Working Scientifically and Scientific Enquiry

Helen Spring
Primary Science and Outdoor Learning Consultant

@SpringLearns
SpringLearning.co.uk
helen@springlearning.co.uk
07790613331

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Feel free to also use the chat to chat to each other ☺

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Chartered Science Teacher
CSciTeach

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CPD MARK
LEAD FACILITATOR

CPD MARK
ONLINE FACILITATOR

Science
ACROSS THE CITY

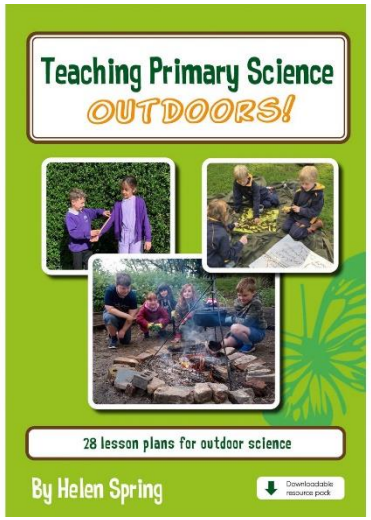
PSQM
Primary Science Quality Mark

HOWSHAM MILL
RENEWABLE HERITAGE TRUST

Explorify
Champion

fascinate

The Association for Science Education
Promoting Excellence in Science Teaching and Learning



POLAR EXPLORER
PROGRAMME

CLEAPSS
primary

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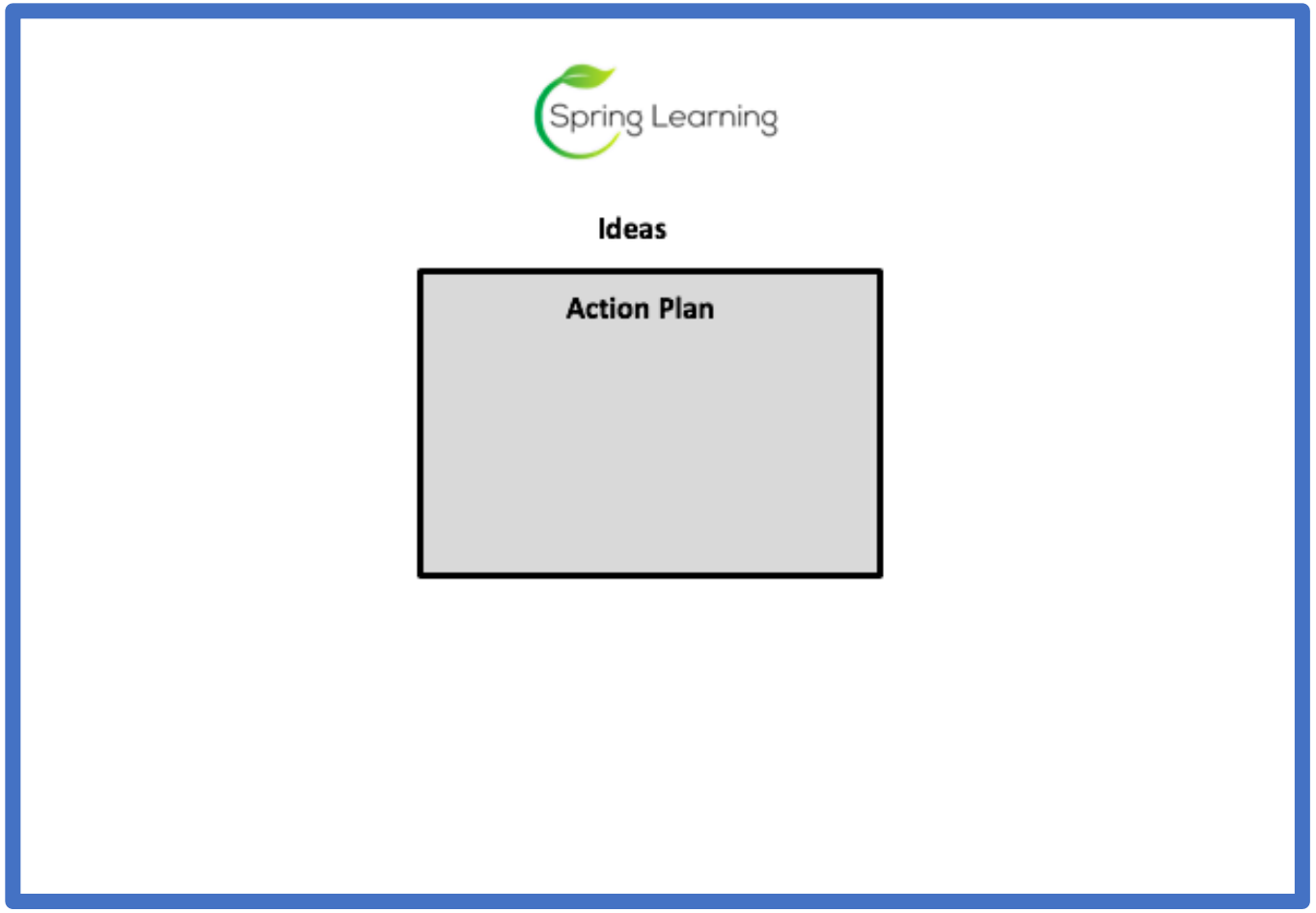
Action planning



