Spring 2018 *Issue 2*

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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Why & How? is the brand name of the Primary Science Teaching Trust
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Welcome

A warm welcome to our Spring 2018 issue of 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.

This issue brings you another set of **free resources**. The recent *'State of the nation' report of UK primary science education* from the Wellcome Trust (2017) again highlights issues faced by teachers and schools, in particular that almost half of science subject leaders do not get any specific release time for leading science in their schools. We hope these ready to go resources will make life a bit easier for all busy teachers to deliver high quality and exciting science lessons. Please do pass on the resources to your colleagues.

The **picture as a stimulus for talk** and the suggested questions and discussion prompts provide an easy to use, open-ended and inclusive approach to group talk in science that can be used with children of all ages. The picture we have chosen for this issue will fascinate children and adults alike, and is certain to prompt talk...

Our autumn newsletter's **Why and How Challenge** suggested using a paper spinner as **a whole school competition**. This time the children are challenged to make an elastic band powered car out of easily available materials, and to find out what kind of wheels will make the car travel the furthest. This is a great way for them to develop skills of working scientifically, along with patience and determination...

We bring you a free sample of a PSTT resource with **Let's Go! Feet**. Please try it and if you like it, we have a whole book of trails in Let's Go! Science Trails available **here** – see also page 27 for details. These trails enable teachers to make the most of the outdoor environment to teach

any topic in science. If you want more resources for teaching and learning outdoors, watch this space as very soon we will be launching its sequel, **Let's Go! STEM Trails**.

Outstanding achievements of some of our PSTT colleagues, the latest developments about the Great Science Share for Schools, and an update from the Primary Science Quality Mark (PSQM) about their new awards can all be found in our **news** section. You can also read about the University of Manchester's Science and Engineering Education Research and Innovation Hub's exciting new tinkering website. The site contains over 20 inventive lesson plans based on their seven principles of engineering education.

Let's Go! STEM Trails coming soon

Expert guidance and advice about how to deal with children's **common misconceptions** can be found on page 7. In this issue, PSTT College Fellow and Regional Mentor Kate Redhead offers insights from her own experience for teaching the tricky aspects of electricity.

Our regular feature **'I bet you didn't know .....'** is where we share an exciting piece of real science research and relate this to the principles of primary science teaching and learning. This time PSTT Fellow Dr. Alison Trew writes about incredible developments in stem cell research and how these changed the quality of life for a child with a skin disorder. The article highlights how finding out about the scientific processes behind this cutting edge development can help children learn about the nature of scientific enquiry.

'In conversation with.....' invites PSTT Fellow Nina Spilsbury to share some of her thoughts about primary science and to talk about what motivates her. Nina makes recommendations about the resources she has found most useful in her teaching and explains why she values them.

We encourage you to read our various **updates**. Our research update has a focus on outdoor learning and recommends two recent papers in the Journal of Emergent Science. We are very pleased to welcome a summary of her research from Sarah Frodsham, who was supported by PSTT to study for her PhD. Our project update includes a description of Project 500. Developed by Queen's University, Belfast, this project encourages children to read science books for pleasure. The accompanying guide (free to download) contains all you need to know about how to run the programme in your own school. We also bring you news of an on-going project led by PSTT College Fellow Robin James, which is exploring the use of child-initiated video freeze framing to improve the quality of peer assessment.

Click to go back to contents

Our **key dates** page gives announcements of forthcoming primary science events. We would specially like to draw your attention to our Primary Science Education Conference (PSEC) due to take place in Edinburgh in June 2019. Our call for programme proposals opens in April this year. We have a generous bursary scheme to support teachers to attend the conference. Full details can be found on page 26 and you can register your interest by visiting: www.primaryscienceconference.org

We invite you to share this newsletter with anyone you know who has an interest in primary science, and please do get in touch with us about what you like about our newsletter and what you would like to see in it. Please send your feedback and suggestions to us at **newsletter@pstt.org.uk**

