Summer 2019 *Issue 6*

Why & How?

The Primary Science Teaching Trust Newsletter

Supporting excellent teaching and learning in primary science

Free to access for all

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WELCOME

Welcome to Why and How? - the Primary Science Teaching Trust's termly newsletter. Why and How? is for anyone who has an interest in primary science. Our newsletter offers practical support, news and updates about PSTT and our projects and research. We value feedback from our readers so please do continue to keep us posted about what you find most useful and interesting in our newsletter, and please do keep sharing it with anyone else who would like to receive practical classroom support, news and PSTT updates.

We are delighted to be releasing this newsletter to coincide with our much anticipated international Primary Science Education Conference in Edinburgh. With over 400 delegates, a packed programme and a full and diverse exhibition hall, we are looking forward to a buzzing three days of high quality professional development. We welcome our newest group of Primary Science Teacher Award winners who will be presented with their awards at our conference dinner. In other news we are delighted to be supporting the Children's University by providing free, off the shelf extra-curricular Science/STEM Club resources for children to gain CU accreditation.

Children's common misconceptions about states of matter and physical and chemical changes are explored by PSTT Regional Mentor Tom Holloway. Combining comprehensive background knowledge with practical suggestions, Tom offers support and advice for teachers across the primary age range.

Why & How? is the brand name of the Primary Science Teaching Trust
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DOWNLOAD ALL ISSUES FOR FREE AT: www.pstt.org.uk/what-we-do/why-how-newsletter

An intriguing picture of a house that looks as though it is floating is this issue's picture as a stimulus for talk. It provides opportunities for the children to think about a range of scientific ideas, including floating and sinking, materials and survival of animals. This time we also provide two follow-on pictures which show what happens to the house over time which - these could lead to all sorts of interesting spin-off discussions. Please do share this (and all our free resources) with your colleagues.

In this issue: learn more about the Children's University

The Why and How Challenge in this issue is an open-ended exploration that encourages children to investigate more independently. It is very versatile and can be run as a whole school competition or used as a family learning activity.

In 'I bet you didn't know' PSTT's CEO Prof. Dudley Shallcross provides an interesting insight into the symbiotic relationship between plants and microbes. Whilst it is widely known that plants need the help of microbes to acquire the nitrogen they need for healthy growth, recent research has established the mechanisms by which the plants determine whether microbes are helpful or harmful. His article helps teachers explain this cutting edge research and provides ideas for primary school children to access this science.

We are delighted to bring you a free resource from our collection. In this issue we are launching PSTT Regional Mentor Kate Redhead's 'Engineering Our World' resources for the Children's University. We also share details of all our newest resources: a diverse and inventive collection created by Fellows in collaboration with each other or with other primary science educators – please do take a look!

This issue of Why and How? includes another College Snapshot. Six of our Primary Science Teacher College Fellows from across the UK share some quick thoughts and suggestions to support teaching and learning primary science.

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Following its introduction in the Spring 2019 issue, our collaborator update features a second piece by Scottish Schools Education Research Centre (SSERC) in which they share more about the impact of their professional development programmes.

Please have a look at our key dates page for reminders of what is on the horizon for primary science – in particular the Great Science Share for Schools on 18th June 2019.

Prof. Dudley Shallcross
CEO

Ali Eley
Academic Director

Dr. Sophie Franklin
Cluster Director

Sue Martin
Programme Director

NEWS

PSTA Winners 2018

We are delighted to be celebrating the significant achievements of the Primary Science Teacher Award 2018 winners at our gala dinner to be held at Dynamic Earth, Edinburgh during our international conference, PSEC 2019.

The following outstanding teachers will receive this award and we look forward to welcoming them as PSTT College Fellows:
Anita Angier, Shapinsay Community School, Orkney
Doug Ashton, Kings Norton Junior and Infant School, Birmingham
Nicola Bolton, Heswall Primary School, Wirral
Rebecca Ellis, St Margaret's CE Junior School, Leamington Spa
Laura Jarram, Inglehurst Junior School, Leicester
Anna Killough, St John's Primary and Carnlough Community Nursery School, County Antrim
Jenny Lister, St George the Martyr CE Primary/Betty Layward Primary Schools, London
Chris Lowe, Lowerplace Primary School, Rochdale
Julie Neil, Cathorpe Academy, Birmingham
Angharad Pass, Tranmere Park Primary School, Leeds
Katharine Pemberton, Modbury Primary School, Devon
Vanessa Seehra, Highlands Primary School, Redbridge, London
Kelly Taylor, Kingswood Primary School, West Norward, London

THE ROYAL SOCIETY

tts

The Association for Science Education

2019 Primary Science Teacher Awards

Do you know an OUTSTANDING primary science teacher?

- *Are they innovative and creative in teaching science?*
- *Do they inspire colleagues and contribute to developing science in their school and beyond?*
- *Do they engage pupils in the excitement and fascination of science?*

The PSTAs celebrate amazing primary science teaching across the UK, recognising talented teachers from early years education, through Key Stage 1 and Key Stage 2.

The PSTT understands the importance of teachers; those who do incredible work by raising standards, excelling in challenging conditions and going above and beyond what is normally expected deserve to be celebrated. Teachers who win this award are not only judged to be outstanding practitioners in their own classrooms, they also support and develop colleagues in their own schools and others either locally, regionally or nationally. Award winning teachers are all innovative, creative, enthusiastic, and have significantly raised the profile of science in their own schools and beyond.

Each winner recieves:

- *£1,000 personal prize money*
- *A set of science resources from TTS for their school*
- *A year's membership of the ASE*
- *Fellowship of the Primary Science Teacher College*

NOMINATE A TEACHER AT WWW.PSTT.ORG.UK

Deadline for nominations: July 12th 2019 5pm

children's® UNIVERSITY

Children's University is a programme that inspires children and provides exiting opportunities to learn beyond the classroom. EEF has listed Children's University is a Promising Project. As a proud partner, PSTT offers free Children's University validated STEM resources for all schools. To find out how Children's University could benefit your students, get in touch.

childrensuniversity.co.uk

contactus@childrensuniversity.co.uk | 0161 241 2402

Children's University

PSTT is pleased to support the Children's University Trust in encouraging children to undertake exciting learning experiences outside normal school hours and we recognise those children whose endeavours show a particular interest in and enthusiasm for science.

