**MAYOR OF LONDON** 

# Differentiating effectively in science

Welcome to this Mayor of London webinar. We will be starting at 4.30pm. Please keep your microphones on mute.

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#### **MAYOR OF LONDON**

• London Curriculum: <u>bit.ly/2ySqVJC</u>

Free teaching resources, events and programmes

- Mayor's London Scientist: <u>bit.ly/3cuTtYe</u> Free <u>CREST Awards</u> for eligible London schools
- STEM webinar series: <a href="https://doi.org/10.1111/bit.bit.ly/2WJki5E">bit.ly/2WJki5E</a>

All our STEM webinars for primary schools (secondary coming soon!)

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**MAYOR OF LONDON** 

# Differentiating effectively in science

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## Home learning

- Variation between schools
- Variation within schools
- Variation within the pupils in same class

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## **Different approaches**

- Covering content that would have been delivered
- Revisiting learning from earlier in the year
- Supporting children to carry out enquiry work
- Encouraging children to explore their own interests

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• Encouraging family science



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## What approach have you adapted?

• See attached pdf of mentimeter responses



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## Preparing for full return

Gather the best data possible.

- Assess what was covered prior to closure.
- Identify knowledge NC statements that have been missed.
  - Need to be added, but when?
- Identify knowledge NC statements that have been delivered remotely.

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• Has it been assessed? Who is not secure?



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## **Missed learning**

- There will be gaps
- Identify the missed learning
- Ensure future teachers are aware of this

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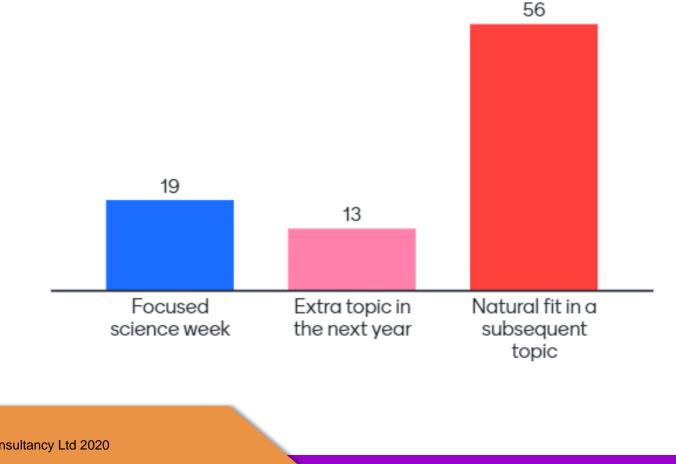
## **Missed learning**

When is the best time to fit it in?

- In a focused science week
- As an extra topic in the next academic year
- When it next naturally fits with a subsequent topic



## What has been your approach to home learning?



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Year			Topics		
Year 1	Plants	Animals, including humans	Everyday materials	Seasonal change	
Year 2	Living things and their habitats	Plants	Animals, including humans	Uses of everyday materials	
Year 3	Plants	Animals, including humans	Rocks	Light	Forces and magnets
Year 4	Living things and their habitats	Animals, including humans	States of matter	Sound	Electricity
Year 5	Living things and their habitats	Animals, including humans	Properties and changes of materials	Earth and space	Forces
Year 6	Living things and their habitats	Animals, including humans	Evolution and inheritance	Light	Electricity



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#### **Progression in knowledge**