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Learning outcomes

You will be able to:

- Explore scientific enquiry and how is it different from working scientifically?
- Raise the profile of the 5 types of enquiry in your classroom.
- Explore practical examples of each type of enquiry.
- Consider how to plan scientific enquiry into your lessons.
- Develop understanding of how to develop working scientifically skills throughout the primary phase.

Working Scientifically in my school….

padlet

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SCIENCE LEARNING

PSQM Science Learning Aim

Science learning is strengthened and developed through a shared understanding of:
A. the purposes and process of science enquiry;
B. the purposes of science assessment and current best practice;
C. the importance of, and strategies for, developing all children's science capital.

These aims are expressed through the following PSQM Science Learning criteria, which define the evidence required to meet them and achieve PSQM, PSQM Gilt and PSQM Outreach.

For Primary Science Quality Mark:

PSQM Science Learning Criteria

Subject leadership develops teachers' practice:
A. Children are taught to use different enquiry types to answer scientific questions about the world around them, through the use of scientific enquiry skills.
B. A range of strategies and processes for formative, summative and statutory assessment are used, which reflect a shared understanding of the purposes of assessment in science and current best practice.
C. Initiatives that encourage all children to think that science is relevant and important to their lives, now and in the future, are supported and promoted.

For Primary Science Quality Mark Gilt and Outreach:

PSQM GILT and OUTREACH Science Learning Criteria

Subject leadership develops and evaluates teachers' practice:
A. Children develop independence in the full range of enquiry types, using scientific enquiry skills appropriately to answer scientific questions about the world around them.
B. There is a school-wide commitment to continually improving assessment practice and processes for formative, summative and statutory assessment, through regular evaluation which ensures that they reflect the shared understanding of the purposes of assessment in science and current best practice.
C. The whole-school community supports and promotes initiatives that encourage all children to think that science is relevant and important to their lives, now and in the future.

PSQM and Working Scientifically

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What do you think the aims of the Primary Science Curriculum are?

Aims

The national curriculum for science aims to ensure that all pupils:

- develop **scientific knowledge and conceptual understanding** through the specific disciplines of biology, chemistry and physics
- develop understanding of the **nature, processes and methods of science** through different types of science enquiries that help them to answer scientific questions about the world around them
- are equipped with the scientific knowledge required to understand the **uses and implications** of science, today and for the future.