Kate Redhead has been looking at ways that we are able to support teachers and other adults to enable children to enjoy science and engineering-based experiences as part of their accredited learning. Many teachers, who would like to run such clubs, requested help to provide suitable activities using readily-available materials and providing background information to ensure the science would be delivered at an appropriate level for the children.

Working with one of our new College Fellows, Julie Neil, and teaching colleagues Janet Morris and Kathryn Grahame, Kate has been developing four 'off-the-shelf' Science and STEM Club resources, each of which provides activity ideas and information for 8 club sessions and all of which have been trialled in schools. An example from one of the clubs, Engineering Our World, can be found later in this newsletter.

COMMON MISCONCEPTIONS

Time for a change!

Tom Holloway

PSTT College Fellow and Regional Mentor, Tom Holloway, addresses common misconceptions surrounding states of matter

What children need to know:

- observe that some materials change state when they are heated or cooled.
- know that some materials will dissolve in liquid to form a solution and describe how to recover a substance from a solution.
- identify the part played by evaporation and condensation in the water cycle.
- demonstrate that dissolving, mixing and changes of state are reversible changes.

Common misconceptions – often children will think:

- **Steam is visible.**
- **Steam and condensation are the same.**
- **Evaporation only occurs when water is boiling.**
- **Clouds are made of gas.**
- **Boiling/evaporation are irreversible changes.**
- **When a solid dissolves in water it does not contribute to the mass of the solution.**
- **Liquids that evaporate/boil disappear forever.**
- **A fizzy-drinks can or glass container becomes wet because liquid from the inside seeps through to the outside.**
- **When a substance has dissolved it has 'disappeared'.**
- **Substances (like sugar) 'melt' in water.**

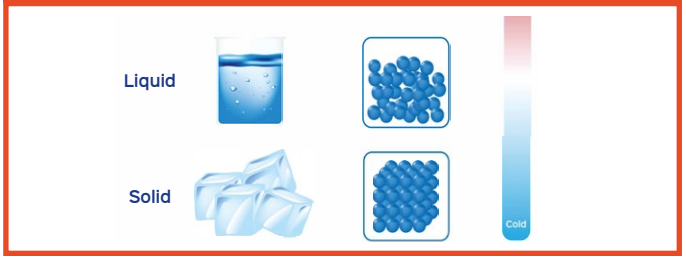
I find that 'changes of state' is one of the most fascinating areas of the science curriculum to teach. I love how closely connected it is to the children's everyday lives and experiences. There is a magical aspect to it too. Salt, when it dissolves, and water when it evaporates both appear to disappear. It is very rewarding to help children unlock the science behind the 'magic'. Unsurprisingly, children have many misconceptions about this area of science. In the following article, I aim to unpick some of these misconceptions and suggest ways that they can be addressed.

Is it melting or dissolving?

Children often confuse the terms 'melting' and 'dissolving'. This may be because when certain types of food (such as a sugar cube) are put into hot water it can appear to breakdown in much the same way that an ice cube does. Children need to understand that melting only involves one material (changing from a solid to a liquid) while dissolving involves two materials (one spreading amongst the other). To help children understand this, get them to act out the two processes.

Figure 1. Ice cubes and sugar cubes appear to break down in a similar way when hot water is poured over them.

Figure 2. Particles in a solid are arranged uniformly and tightly packed. In a liquid, the particles are still closely but less uniformly arranged and move around each other (flow).



For melting, they start as particles in a material in a solid state (e.g. an ice-cube in a pan on an oven). They are arranged close to each other in rows. When heat is applied (the 'oven' is switched on) they should move around each other more freely, but touching each other, to simulate the change into a liquid brought about by melting. It can be useful to show the children a representation of the particles (Figure 2).

Figure 3. The solute particles spread out amongst the solvent particles.

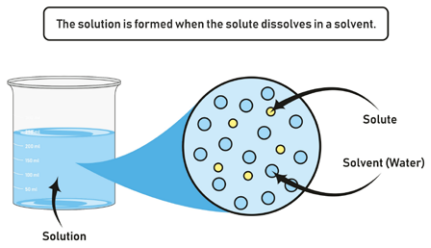


Figure 4. Children experience evaporation and condensation often in their everyday lives – often without realising it.

For dissolving, some children play the particles in the material that is dissolving (the solute – e.g. sugar) while others the particles in the liquid (the solvent – e.g. water). The solute 'particles' spread out among the solvent 'particles' to make a solution (Figure 3). This activity is also a great way of addressing the common misconception that when a solid, like sugar, dissolves it has disappeared. The 'solute particles' can 'hide behind' the 'solvent particles' so they can no longer be seen. Other ways this misconception can be addressed are by:

- *Observing colourful sweets dissolving rather than salt/sugar. The solute spreading out amongst the solvent can be clearly seen.*
- *Dissolving 5g of salt in 100ml of water and getting the children to measure the mass of the solution before and after.*

Evaporation and condensation

Children observe evaporation and condensation frequently in their everyday lives but are often confused about what is happening.

What's in a name?

As with many science topics, the common use of language is often a source of much of this confusion. We talk about puddles 'drying up' which gives the impression that water is absorbed (by the ground). We complain that the windows of our cars have 'steamed up' or observe that you can see 'steam' coming out of our mouths on a cold morning or from a kettle as it boils, giving the impression that 'steam' is visible and confusing water vapour (invisible gas) with water droplets floating in the air. For children to gain a secure understanding of evaporation and condensation, it is important that these processes are correctly identified and named, for example:

- *The puddles have evaporated!*
- *The windows are covered by tiny water droplets.*
- *There is a cloud above the kettle.*

Challenging children to identify as many examples of evaporation and condensation as they can is a great way of connecting their conceptual knowledge with the real-world and assessing their level of understanding.

How did the water get there?

It is logical for children to think that when water evaporates it has disappeared – it is no longer in the puddle or bowl and can no longer be seen. To address this misconception, children need to observe evaporation and condensation first-hand. A great way of doing this is to make a simple 'still'. Fill a container with water and cover the top with clingfilm. Place the container in direct sunlight or on top of a radiator and leave for around a day. The clingfilm will trap the water vapour as it evaporates. Children will be able to observe water droplets forming on the inside of the clingfilm leading to the questions; how did the water get there? Where did it come from? A bowl full of water but without a clingfilm covering could also be placed alongside for comparison. This could be extended by observing what happens to fizzy-drinks cans when they are taken out of the fridge. Often children think that the water covering the can has seeped out from the inside so it is important to demonstrate that the can is waterproof.