#### National Curriculum statements in red are from other linked topics.

#### Plants

Early learning goal	<ul> <li>Children know about similarities and differences in relation to places, objects, materials and living things. They talk about the features of their own immediate environment and how environments might vary from one another. They make observations of animals and plants and explain why some things occur and talk about changes.</li> </ul>
Year 1	<ul> <li>Identify and name a variety of common wild and garden plants, including deciduous and evergreen trees.</li> <li>Identify and describe the basic structure of a variety of common flowering plants, including trees.</li> </ul>
Year 2	<ul> <li>Observe and describe how seeds and bulbs grow into mature plants.</li> <li>Find out and describe how plants need water, light and a suitable temperature to grow and stay healthy.</li> <li>Identify and name a variety of plants and animals in their habitats, including microhabitats. (Y2 - Living things and their habitats)</li> </ul>
Year 3	<ul> <li>Identify and describe the functions of different parts of flowering plants: roots, stem/trunk, leaves and flowers.</li> <li>Explore the requirements of plants for life and growth (air, light, water, nutrients from soil, and room to grow) and how they vary from plant to plant.</li> </ul>
	<ul> <li>Investigate the way in which water is transported within plants.</li> <li>Explore the part that flowers play in the life cycle of flowering plants, including pollination, seed formation and seed dispersal.</li> </ul>
Year 4	<ul> <li>Recognise that living things can be grouped in a variety of ways. (Y4 - Living things and their habitats)</li> <li>Explore and use classification keys to help group, identify and name a variety of living things in their local and wider environment. (Y4 - Living things and their habitats)</li> </ul>
Year 5	<ul> <li>Recognise that environments can change and that this can sometimes pose dangers to living things. (Y4 - Living things and their habitats)</li> <li>Describe the life process of reproduction in some plants and animals. (Y5 - Living things and their habitats)</li> </ul>
Year 6	Describe how living things are classified into broad groups according to common observable characteristics and based on similarities and differences, including micro-organisms, plants and animals. (Y6 - Living things and their habitats)
KS3	<ul> <li>Give reasons for classifying plants and animals based on specific characteristics. (Y6 - Living things and their habitats)</li> <li>Reproduction in plants, including flower structure, wind and insect pollination, fertilisation, seed and fruit formation and dispersal, including quantitative investigation of some dispersal mechanisms.</li> </ul>

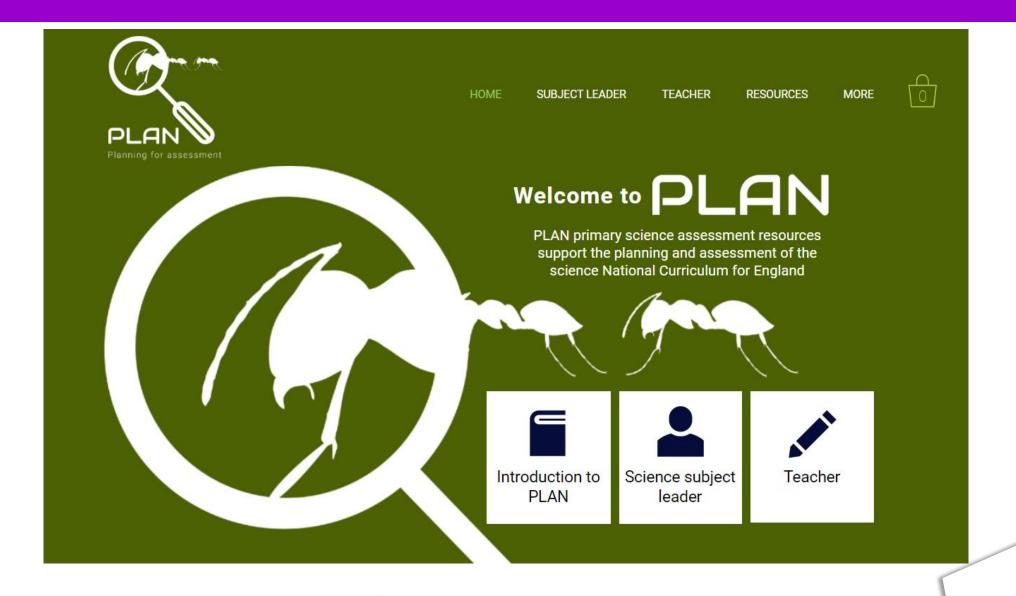


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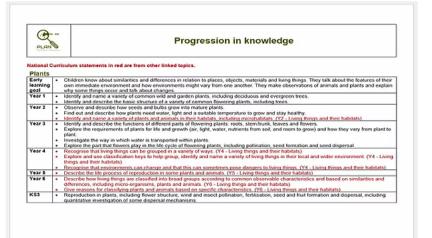




#### Science subject leader

The PLAN assessment resources include a range of resources that are designed to support science subject leaders to implement effective and robust assessment systems. The resources for science subject leaders are set out below.

If you are not familiar with the PLAN assessment resources and how they support the planning and assessment of science, you may want to read our <u>Introduction to PLAN</u>.