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5 Types of Enquiry

The nature, processes and methods of science

'Working scientifically' specifies the understanding of the nature, processes and methods of science for each year group. It should not be taught as a separate strand. The notes and guidance give examples of how 'working scientifically' might be embedded within the content of biology, chemistry and physics, focusing on the key features of scientific enquiry, so that pupils learn to use a variety of approaches to answer relevant scientific questions. These types of scientific enquiry should include: observing over time; pattern seeking; identifying, classifying and grouping; comparative and fair testing (controlled investigations); and researching using secondary sources. Pupils should seek answers to questions through collecting, analysing and presenting data. 'Working scientifically' will be developed further at key stages 3 and 4, once pupils have built up sufficient understanding of science to engage meaningfully in more sophisticated discussion of experimental design and control.

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5 Types of Enquiry

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5 Types of Enquiry in EYFS

Science in EYFS

ELG: The Natural World

Children at the expected level of development will:

- Explore the natural world around them, making observations and drawing pictures of animals and plants;
- Know some similarities and differences between the natural world around them and contrasting environments, drawing on their experiences and what has been read in class;
- Understand some important processes and changes in the natural world around them, including the seasons and changing states of matter.

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Progression in Working Scientifically

‘KS1 - pupils should be helped to develop their understanding of scientific ideas by using different types of scientific enquiry to answer their own questions, including observing changes over a period of time, noticing patterns, grouping and classifying things, carrying out simple comparative tests and finding things out using secondary sources of information.’

Science programme of study 2014

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Progression in Working Scientifically

‘LKS2 - Pupils should ask their own questions about what they observe and make some decisions about which types of scientific enquiry are likely to be the best ways of answering them, including observing changes over time, noticing patterns, grouping and classifying things, carrying out simple comparative and fair tests and finding things out using secondary sources of information.’

Science programme of study 2014

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Progression in Working Scientifically

‘UKS2 – Pupils should select the most appropriate ways to answer science questions using different types of scientific enquiry to answer their own questions, including observing changes over different periods of time, noticing patterns, grouping and classifying things, carrying out comparative and fair tests and finding things out using a wide range of secondary sources of information.’

Science programme of study 2014

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Resources for planning for progression in Working Scientifically

Substantive knowledge (the stuff about science)

Working Scientifically

Enquiry type

Question to investigate

https://www.facebook.com/Primary-Science-Geeks-332136757195457

@priscigeeks

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Resources for planning for progression in Working Scientifically