This experiment provides an opportunity to address any misconceptions that evaporation can only occur when water is boiling. This can be further reinforced by discussing how puddles evaporate even though the temperature of the water is much lower than boiling point. It is also a great way of demonstrating that evaporation is a reversible change.

What have dinosaurs got to do with condensation?

Children often think that clouds are a gas. Once they have a secure understanding of evaporation/condensation they can learn that they are in fact made up of millions of droplets of water that have condensed around tiny specks of dust. This can be related to the activity above with the water condensing on the bottom of the clingfilm representing a cloud.

I love to explain to children that water has been evaporating and condensing on Earth for billions of years. Rain falling on their heads at playtime once fell on the heads of dinosaurs – it is a wonderful 'wow moment'.

FREE RESOURCES

Pictures for talk in primary science

A picture can be a very good stimulus for children to engage in effective talk in science. Using pictures is an inclusive approach which facilitates high levels of participation. Pictures can also be used as a starting point for inquiry. The discussions the children have will generate questions that they want to investigate.

Asking the children carefully chosen questions about the picture will support them with learning to:

- construct explanations and link their ideas with evidence
- make confident challenges to the ideas of others
- explore scientific terminology and use it with genuine understanding

Pictures for talk in science activities are designed to be very open ended and usable with any age of children. The activities can be done as a quick ten minute starter, or extended into a longer and more in-depth lesson.

WHAT TO DO

Download the image overleaf by following the link and either display on a whiteboard or give out printed copies. Ask the children to discuss, in groups of three, the following questions:

WHAT DO YOU THINK HAS HAPPENED TO THIS HOUSE OVER TIME?

WHY DO YOU THINK THIS?

WHAT DO YOU THINK MIGHT HAPPEN NEXT?

Other questions to generate and promote thinking and explaining:

- The picture is called 'Last House on Holland Island' (it was taken in May 2010 by an American photographer).
- Why do you think the photographer gave it this name? What further evidence might be useful to help you answer this question?
- What materials were chosen to make this building.
- Why do you think they were they chosen?

'Last House on Holland Island'
Baldeaglebluff, "Last House on Holland Island", 23rd May 2010, online image, Flickr, 20th May 2019, https://www.flickr.com/photos/baldeaglebluff/5193166145/in/photostream/

- What problems do you think the house has faced?
- Do you think that these problems could have been prevented? Why do you think this?
- Ask the children to look closely at the photograph. Is the house floating? Why do you think this?
- What type of birds are on the roof of the building? Why might they choose this place?

Follow-on discussion ideas:

- The house was built in 1888. What do you think the house would have looked like 100 years ago? What might it look like in 10 years' time? Why do you think this?

Download and look at the two pictures below that follow on from the main image:

- Is the house floating in the first image?
- Why do you think the house was burned down after it collapsed? What does this tell you about the materials from which it was made?

October 9, 2010

October 16, 2010

HTTPS://WWW.FLICKR.COM/PHOTOS/BALDEAGLEBLUFF/5193166145/IN/PHOTOSTREAM/

FREE RESOURCES

The Why and How Challenge

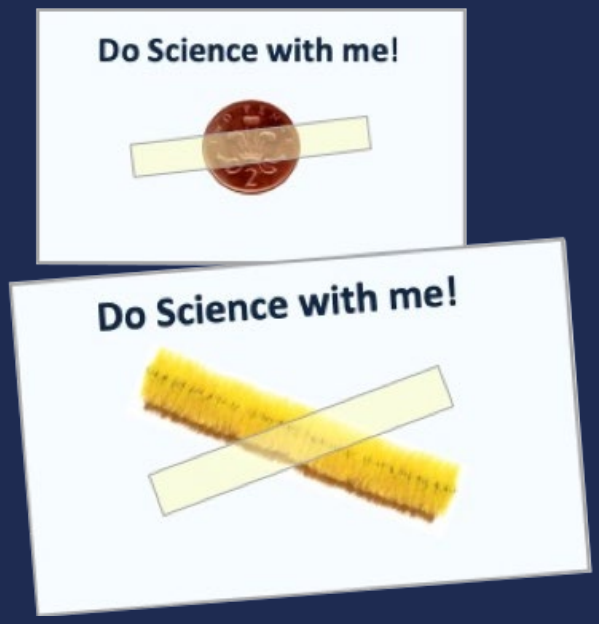
The 'Why and How' Challenge is intended to be something for the staffroom table that lots of teachers will want to try. The idea is to motivate the children to work scientifically, to design and make something, or to solve a problem.

This issue's Why and How Challenge is based on open-ended exploration and can be run as a whole school challenge.

Do Science with me!

You will need:

- ***White A5 cards – one per child – with "Do Science with me!" printed across the top.***
- ***Masking tape***
- ***A selection of objects (e.g. coin, pipe cleaner, cork, feather, piece of felt/other material, velcro, button, drinking straw, bamboo, clothes peg .....). You need enough objects for one per child but NB they don't all have to be different.***



WHAT TO DO

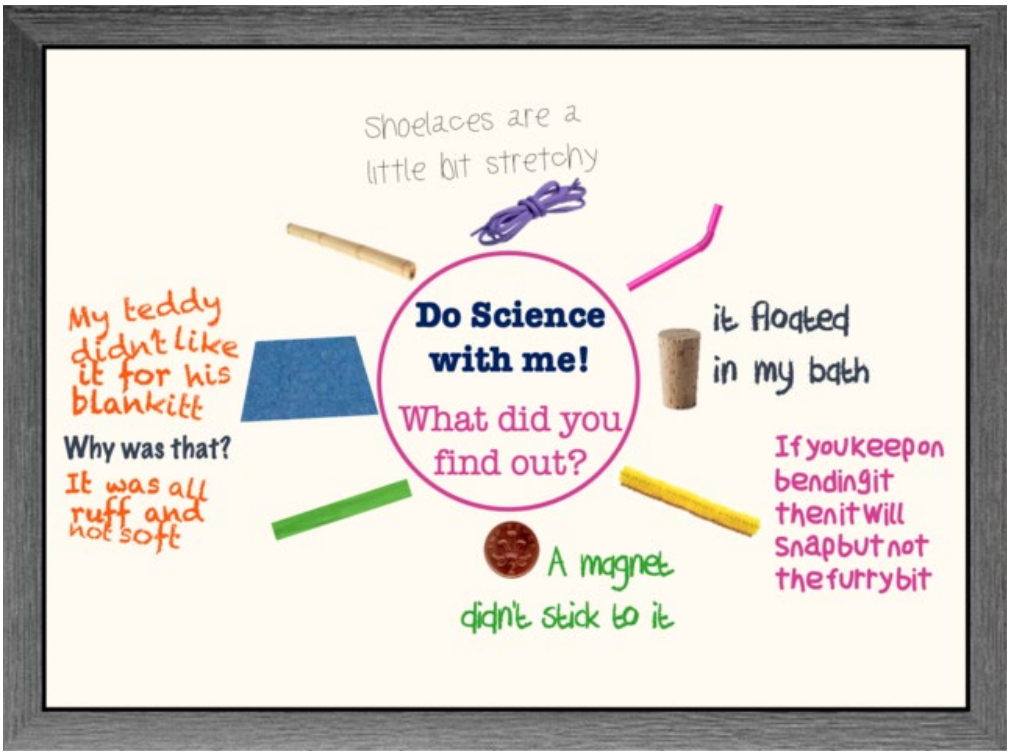
1. Tape one object to each card.