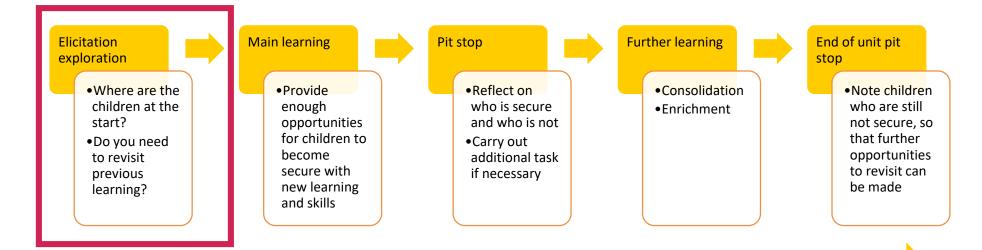
#### PLAN Progression in knowledge

This document shows the links between the topics taught in different year groups, so that you can easily check that teachers are covering the correct content for their year group.

DOWNLOAD

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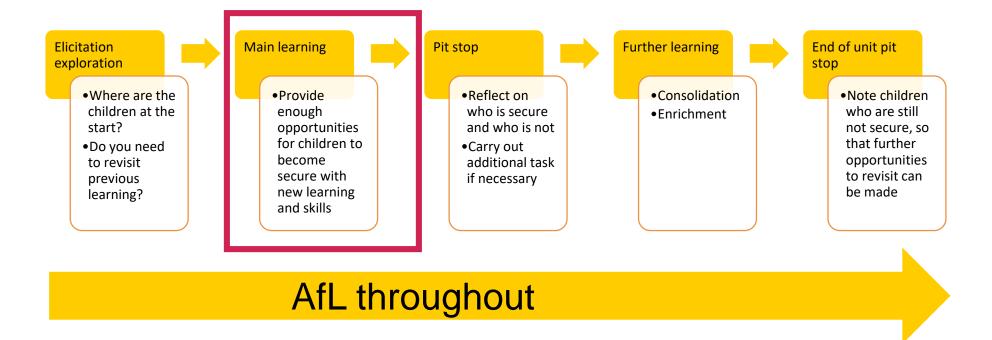




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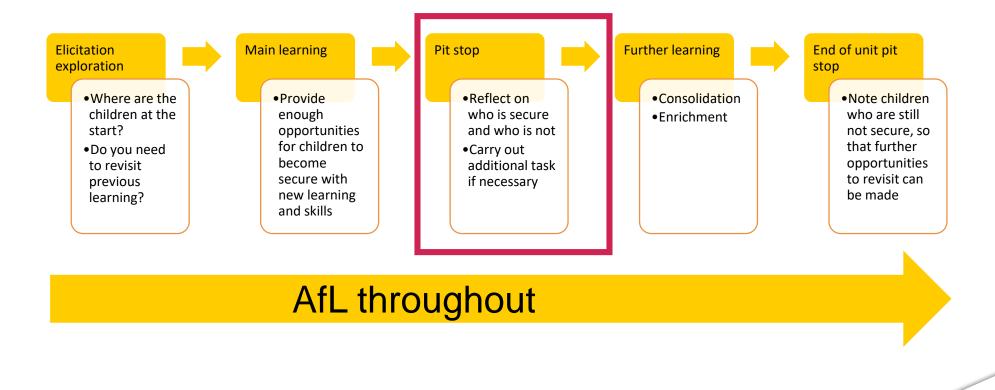


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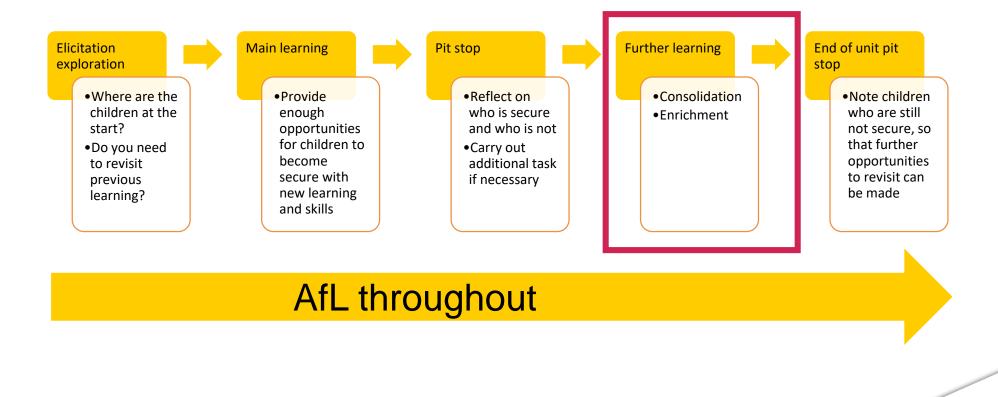


