'learning walk' while all classes focus on comparative tests – identify good practice and highlight areas for development.	Lead pupil voice work that focuses on working scientifically, exploring children's perceptions on experiences and levels of understanding.
Celebrate	Have a working scientifically'notice board with a display that changes to a new type of enquiry each half term.	Display high-quality examples of comparative test enquiry work from each class and identify key features and progression.	As a special whole school focus, put in place a system of reward for individual success in working scientifically.