2. Give the children a card each – ideally they will take this home, but it can also be done in school. Either way, give them enough time to explore different scientific things they could do with their object. Note that this is very open-ended and allows children to be creative and diverse with their thinking and with what they do.

3. Ask the children to write and draw on the card what they did/observed/found out and bring it back with the object.

4. When the children have brought back the objects, use them to make a display, either leaving the objects on the cards or transferring them to the display and getting the children to write or draw what they did/observed/found out straight onto the display board (NB health and safety note – an adult may need to do this for the child).

You might end up with something like this:



The display can be built up by adding questions for the children to answer, or by asking the children to respond to each other's ideas.

Ideas for making this into a whole school challenge:

Morning

Give every child/pairs of children an object on a card in the morning and encourage them to explore how they could do science with the object during that day. This could be done at playtime or lunchtime, or some class time made available for it. Remind them to write or draw on the card what they did/observed/found out.

(NB this could also be done as a homework task and send the children home with the cards for the weekend.)

After Lunch

Share the ideas as a class, maybe creating a wall or table display.

Discuss with the children:

- How many different ideas have they had?
- What questions do they have?
- What do they want to find out next?

Decide with the children on one or two of the most scientific, interesting or unusual ideas to share across the school. Take a picture of these cards.

Collate the pictures from each class into a slide show to share with the whole school in an assembly. Children can tell the school about their idea.

Ask each class to count how many different ideas they had had about the science they could do with their objects – how many in total is this across the school? Did anyone have the same ideas as other people?

This activity was developed from an idea by PSTT Fellow Rufus Cooper. It was included in the child-led enquiry workshop he delivered with Ali Eley at ASE 2018. If you would like to see more ideas from this workshop, please visit https://pstt.org.uk/what-we-do/news/child-led-enquiry-what-does-it-look-practice to download the **Frameworks and practical ideas to support child-led enquiry in science** guide.

FREE RESOURCES

Engineering Our World

Aimed at teachers or other adults looking to introduce a science or STEM club to children for the first time, PSTT is creating 4 freely accessible resource packs that will each cover a series of 8 sessions for an extra-curricular science or STEM club.

In this issue we launch the first of these resource packs, Engineering Our World, which will be freely available to download from the PSTT website. Based around a famous scientist, engineer or artist, each session includes an activity to challenge the children and a fact sheet to take home so the children can share their findings with their families and take their learning further.

Emily Roebling

LINKED CHALLENGE

To build a bridge between two supports that will hold 50g

ACTIVITY OVERVIEW

Two groups with two different sets of equipment (see resources list).

Activity leader to encourage children to explore different masses: 10g, 20g, 50g.

Activity leader to set initial challenge for children and let them explore the equipment. Children reminded they can decide to ask for a 'top tip' as a group if they find the challenge difficult. Activity leader to then determine how much of a pointer the group needs to get on track. *Building the bridge between two tables will make this easier.

When testing as a group, activity leader to begin with the smallest mass and work upwards to test the strength of the bridge.

KEY FACTS/SCIENCE

Bridges are built to cross an area without blocking the way underneath; for example, a stretch of water or a road. There are many different types of bridges, built for different specifications. *Check out the QR code for more information.

The Brooklyn Bridge is a suspension bridge. This is a bridge that has towers to which are attached cables, as well as anchors at either side of the deck. This allows the forces on the bridge to spread out, creating tension in the cables and pushing down through the towers.

A beam bridge is the simplest bridge. The deck (the beam) rests across supports at each end. This is the type that children will be most likely to make.

https://www.youtube.com/watch?v=oVOnRPefcno

RESOURCES

GROUP 1	GROUP 2
Newspaper	Garden canes
Cardboard	Lollipop sticks
Paperclips	

GENERAL RESOURCES

10g, 20g and 50g masses
Sticky tape
Scissors

QUESTIONS/FURTHER LEARNING

- Which is the strongest bridge?
- How do the materials used effect how much the bridge can hold?
- How could you improve your bridge?
- What different types of bridges are there?

EMILY ROEBLING

What is she most famous for?

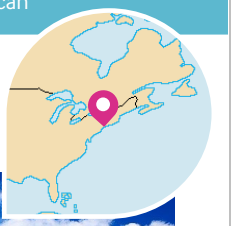
She is most famous for her contribution to the construction of the Brooklyn Bridge in New York.

Why is this important?

- She was the first woman field engineer.
- She undertook most of the work of the Chief Engineer and project-managed the [illegible]n of the Brooklyn Bridge when [illegible]nd was taken ill.
- [illegible]e of the most famous in [illegible]

KEY FACTS

Born	September 23, 1843 New York, United States
Died	February 28, 1903 (aged 59) New Jersey, United States
Nationality	American



New York, United States

The Brooklyn Bridge

[illegible]achievements?

[illegible]ed a Law degree, at a time when few women were able to

[illegible]omen's causes and for the Relief Society during the

[illegible]ning take you?

[illegible]ons? Can you do
[illegible]to find answers?
[illegible]out more about
[illegible]s.

[illegible]oVOnRPefcno

All our club materials can be downloaded from the PSTT website:

https://pstt.org.uk/resources/curriculum-materials/childrens-university-stem-clubs

All activities are validated by the Children's University and as such count towards accredited learning for any children taking part.