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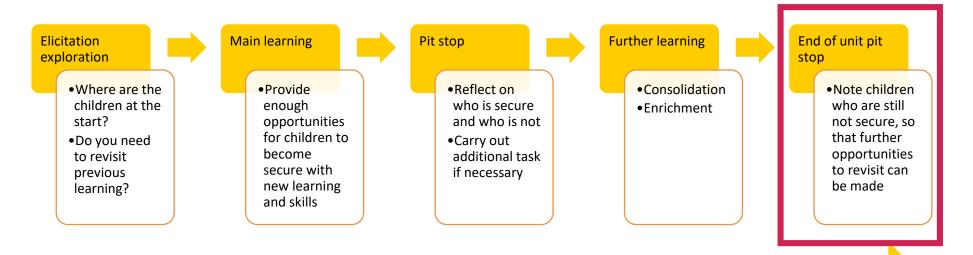
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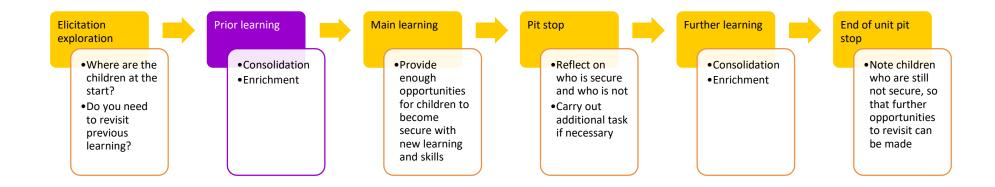
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#### AfL throughout



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#### AfL throughout

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## PLAN Knowledge matrices

	Year	3	Торіс	Plants
PLAN Planning for assessment	<ul><li>Explore the requirements of p from plant to plant.</li><li>Investigate the way in which v</li></ul>	lants for life and growth (air, light, vater is transported within plants.	plants: roots; stem/trunk; leaves; a water, nutrients from soil, and roor ants, including pollination, seed for	n to grow) and how they vary

Prior learning	Future learning	
<ul> <li>Observe and describe how seeds and bulbs grow into mature plants. (Y2 - Plants)</li> <li>Find out and describe how plants need water, light and a suitable temperature to grow and stay healthy. (Y2 - Plants)</li> </ul>	<ul> <li>Describe the life process of reproduction in some plants and animals. (Y5 - Living things and their habitats)</li> <li>Reproduction in plants, including flower structure, wind and insect pollination, fertilisation, seed and fruit formation and dispersal, including quantitative investigation of some dispersal mechanisms. (KS3)</li> </ul>	



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## PLAN Knowledge matrices

WHAT PUPILS NEED TO	WHAT PUPILS NEED TO KNOW OR DO TO BE SECURE				
Show understanding of a concept	Show understanding of a concept using scientific vocabulary correctly				
Key learning	Possible evidence				
Many plants, but not all, have roots, stems/trunks, leaves and flowers/blossom. The roots absorb water and nutrients from the soil and anchor the plant in place. The stem transports water and nutrients/minerals around the plant and holds the leaves and flowers up in the air to enhance photosynthesis, pollination and seed dispersal. The leaves use sunlight and water to produce the plant's food. Some plants produce flowers which enable the plant to reproduce. Pollen, which is produced by the male part of the flower, is transferred to the female part of other flowers (pollination). This forms seeds, sometimes contained in berries or fruits which are then dispersed in different ways. Different plants require different conditions for germination and growth.	<ul> <li>Can explain the function of the parts of a flowering plant</li> <li>Can describe the life cycle of flowering plants, including pollination, seed formation, seed dispersal, and germination</li> <li>Can give different methods of pollination and seed dispersal, including examples</li> </ul>				
Key vocabulary					
Photosynthesis, pollen, insect/wind pollination, seed formation, seed dispersal (wind dispersal, animal dispersal, water dispersal)					