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References

Wellcome (2017) 'State of the nation' report of UK primary science education

News

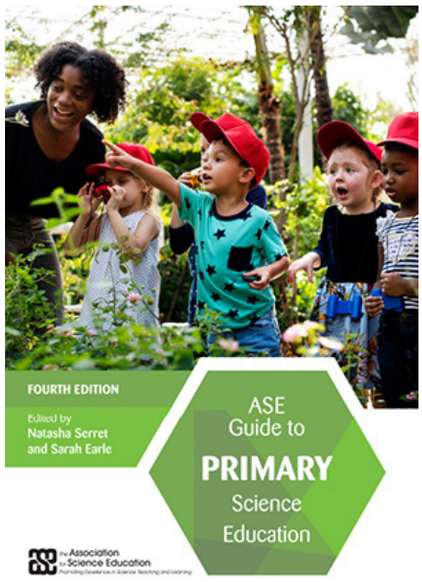
BBC Terrific Scientific Webinar

PSTT College Fellows make up the panel that will be supporting teachers looking to participate with their classes in Investigation 10 of the BBC's Terrific Scientific project during an interactive webinar in May. Our Fellows will share a wealth of classroom experience and expertise to help teachers get the most from this activity. **The Terrific Scientific project provides free resources to support investigative science at Key Stage 2.** Keep an eye out for details of the webinar on the BBC Terrific Scientific website: www.bbc.co.uk/terrificscientific.

If you have not yet participated in BBC Terrific Scientific, there is still time. PSTT College Fellow Claire Seeley, a major contributor to the programme, shares her tips for teaching KS2 science here: www.bbc.co.uk/guides/zpvfxfr

The ASE Guide to Primary Science Education – 4th Edition

The ASE 2018 conference in Liverpool saw the launch of the fourth edition of their Guide to Primary Science Education. **At PSTT we are delighted that more than ten of our Fellows, two of our funded PhD students, and colleagues from three of our Collaborators have contributed to this.** The book provides comprehensive guidance for all teachers, whether newly qualified or experienced science subject leaders. It encourages teachers to engage in critical reflection about different teaching and learning strategies by considering the evidence for their effectiveness. It also explores the role of working scientifically in the development of learning with understanding.



Senior Fellowship Award

Many congratulations to Dr Lynne Bianchi, Director of the Science and Engineering Education Research and Innovation Hub (SEERIH) at The University of Manchester, who has been awarded Senior Fellowship of the Higher Education Academy. The assessors were **extremely impressed with the quality and reach of SEERIH's professional development programmes** for science educators and teaching leaders across UK primary schools. They particularly noted that Lynne's work has, "academic rigour and commercial application demonstrating Manchester's commitment to developing teaching excellence." SEERIH is one of PSTT's Academic Collaborators. You can find out more about its activity, such as the Great Science Share for Schools, by visiting www.fascinate.manchester.ac.uk