The Engineering Our World resources have been created by PSTT College Fellow and Regional Mentor Kate Redhead, who will also be sharing activities from the club resources on the PSTT stand at PSEC 2019.

I BET YOU DID'T KNOW...

Electrical signals and biology

Prof. Dudley Shallcross, PSTT CEO, links **cutting edge research** with the **principles of primary science**

dudley.shallcross@pstt.org.uk

"PLANT TALK OR HOW DO PLANTS KNOW GOOD MICROBES FROM BAD ONES"

Plants are vital to life on Earth (do our primary school children know why?). Apart from producing oxygen through photosynthesis, without which we would not be able to inhabit the Earth, in what other ways do plants support life? Some plants produce fruit, some contain nectar, and many have other edible structures; they provide shade to animals; they provide a home to others; they prevent soil erosion, regulate light, temperature and water balance in the ecosystems that they inhabit; they are vital in the regulation of carbon dioxide, a key greenhouse gas and modify the Earth's albedo (how reflective the Earth's surface is). Why might this be important?

We may ask our primary school children, 'What do plants need to survive?' Water, sunlight and nutrients (plant food) are all essential, but how do plants obtain these vital ingredients? In the main, nutrients and water are derived from the soil that the plant resides in, through its root system. One vital nutrient is nitrogen but in a rather bizarre situation, the plant cannot access nitrogen in the atmosphere, even though the atmosphere is dominated by nitrogen (78%). Why is this? Atmospheric nitrogen, or N_2, consists of two nitrogen atoms bound together by a triple bond. What this means is that the plant would need a lot of energy to break the N_2 apart in order to use it. *Can the children think of analogies for this? Perhaps consider a sweet, locked in a very strong box.*

So how does the plant access the nitrogen? The plant uses bacteria, which are tiny microbes that attach themselves to the roots of the plant. The bacteria are able to convert nitrogen from the air into ammonia, NH_3. A symbiotic relationship is established whereby the plant benefits from the ammonia (NH_3), which it can easily break down to access the nitrogen, and the bacteria is able to extract energy from the plant. This is well known, but how does the plant know which are good bacteria that will help it and which are bad bacteria that will harm the plant? *We could ask the children for their ideas.*

In the research paper by Cyril Zipfel and Giles Oldroyd, they review how plants work out good from bad microbes. The plant cannot talk with the microbe as we might understand it, but they do have a chemical 'conversation'. **First, the plant can use shape and size: only microbes that have the right shape and size will be able to attach to the root.** But why is this not a good enough discriminator? Ask children for their ideas as to why this will not be enough. They may need clues to help them think about this. Perhaps imagine a puzzle piece that fits into a space but comes from another puzzle picture. The puzzle is complete but the picture does not make sense and is spoilt. Microbes are sneaky; they all want to attach to the root as it is a great place for them to live and some bad bacteria have adapted (*check that the children understand what this means*) so that they have the right shape and size and so can pass the first test.

How then does the plant work out whether to let the intruder stay or to get rid of it? It turns out that the plant plays the chemical equivalent of 'twenty questions'. The microbe will release several chemicals once attached and the plant analyses them and works out if the intruder is good or bad. We could play a similar game in the classroom but are there other ways to illustrate this through science investigations? Yes, there are. First, we could set up a simple electrical circuit with a battery and a bulb but leave the circuit open and test materials to see if they will fit into the gap and light the bulb (see Figure 1). This will only happen if the material conducts electricity; it may be the right length and connect to the ends of the circuit (right shape and size) but unless it is made of the right material the bulb won't light. This is an example of using electricity to pass a signal. Many natural systems use electrical signals to pass information; these are happening in our bodies all the time. Second, we could make some red cabbage indicator (see Figure 2), use it to test a range of substances and see what colour the indicator turns in their presence. In the classroom, prepare a range of substances for children to test in advance and let them observe how the cabbage solution produces different colours when different chemicals are added.

The plant is doing something similar, testing the chemicals produced by the microbes. If they produce the right sequence of colours, in our indicator analogy, then they are allowed to stay. This is clever work on the part of the plant - the longer the sequence of testing, the harder it is for the plant to be fooled by a bad microbe.

Figure 1. Creating a simple circuit test circuit.

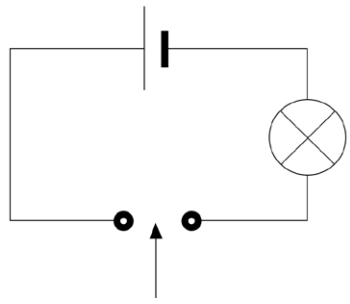


Figure 2. Creating an indicator solution using red cabbage.

Red cabbage indicator can be made by shredding cabbage (e.g. in a food processor) and covering in boiling water for a few minutes. Strain the solution from the cabbage and allow this to cool. The neutral purple solution will turn pink/red in the presence of acids (e.g. vinegar, lemon juice, tartaric acid) and blue/green in the presence of alkalis (e.g. bicarbonate of soda, toothpaste, soap).

We stress, however, that you need to carry out your own health and safety and risk assessments for any classroom activity.

What happens if bad microbes crack the code and can produce the correct chemicals in the correct sequence? Sometimes this means that a plant species is destroyed, at least on a regional basis, because it cannot now sort good from bad microbes.

Discuss these questions with the children:

Do you think the 'Sainsbury Laboratory' where the authors work is the same Sainsbury as the supermarket?

Why would Sainsbury be interested in research into plants?

The research paper that generated this work was:

Plant signalling in symbiosis and immunity

By Cyril Zipfel[1] and Giles E.D. Oldroyd[2]. Nature, vol. 543, pp. 328-336 (2017)

1. The Sainsbury Laboratory, Norwich Research Park, Norwich, NR4 7UH

2. School of Experimental Psychology, University of Bristol, Bristol BS8 1TU, UK.

PSTT COLLEGE SNAPSHOT

Meet six of our **College Fellows** who share some quick thoughts and suggestions for teaching primary science.

Linda Curwen

Cardiff

Current Role: Year 5 part time teacher and Science Subject Leader

Year of award: 2010

Most recommended book/website for supporting teaching in science?