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## PLAN Knowledge matrices

	Common m	niso	conceptions
So	ome children may think:		
•	plants eat food food comes from the soil via the roots flowers are merely decorative rather than a vital part of the life cycle in re plants only need sunlight to keep them warm roots suck in water which is then sucked up the stem.	pro	duction
	Apply knowledge in familiar related	coi	ntexts, including a range of enquiries
	Activities		Possible evidence
•	Observe what happens to plants over time when the leaves or roots are removed. Observe the effect of putting cut white carnations or celery in coloured water. Investigate what happens to plants when they are put in different conditions e.g. in darkness, in the cold, deprived of air, different types of soil, different fertilisers, varying amount of space. Spot flowers, seeds, berries and fruits outside throughout the year. Observe flowers carefully to identify the pollen. Observe flowers being visited by pollinators e.g. bees and butterflies in the summer. Observe seeds being blown from the trees e.g. sycamore seeds. Research different types of seed dispersal. Classify seeds in a range of ways, including by how they are dispersed. Create a new species of flowering plant.	•	Can explain observations made during investigations Can look at the features of seeds to decide on their method of dispersal Can draw and label a diagram of their created flowering plant to show its parts, their role and the method of pollination and seed dispersal

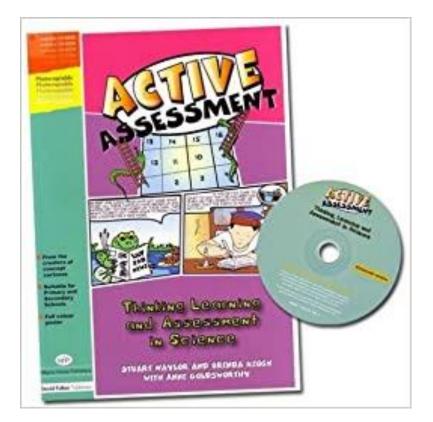
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#### Resources to support with elicitation





#### **EXPLORE, ENGAGE, EXTEND**

iciting children's knowledge and understanding in science inform the planning of new learning experiences

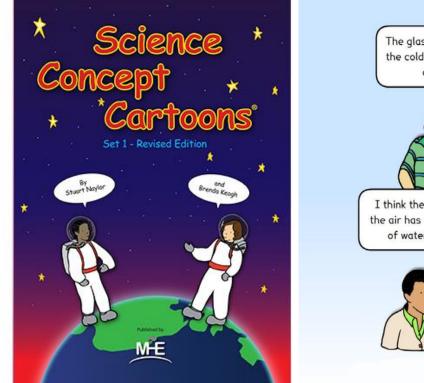


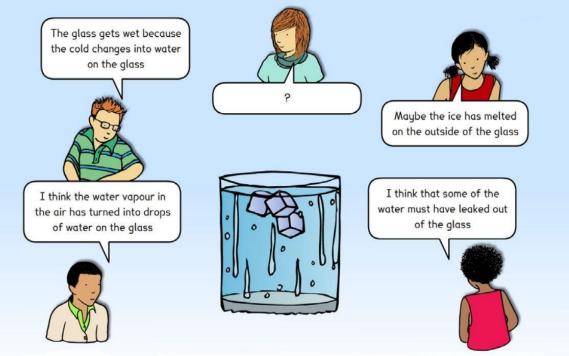
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#### **Concept cartoons**