The Ogden Trust
making physics matter

why & how?
PRIMARY SCIENCE TEACHING TRUST

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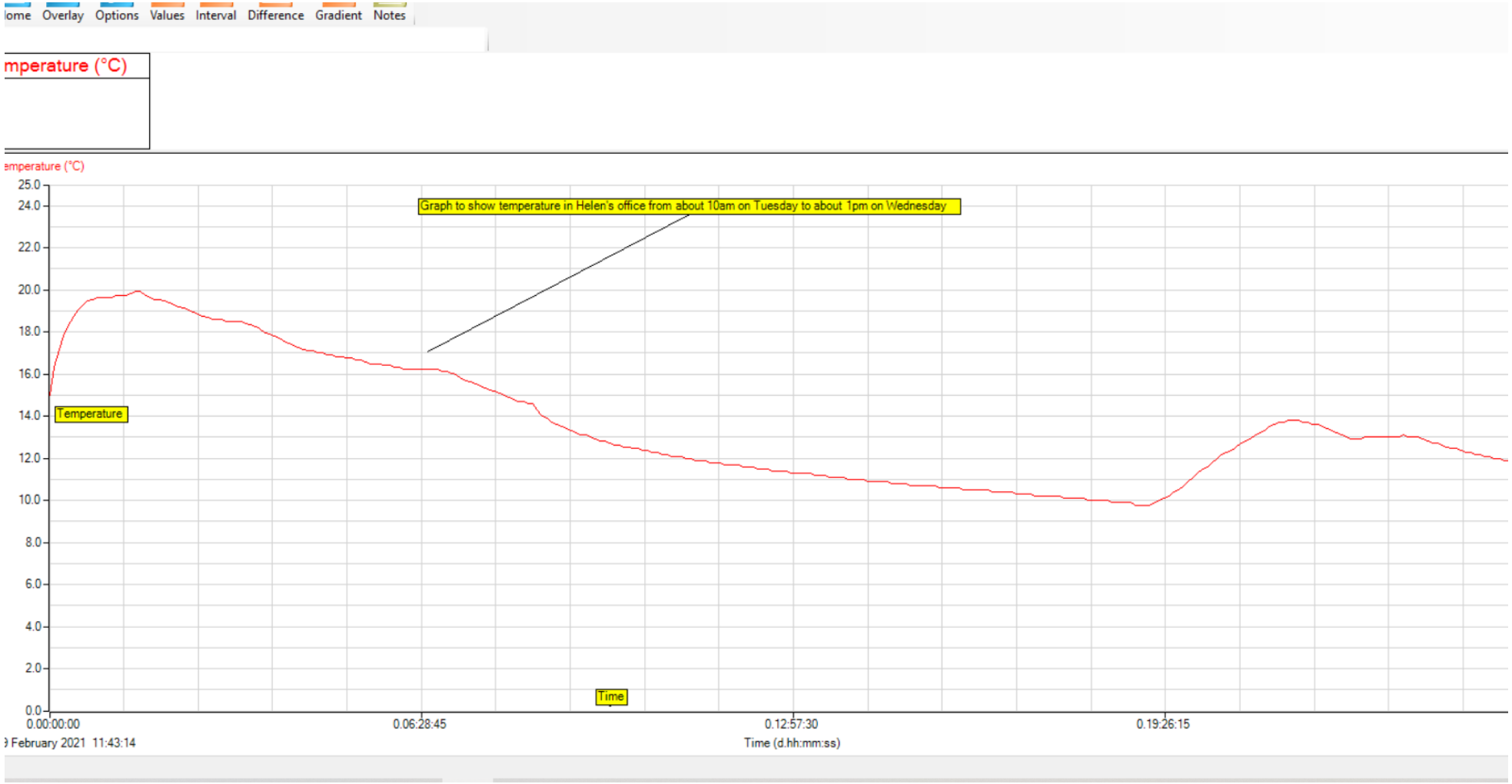
Observing over time



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Substantive knowledge (the stuff about science)

Understand temperature of materials can be measured in °C

Take accurate measurements using standard units, using a range of equipment including thermometers and data loggers

Working Scientifically

Enquiry type

Which material is best for keeping our hot chocolate warm?

Question to investigate

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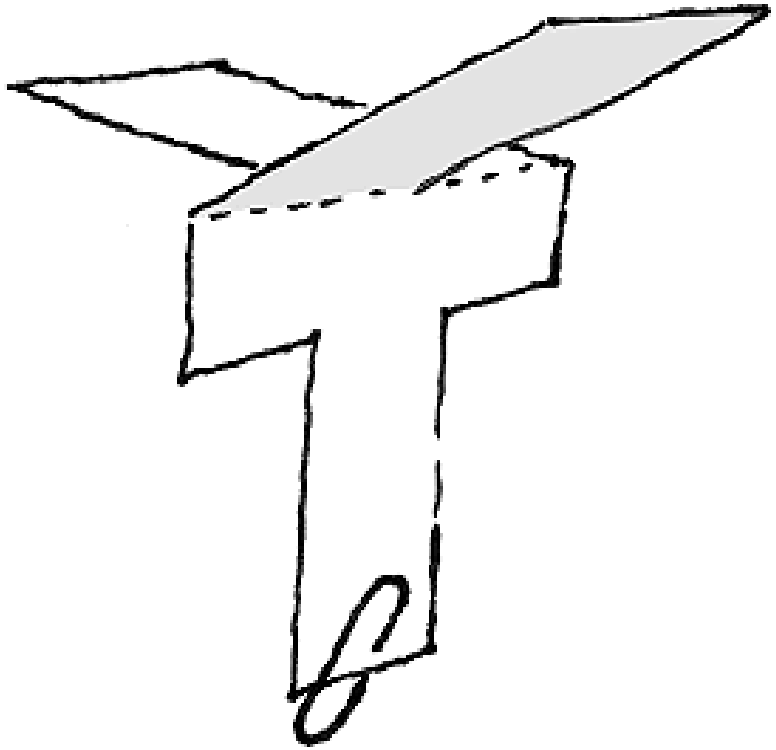
Comparative and Fair Tests



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Substantive knowledge (the stuff about science)

Describe the life processes of reproduction in some plants.

planning different types of scientific enquiries to answer questions, including recognising and controlling variables where necessary

Working Scientifically

Which seed shape takes the longest to fall?