'It's not fair'- or is it?' Written & edited by Jane Turner, Brenda Keogh, Stuart Naylor and Liz Lawrence and published by the ASE. Brilliant for illustrating that there's more to science enquiry than fair testing! Gets teachers thinking about imaginative ways to teach pattern seeking, classification & identification, making things and exploring over time enquiries too.

Best idea for an observing over time investigation?

A geranium plant on a sunny windowsill looked after and kept watered with ONE leaf completely covered (in a paper 'envelope' that can slip on and off easily). Uncover the leaf every few days and photograph it. Over time this illustrates the need for the leaf to have light in order to remain healthy, as the covered leaf will turn yellow compared to the other leaves which will remain green, having been constantly in the light.

Jess Bolton

Southport

Current role: Class teacher in a school for pupils with Severe and Complex Learning Difficulties

Year of award: 2015

Most used piece of equipment in your science cupboard?

My class are fascinated by the Easi-Scope Microscope (available from TTS-group https://www.tts-group.co.uk/easi-scope-microscope/1010495.html). It has been an excellent vehicle for speech and language development as children react and respond to things they can see. It has generated high quality talk about colours, shapes, patterns, similarities and differences. It is incredible watching the first moment the children investigate using this tiny little tool and the sparkle in their eyes the minute they realise they are looking at their fingerprint or a close up of their clothing on the screen!

Most recommended book/website for supporting teaching in science?

I believe absolutely everyone should own a copy of The Lost Words (Robert MacFarlane). Our curriculum at Merefield encourages hands-on learning and the majority of our learning takes place outdoors as we are a Forest and Beach School. This book encourages all children to get into nature and discover the world around them.

Nicky Collins

Yealmpton

Current year group: All – science specialist teacher

Year of award: 2015

Favourite topic to teach in science?

I am never happier than when I am out and about with children peering under rocks on the seashore or logs in our school orchard to find out what might be hiding underneath.

Most recommended book/website for supporting teaching in science?

Concept cartoons https://www.millgatehouse.co.uk/product/science-concept-cartoons-set-1/ are great – they have so many uses: as a starter for an activity or investigation, for assessing understanding of a concept, or as part of a display in our curiosity corners where children can stick up their responses on post-it notes.

Rachel Wolford

Kinloss

Current role: Head Teacher

Year of award: 2017

Most enriching off-site science trip?

The forest or the beach are amazing environments to use to capture children's imagination, especially on mini beast hunts, shelter building, making music, being environmentally aware and collecting plastic/rubbish.

Best idea for an observing over time investigation?

A puddle! Particularly on a warm/sunny day, great to get the children investigating evaporation, the water cycle, time and weather! Or if you are really lucky - observing a snowman if there is snow. Plenty of different types of weather in Scotland!

Julia Nash

Limpsfield

Current year group: key stage 1

Year of award: 2012

Most used piece of equipment in your science cupboard?

My table dark tent is my most used piece of science equipment. It is a simple piece of lining material, sewn into a 'skirt' that fits over two small tables neatly without impacting on the limited space in a classroom; it is often out for many days in a row and is fantastic for children to explore light and shadow.

Most recommended book/website for supporting teaching in science?

I think so many are brilliant; however, the one I recommend most is Reachout CPD https://www.reachoutcpd.com/ This provides an easy accessible resource to support teachers and build confidence with science knowledge and understanding.

Kelly Thomas

Swansea

Current year group: Year 1/2 teacher

Year of award: 2016

Favourite topic to teach in science?

My favourite topic to teach in any year group is Materials. There is always an exciting investigation that the children can do independently. I work in the foundation phase and the children love finding out for themselves things like which material will keep the three pigs dry.

Best idea for an observing over time investigation?

We place three pieces of bread in sealed bags. One untouched, one touched with unwashed hands and one with clean hands. They children can't believe how quickly the mould grows with dirty hands. They wash their hands well after this!

COLLABORATOR UPDATE

SSERC

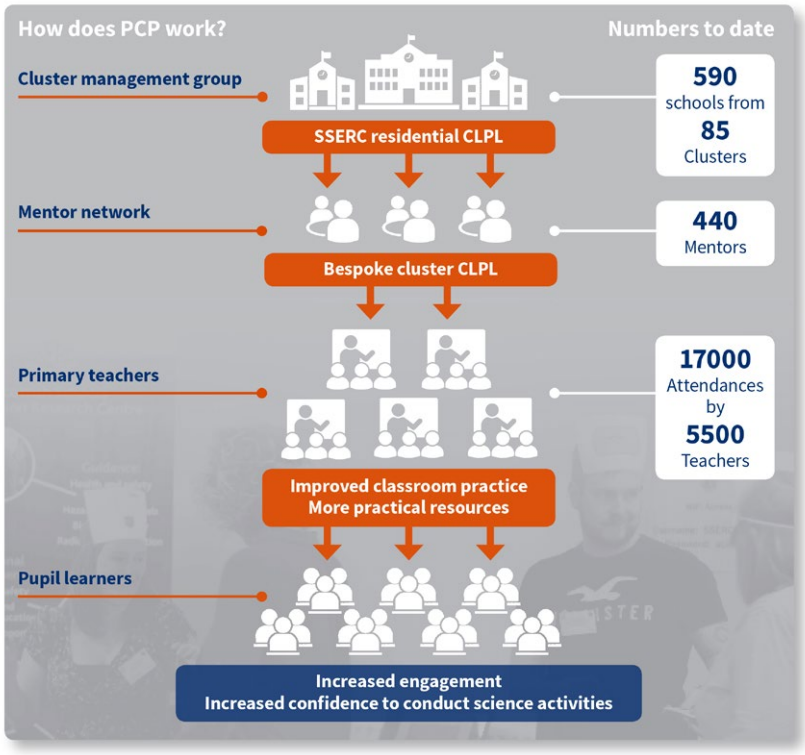
The Scottish Primary Cluster Programme – A Teacher's Journey

The Scottish Schools Education Research Centre (SSERC) is delighted to announce the start (as of 1st April 2019) of a new 26 month programme that brings together the best aspects of the existing Primary Cluster Programme (PCP) and the PSTT Sustain and Extend Programme (PSTT SEP) into a single programme. Both the PCP and the SEP receive core funding from the Primary Science Teaching Trust.