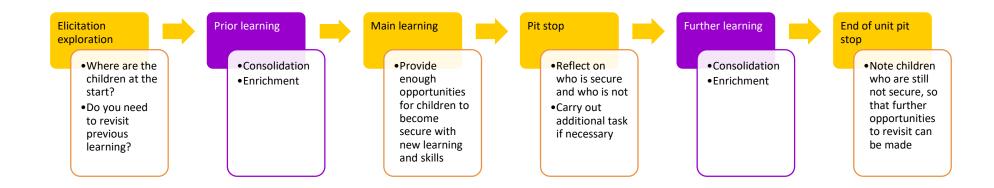






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#### Differentiation

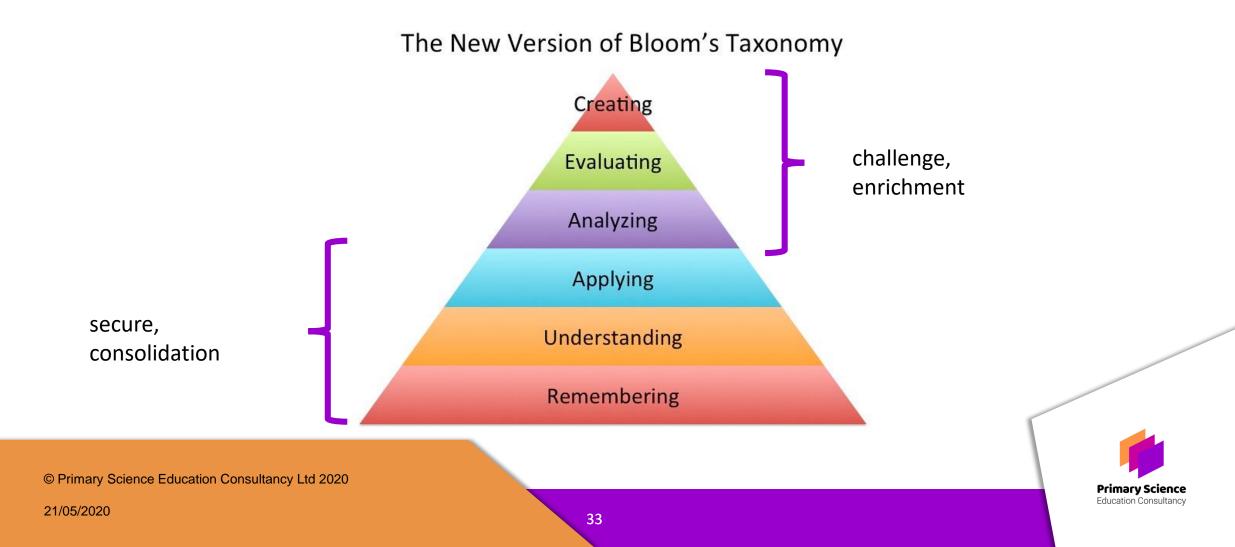


#### AfL throughout



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## Differentiation



## Differentiation by activity

Additional science enquiry activities



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#### Differentiation by activity - CREST





#### **CREST resources**



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#### Brilliant Bubbles Organiser's Card



This activity is designed to get children thinking about liquids, gases and bubbles. Cosmic has a new bubble machine. All the bubbles are the same. He would like different bubbles.

- Through this activity you will support children to:
- + Carry out their own tests to try and make different shaped bubbles
- + Carry out their own tests to try and make different sized bubbles
- + Carry out their own tests to try and make different colour bubbles

#### **Kit list**

Plastic trays or bowls
 Clean drinking straws - 1 per child
 Bubble wands
 Soft wire (e.g. florist's wire or pipe cleaners)

to bend into different shape frames such as a triangle or square • Bubble mixture • Food colouring

#### What to do

- Introduce the activity using the story. Ask the children if they have blown bubbles before, were they all the same?
- Give out activity cards and equipment to the children.
- Explain that they will be using the equipment provided to test if they can make different shape, size and colour bubbles.
- Encourage children to discuss their ideas and how to carry out their investigations. Prompt questions:
- How will they make sure their test is fair?
   How will they record their results?

- Support children to conduct their tests and make their own records of their results. They could also take photographs or make drawings.
- Ask the children to present their findings to the rest of the group, they can be as creative in their presentation as they want - the activity card suggests a bubble competition.

Things to think about Children will get better bubbles if they blow slowly and gently through a straw.

They will usually get bigger bubbles from a wand or a wire frame.

A bubble is a pocket of air, surrounded by a very thin film of liquid.

Water acts as though it has a stretchy skin, it is this that helps to make a round bubble shape. Scientists call this surface tension.

The colour of bubbles is due to the light reflecting off the bubble surface and creating what scientists call interference patterns. The pattern and colour changes according to the direction of the light and the thickness of the bubble's 'skin'.

#### Keywords

Bubbles
 Surfaces

Gases

#### Watch out!

prepared for this.

Children will create a lot of mess with their bubbles, so be

You can colour the mixture with food colouring, but when the bubbles burst the children get sprayed with drops of food colouring, so this is VERY messy.



**CREST** resources





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### Brilliant Bubbles

**STAR** 

Cosmic is very excited. Today is his birthday!