Enquiry type

Question to investigate

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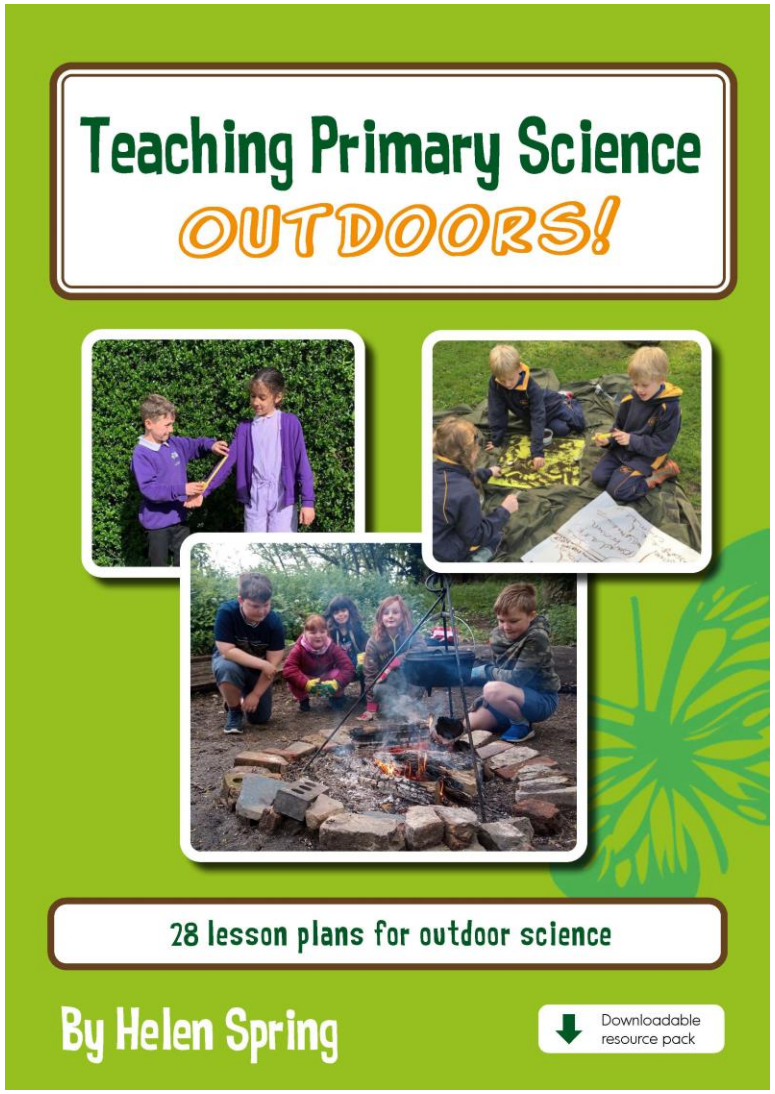
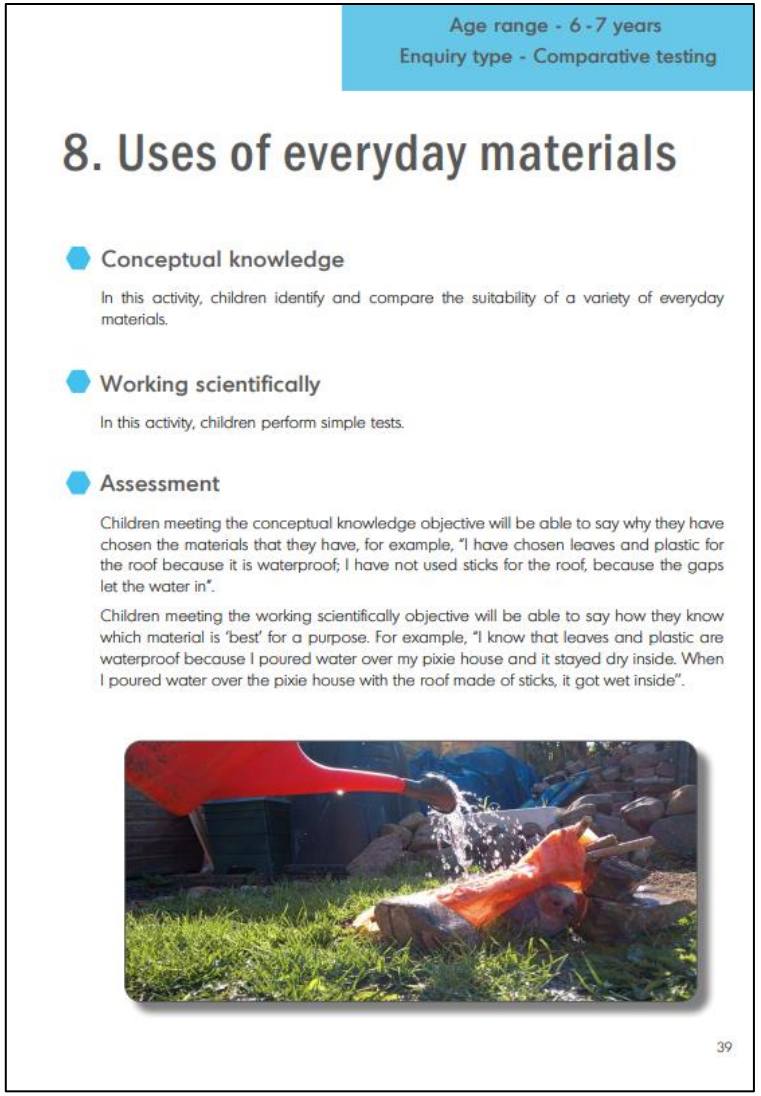
Comparative testing