The PCP Model

PCP is a national career-long professional learning (CLPL) programme in Scotland that aims to improve the confidence and expertise of all teachers in a participating cluster in their teaching of science and technology. In Scotland, a cluster includes a secondary school and all its associated primary schools. The 6-year pilot ended in 2018 and an independent evaluation found that PCP has been highly successful in raising levels of teacher confidence and expertise, and pupil confidence[1]. The programme works by empowering groups of teachers to become mentors who then go on to design, implement and lead a bespoke cluster CLPL programme to meet the needs of their colleagues and improve the confidence and competence of all teachers in their cluster (see Figure 1).

Figure 1: PCP Model



The PSTT SEP

A key recommendation of the initial evaluation is that PCP should be sustained and extended, giving mentors access to continued support and funding to strengthen and develop existing mentor networks. Consequently, the PSTT SEP was designed in 2016 to support the development of new mentors and extend professional learning opportunities across Local Authorities.

A Teacher's Perspective – Nicola Connor

Prior to her involvement in PCP, Nicola Connor was a classroom teacher from Peel Primary in the Inveralmond Community High School (ICHS) Cluster in West Lothian with a keen interest in science but with little scientific background. Nicola is now one of 9 SSERC mentors (including one mentor from ICHS) from her cluster of 7 primary schools who were trained as part of PCP in 2016/2017. Nicola's school was awarded a PSQM Outreach Award in 2018 and Nicola has currently been given the opportunity to act as lead coordinator for PSTT SEP 2018/2019 in West Lothian.

Following the initial SSERC CLPL (see Figure 2), Nicola and her mentor colleagues carried out a baseline survey of teacher confidence across the cluster in each of the 6 science themes using a confidence wheel. They used the results to design a bespoke CLPL programme for their colleagues, focusing on biodiversity as this was the area in which teachers lacked most confidence. They also arranged for external providers to deliver sessions on forces and other topics to ensure a wide variety was available. Three compulsory sessions and five opt-in sessions were offered to cluster colleagues. All sessions were fully booked and well received, in part due to excellent support from school and cluster management. Following implementation of the CLPL programme, Nicola and her mentor colleagues carried out a follow-up survey and found that levels of staff confidence had increased. Resource boxes, purchased using Edina Trust funding[2], containing lesson plans and additional teaching aids developed by the mentors covering a variety of common primary science themes, are stored centrally at the High School. All primary schools in the cluster have access to the boxes through an online booking system. The boxes are very popular and have been used regularly over the last two years.

Figure 2: Teachers taking part in mentor organised CLPL

There has been a significant impact on the pupils in Nicola's school and cluster. When previously asked to draw a scientist, pupils would often draw an elderly male in a lab coat but now they are increasingly drawing images of themselves or their female teachers doing science. There is a continuous whole school focus on science and the school actively shares their experiences and achievements through blogs and twitter. Pupils in Nicola's school love science. They are now more motivated and know they are always going to get practical science in class. Regardless of stage, everyone gets a new experience and as a school they bring in external visitors more frequently, particularly parent visitors with a science background.

Figure 3: Pupils' science display

1 https://www.sserc.org.uk/wp-content/uploads/2019/04/SSERC-PCP-Final-Report-30-March-2019.pdf

2 https://www.edinatrust.org.uk/

Nicola will be talking about her experiences in PCP as part of a joint reflective seminar 'Scotland's National Primary Cluster Programme in Science and Technology: Impact on Learning and Teaching' with SSERC at the PSEC conference.

The programmes described here are supported through core funding from PSTT and the Scottish Government.

RESOURCE UPDATE

PSTT's new collection

We are delighted to bring you details of our four newest resources. Created by PSTT Fellows working with each other or in collaboration with other primary science educators, they all offer valuable support for excellent teaching and learning in primary science. Please visit our website and our PSTT Trading shop site for further information about these and our other resources.

PLAYGROUND SCIENCE

Self-directed activities to support learning in science and add purpose and enjoyment to playtimes

Written by PSTT Fellows Tom Holloway and Ruth Shallcross

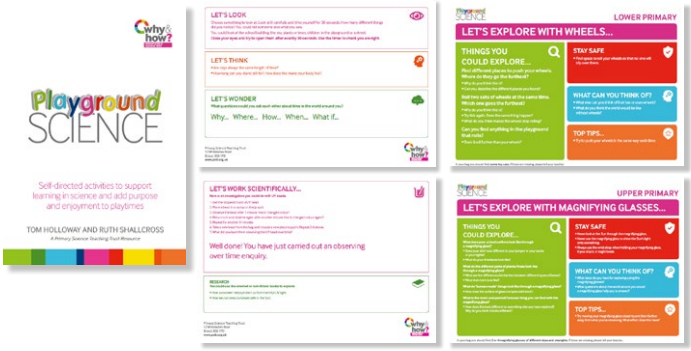
Playground Science is a set of fun and informal science activities that children can carry out in their playtimes. The activities use simple instructions and a small amount of equipment to encourage the children to explore the world around them and to develop scientific skills. They are deliberately semi-structured so that children can follow the suggestions if they want, but they also have the option to make their own decisions about what to do. The children can do the activities independently or with other children.

Each set of Playground Science includes:

- Five coloured drawstring bags (one each of: navy blue, turquoise, pink, orange and apple green) with space on the front to add a bespoke label to the bag (e.g. with the topic, class name, year group).
- Five printed cards to guide the children through the activity. Each card has a set of initial ideas and questions on one side, with a follow-up activity on the back. The follow-up activities are designed to encourage the children to work more scientifically.
- A teacher guide.

There are two sets of Playground Science bags available:

- Lower primary for younger children (roughly aged 4-7), and
- Upper primary for older children (roughly aged 7-11).



For more information please visit:

www.pstt.org.uk/resources/curriculum-materials/playground-science

NB The equipment needed is not supplied with the Playground Science bags. Much of it can be sourced from within school as many of the items are commonly used in school science or maths. There are one or two items that your school might not already have, and these are available from many educational suppliers.

SEE THROUGH SCIENCE

Using photographic images to engage and inspire children to ask scientific questions about the world around them

Written by PSTT Fellow Paul Tyler, with Alex Farrer.

See Through Science is a fabulous set of fifteen high-resolution digital images (included with the book as a digital download). The book is packed with practical advice for teachers about using the image pack to develop children's observation, questioning and discussion skills.

The images have been selected to be inspiring and thought-provoking. They cover a range of scientific phenomena, enabling children to explore and discuss science in a variety of contexts, and to appreciate many different applications of science. Each image comes with associated background information and key scientific words.