CREST AWARDS

His present is a big, bright purple bubble machine. When he turns the handle, dozens and dozens of bubbles float out into the air.

Gem arrives to wish him happy birthday. Cosmic shows her how his new bubble machine works.

#### "What lovely bubbles!" Gem shouts, as she jumps about trying to catch them.

"You must be able to make different bubbles," says Gem, peering into the end of the machine. "Perhaps there's something wrong with it."

What do you think?

### Your challenge

Can you find a way to blow different bubbles for Cosmic?

Cosmic thinks you can make bubbles with different shapes

Gem thinks you can make different size bubbles

Aunt Stella thinks you can make different colour bubbles

#### "They are OK," says Cosmic. "But they are all the same shape... And they are all the same size... And they are all the same colour. I wanted lots of different bubbles, but these are all the same."

and the second second

'I'm not sure," says Cosmic.

### Discuss

Have you ever blown bubbles? Do you think that they were all the same?

### Getting started

Put some bubble liquid in a bowl or tray. Use a straw to blow some bubbles. **Don't share your straw with anyone else.** Dip the end of the straw in the liquid. Lift it out. Now blow down your straw to make a bubble. Try blowing gently and then blowing harder. How do the bubbles change?

### **Test your ideas**

Can you think of other ways to find out about bubbles?

### Share your ideas

You could have a bubble competition to see how many different types of bubbles you can blow.

### Extra things to do

Find out how long you can keep a bubble before it bursts. Find out whether bubbles float or fall to the ground. Find out how long you can keep a bubble in the air.

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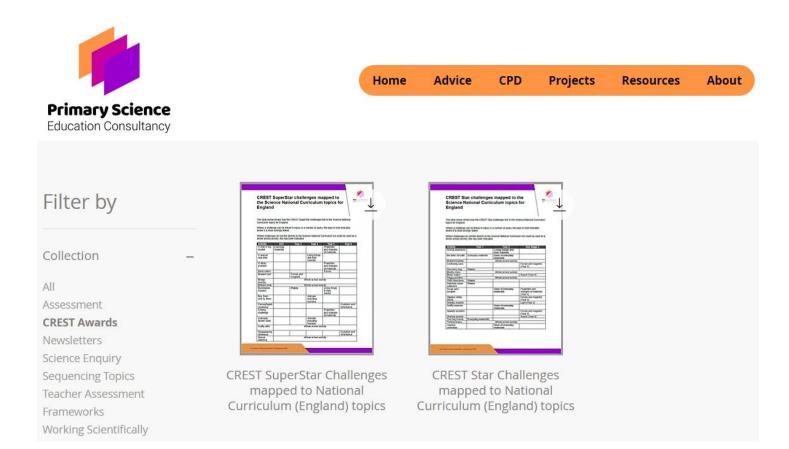
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### **CREST** resources





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## Differentiation by activity - Explorify



Design a sports kit A creative task which asks your class to design a sports kit.

Ages 5 - 7

Materials



Seeds

A hands-on activity – whose creation is best adapted for classroom survival?

Ages 9 - 11

Living things and their habitats
 Plants
 Evolution and inheritance



### What is the best surface to run on?

Plan a fun investigation and get your class thinking about the properties of different...

Ages 5 - 7

• Materials

Explorify

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- Additional science enquiry activities
- Extended thinking tasks



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### Extended thinking tasks



### THE BIG QUESTION

### How would you stay warm in the Arctic?

Plan a fun enquiry and get your class thinking like scientists.

### Ages 9 - 11

 Animals, including humans
 Living things and their habitats

### Run the activity

#### Run the activity in 4 steps

1. Planning an enquiry will really get your class thinking like scientists.

Explain that you will be working as a class to answer a big question. Present it to the class. The pupils are taking a trip to the Arctic and need to decide what to pack to help them keep warm.

**2.** Discuss as a class the different ways you can approach the question. Ask the class to think about what they would pack and why. Here are some further prompts:

- where is the Arctic?
- · what is the climate like there?
- · why is it important to keep warm?
- what animals live in the Arctic?

3. How will they – as a group – explore the question? Prompt pupils to explain their ideas, qualify them with what they already know and refine them based on views expressed by other people. What is their plan for the investigation? Here are some tips:

- how do the animals in the Arctic keep warm?
- · could you copy their ideas?
- · how do you keep warm at home?
- · would these methods work in the Arctic?