Age range - 6-7 years
Enquiry type - Comparative testing

8. Uses of everyday materials

Conceptual knowledge

In this activity, children identify and compare the suitability of a variety of everyday materials.

Working scientifically

In this activity, children perform simple tests.

Assessment

Children meeting the conceptual knowledge objective will be able to say why they have chosen the materials that they have, for example, "I have chosen leaves and plastic for the roof because it is waterproof; I have not used sticks for the roof, because the gaps let the water in".

Children meeting the working scientifically objective will be able to say how they know which material is 'best' for a purpose. For example, "I know that leaves and plastic are waterproof because I poured water over my pixie house and it stayed dry inside. When I poured water over the pixie house with the roof made of sticks, it got wet inside".

39

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Research using secondary sources

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Substantive knowledge (the stuff about science)

identify and describe the basic structure of a variety of common flowering plants, including trees

Asking simple questions and recognising that they can be answered in different ways.

Working Scientifically

Enquiry type

What can we find out about plants?

Question to investigate

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Pattern seeking

https://www.vionicshoes.com/blog/how-to-measure-your-shoe-size-for-a-perfect-fit/

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Substantive knowledge (the stuff about science)

identify that humans have skeletons and muscles for support, protection and movement

taking accurate measurements using standard units

Working Scientifically

Enquiry type

Is height associated with shoe size?