For more information please visit:

www.pstt.org.uk/resources/curriculum-materials/see-through-science

Project Teachers:

"These photographic images provide a fantastic hook to science lesson topics that are accessible to all the children."

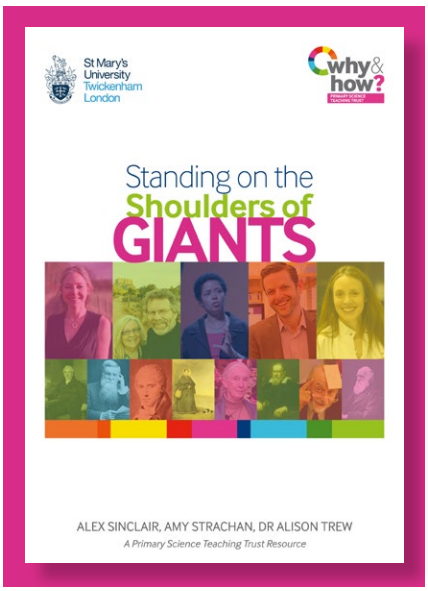
"The images inspire awe and wonder while developing questioning and explaining."

STANDING ON THE SHOULDERS OF GIANTS

Introducing historic and contemporary scientists' discoveries in the primary classroom through practical investigations

Written by Alex Sinclair, Amy Strachan and Alison Trew

Offering a series of engaging practical investigations based on the scientific work of a historic figure that encourage children to generate their own questions to explore and develop their understanding further, the resource links the work of 10 famous historic scientists to the work of contemporary scientists.



Included in the resource for each of 10 historic scientists and their contemporary counterparts:

- Teacher's Guide (in the book)
- Classroom Presentation (digital, to download)
- Timelines of events (in the book and in digital format)
- Templates for lessons (in the book and in digital format)

For more information please visit:

www.pstt.org.uk/resources/curriculum-materials/sotsog

"If you don't understand how evolution works, buy this book and your kids can explain it to you."

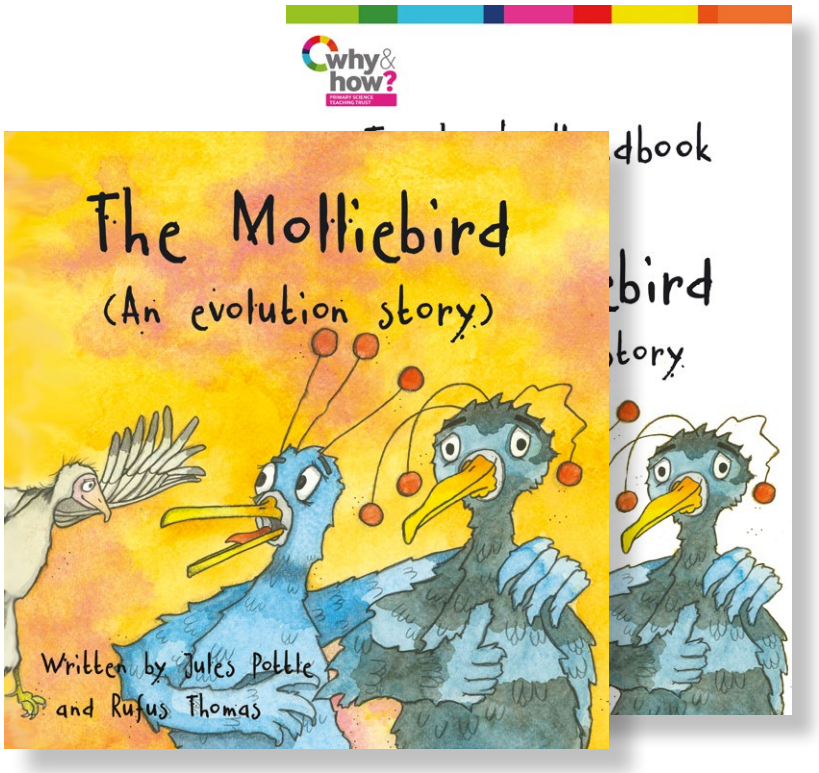
George McGavin

THE MOLLIEBIRD

An evolution story

Beautifully written as a narrative poem by PSTT Fellow Jules Pottle, and exquisitely illustrated by PSTT Fellow Rufus Cooper, The Molliebird tells the story of natural selection. After a natural disaster that leaves her badly camouflaged in her surroundings, the bright blue Molliebird becomes desperate for her babies to survive. She notices that brown baby birds thrive, and so tries painting herself brown in the hope that her babies will be born brown, and she is devastated when this does not work and has to think again...

The Molliebird provides a highly engaging fictional context for discussion about evolution. The story skilfully supports teachers with how to identify and address children's misconceptions about inheritance and changes within species. The free to download teacher's handbook includes background information, additional supporting ideas and cross-curricular activities.



For more information please visit:

www.pstt.org.uk/resources/curriculum-materials/the-molliebird

KEY DATES

Primary Science Teacher Award Deadline

12th July 2019

Nominations are open via the PSTT website

Do you know an outstanding primary science teacher?

These awards celebrate amazing primary science teaching across the UK, recognising talented teachers in early years, Key Stage 1 and Key Stage 2. Teachers who win this award are not only judged to be outstanding practitioners in their own classrooms, they also support and develop colleagues in their own schools and others either locally, regionally or nationally. Award-winning teachers are also innovative, creative, enthusiastic and will have significantly raised the profile of science in their own schools and beyond.

Great Science Share for Schools

18th June 2019

#GreatSciShare

Are you registered for the Great Science Share for Schools?

Reaching over 40,500 young people in 2018 it's time to register to take part in the Great Science Share for Schools on 18th June 2019.

The Great Science Share for Schools is a national campaign to inspire young people into science and engineering by sharing their scientific questions. You'll benefit from taking part by:

- encouraging young people to communicate their scientific questions and investigations with new audiences
- improving teacher confidence in teaching children to think and work scientifically
- raising the profile of school science, improving the science capital of children and families

Register your interest now at https://www.eventbrite.co.uk/e/the-great-science-share-for-schools-2019-registration-registration-54646010689

Download resources and information at www.greatscishare.org.uk

Any questions or ideas email us at greatscishare@manchester.ac.uk and follow us on Twitter.

sharing
&learning

excitement
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discovery
&delight

investigating
&questioning

www.pstt.org.uk

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