4. Ask the class to imagine they had to present their investigation at school assembly or to their family, how would they show their action plan? Discuss as a class the various ways this could work. Why not let the pupils carry out an investigation?

### **Explorify**



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- Additional science enquiry activities
- Extended thinking tasks
- Independent projects/activities
  - Being creative seed design
  - Wider research broader range of life cycles
  - Greater variety digestive systems of other animals
  - Application in real life designing the planting for a garden

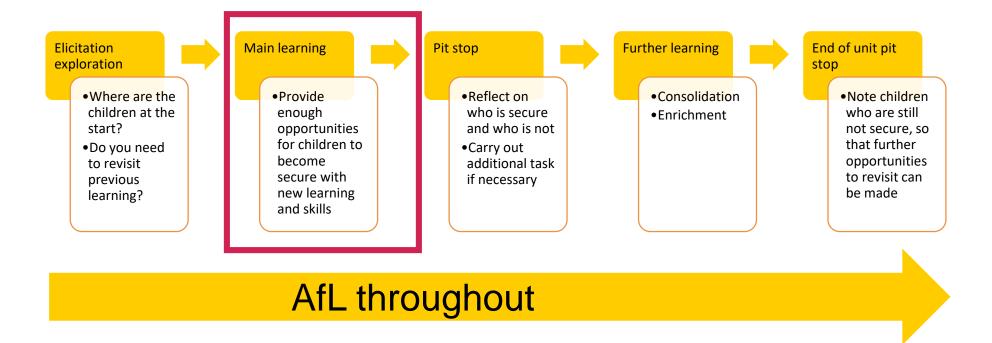


- What independent projects/activities have you used to challenge children?
- See attached pdf of mentimeter responses.



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### Ongoing teacher assessment





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## Differentiation

• Ability groups – by task



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## Differentiating classification

- Provide different objects to sort.
- Use different presentation methods



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## Differentiation research

- Range of resources
- Questions they are researching.
  - Will the questions involve synthesis and evaluation or just retrieval?
- Use different presentation methods



# Differentiating comparative/fair testing

- Providing different resources can lead to them exploring different questions
- Providing different measuring equipment can make the task more challenging
- Exploring different questions some become comparative tests some become fair tests



# Differentiating comparative/fair testing

Question	Variable to Change	Variable to measure	Type of graph
How does the shape of a parachute affect its path	Shape - words	Description of path - words	No graph
How does the material of the canopy affect the time it takes to drop?	Type of material - words	Time to drop - numbers	Bar chart
How does the number of strings affect the time it takes to drop?	Number of strings – discrete numbers	Time to drop - numbers	Bar chart
How does the area of the canopy affect the time it takes to drop?	Area of the canopy – continuous number	Time to drop - numbers	Line graph

Different questions lead to different types of presentation – bar charts (comparative), line graphs (fair tests)



## Differentiating observations over time

- Type of observation to be made at each time counting leaves, measuring height
- Change the object being observed e.g. large ice hand, ice cube
- Quantity of observations to be made at each point



# Differentiating pattern seeking

- Exploring different questions
  - Is pulse rate linked to gender?
  - Is pulse rate linked to number of hours of exercise a week?
  - Is pulse rate linked to age?
  - Is there a link between pulse rate and height?



## Differentiation

- Ability groups by task
- Mixed ability groups by support and outcome
  - Questioning
  - Roles in the group
    - Team leader, tester, resources managers, recorder, presenter
  - Support adult support or scaffolds



## Summary – subject leaders

Immediate future - this year/during partial opening

- retain depth of coverage
- assess thoroughly
- record missed content
- On return to normal
- identify where missed content will be covered
- highlight on long term curriculum map
- ensure good assessment for learning and differentiation



## Summary – teachers

- Good AfL at start of topic
- Build in time for pre teaching of missed content
  - Differentiate by task teaching/enrichment
- Main learning
  - Differentiate by support and outcome
- Further learning
  - Differentiate by task teaching/enrichment



## Differentiation – the magic bullet?

- There isn't one!
- Use a range of strategies as discussed to differentiate according to the activity, children, support available and a whole host of other variables.