Question to investigate

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Identifying, classifying and grouping

https://www.google.com/url?sa=i&url=https%3A%2F%2Fwww.vecteezy.com%2Fvector-art%2F682467-set-of-random-objects&psig=AOvVaw2m4mmZ99sdcP6w1fcw_wZ1&ust=1587707769153000&source=images&cd=vfe&ved=2ahUKEwjnmPy97v3oAhUP2eAKHUnbCowQr4kDegUIARCeAg

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Substantive knowledge (the stuff about science)

Working Scientifically

Enquiry type

Question to investigate

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Planning for the 5 types of enquiry

Year 2	Observing over time	Pattern seeking	Identifying, classifying and grouping	Comparative and fair testing	Research using secondary sources
Living things and their habitats					
Plants					
Animals including humans					
Uses of everyday materials					

Assessing Working Scientifically

Overview of TAPS plans for Focused Assessment of Working Scientifically

(Any focus can be chosen for open-ended enquiries, these are only suggestions)

	Plan		Do		Review	
	Ask Qs and plan enquiry	**Set up enquiry**	**Observe + Measure**	**Record**	**Interpret + Report**	**Evaluate**
KS1 (age 5-7) ***Develop close obs***	Ask simple Qs and recognise that they can be answered in different ways*.	Perform simple tests.	Observe closely, using simple equipment.	Gather and record data to help in answering questions.	Identify and classify. *Use appropriate scientific language to communicate ideas.*	Use their observations and ideas to suggest answers to questions.
Y1 TAPS plans	Materials: reflection tests	Materials: floating and sinking	Plants: structure	Seasons: seasonal change	Animals inc Humans: animal classification	Animals inc Humans: body parts
Y2 TAPS plans	Materials: waterproof	Materials: rocket mice	Plants: compare growth	Living things: woodlice habitats	Living things: nature spotters	Animals inc Humans: handspans
Lower KS2 ***(age 7-9)*** ***Develop systematic approach***	Ask relevant questions and use different types* of scientific enquiries to answer them.	Set up simple practical enquiries, comparative and fair tests.	Make systematic and careful observations and, where appropriate, take accurate measurements using standard units, using a range of equipment, including thermometers and data loggers.	Gather, record, classify and present data in a variety of ways to help in answering questions. Record findings using simple scientific language, drawings, labelled diagrams, keys, bar charts, and tables.	Report on findings from enquiries, including oral and written explanations, displays or presentations of results and conclusions. Identify differences, similarities or changes related to simple scientific ideas and processes.	Use results to draw simple conclusions, make predictions for new values, suggest improvements and raise further questions. Use straightforward scientific evidence to answer questions or to support their findings.
Y3 TAPS plans	Animals inc Humans: investigating skeletons	Forces: shoe grip Forces: strongest magnet	Plants: measuring plants	Light: making shadows Forces: cars down ramps	Rocks: rock reports	Plants: function of stem Forces: balloon rockets
Y4 TAPS plans	Sound: investigating pitch	Materials: drying materials	Materials: measure temperature	Living things: local survey	Electricity: conductors Sound: string telephones	Animals inc Humans: teeth (eggs) in liquids
Upper KS2 ***(age 9-11)*** ***Develop independ-ence***	Plan different types* of scientific enquiries to answer *their own questions,* including recognising and controlling variables where necessary.	Use test results to make predictions to set up further comparative and fair tests.	Take measurements, using a range of scientific equipment, with increasing accuracy and precision, taking repeat readings when appropriate	Record data and results of increasing complexity using scientific diagrams and labels, classification keys, tables, scatter graphs, bar and line graphs.	Report and present findings from enquiries, inc conclusions and causal relationships, in oral and written forms such as displays and other presentations, *using appropriate scientific language*.	Explain degree of trust in results. Identify *and evaluate* scientific evidence *(their own and others')* that has been used to support or refute ideas or arguments.
Y5 TAPS plans	Materials: dissolving Materials: nappy absorbency	Materials: insulation layers	Animals inc Human: growth survey Forces: spinners	Materials: sugar cubes Space: craters	Materials: champion tapes Living things: life cycle research	Forces: aquadynamics
Y6 TAPS plans	Electricity: bulb brightness	Animals inc Humans: heart rate	Light: investigating shadows	Living things: outdoor keys	Living things: invertebrate research	Evolution: fossil habitats Evolution: egg strength

Types of enquiry including: observing changes over time, noticing patterns, grouping and classifying, comparative and fair tests, using secondary sources.

(English 2013 National Curriculum statements, *additions from Interim Teacher Assessment framework 2016-7)*

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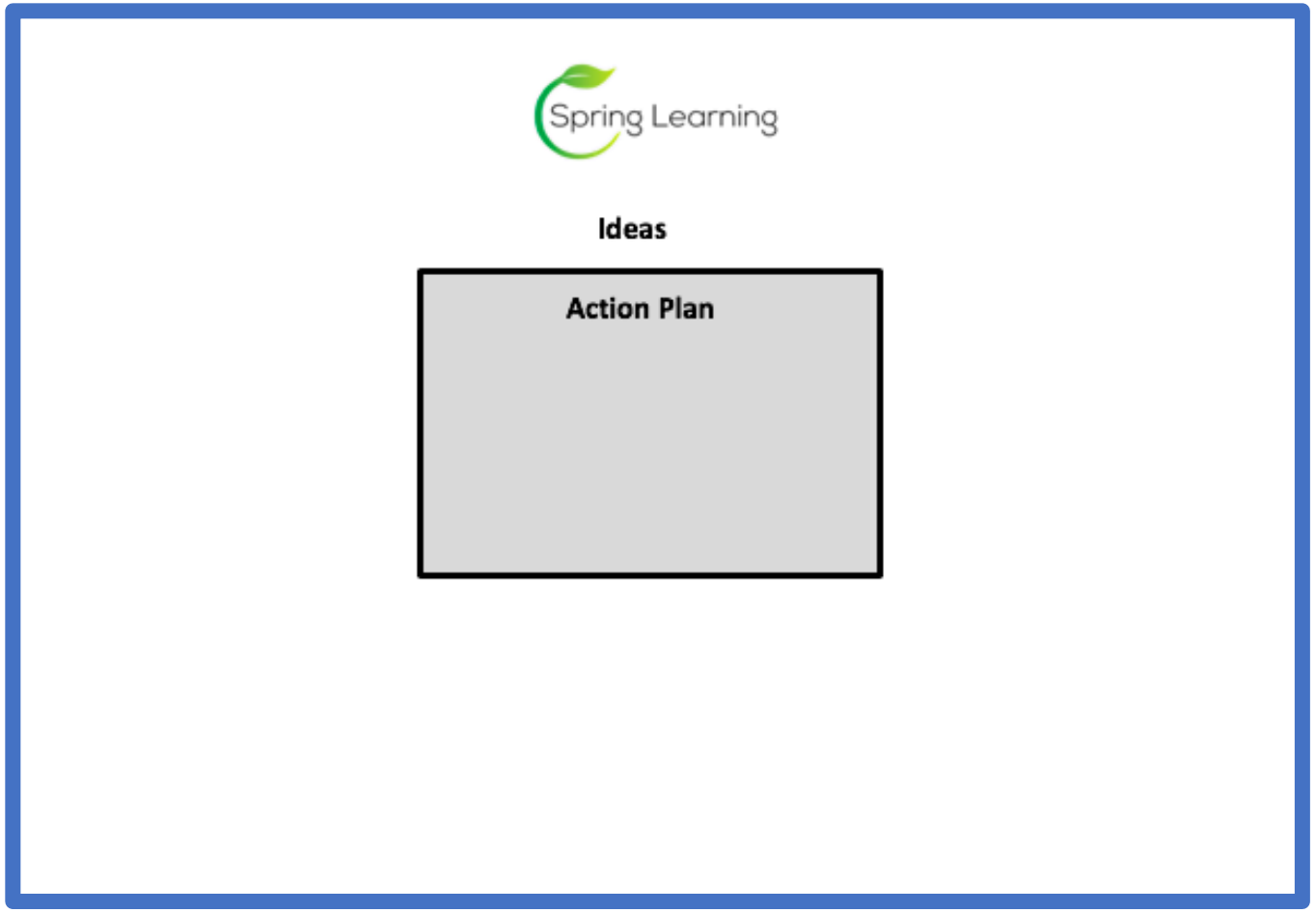
Action planning and evaluations



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