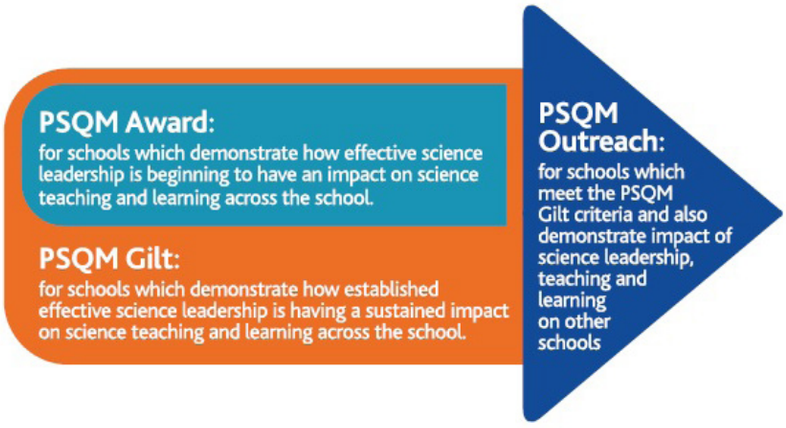
PSTT Chair of Trustees awarded an MBE

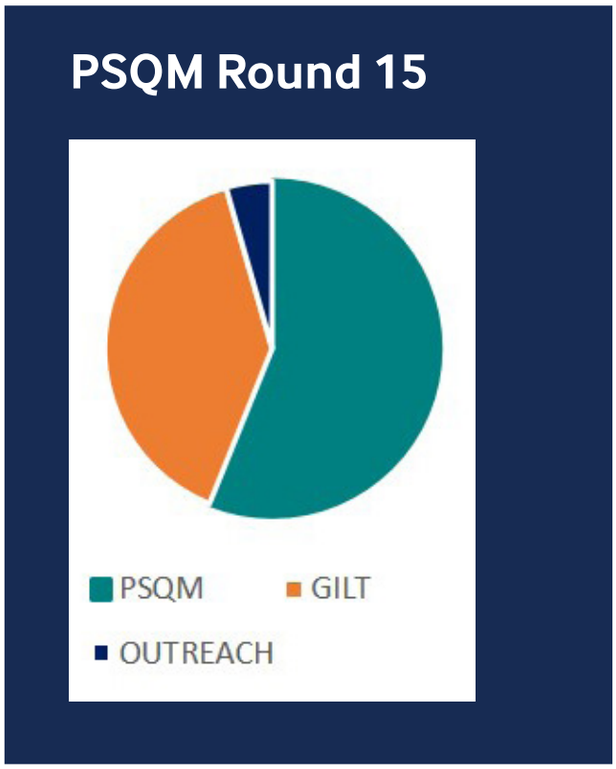
We are thrilled to share the news that our wonderful Chair of Trustees Mike Rance has been awarded an MBE for his **services to a number of charities, particularly those based in Macclesfield**.

We are extremely proud of Mike who has been an exceptional trustee of the PSTT for over ten years and Chair for much of that time. In addition he has been chairman and supporter of Macclesfield Town Football Club and has supported a number of other locally based activities such as Make it Macclesfield.

What's new at PSQM?

In September three new Primary Science Quality Marks were launched: **PSQM Award, PSQM Gilt and PSQM Outreach**. These new awards replace the old bronze, silver and gold. Whilst not radically different from the previous awards, each has new criteria and descriptors which have been designed to ensure that all schools will be able to work towards an aspirational and achievable award.





The concept of leadership supported by the PSQM criteria has been broadened to encompass a more distributed model where vision and responsibilities, although motivated and coordinated by the subject leader, are shared and influenced by all staff, children, leadership teams and governors. **To achieve a PSQM Gilt Award schools need to demonstrate the sustained impact of effective leadership on science teaching and learning**. A new self-assessment tool helps subject leaders to identify the appropriate starting points for their schools, and has resulted in many more schools working towards the entry level award than previously, and no longer can beleaguered, hardworking subject leaders be told by their head teachers 'You have to get gold!' when there has been no leadership focus on science for years.

Subject leaders from reaccrediting schools will be delighted to know that the old PSQM website has also been replaced with a brand new VLE, and that all PSQM documentation is contained in a smart PSQM folder, with plenty of space to add planning, evidence and reflective notes. Perfect for when reporting to SLT or inspectors!

To find out more go to the **PSQM website www.psqm.org.uk**

Great Science Share for Schools

Save the date! Tuesday 19th June 2018

Be part of this nationwide campaign to raise the profile and engagement in science and engineering. Last year 10,000 young people were involved in sharing their science learning with new audiences. Join in and make this year even greater!

Great Science Share for SCHOOLS

So, what's it all about?

- The Great Science Share for Schools is a national campaign to place children at the centre of sharing their science learning. It's child-led, non-competitive and encourages us to involve new audiences.
- 19th June 2018 is a key date, offering chance for children to share and celebrating science. Whether you have half an hour or the full day – make it as small or large as you can, the main thing is to be involved. Link with STEM Ambassadors, local schools and STEM businesses/organisations to support you.
- Developed by The University of Manchester SEERIH team there will be a central event taking place. However, this year's aim is to involve more schools nationally. To this end GGSfS has partnered with the BBC Terrific Scientific Campaign's Investigation 10.

What next for schools?

Please visit www.greatscienceshare.org for more information. Don't work alone – to register interest and gain more information, email greatscishare@manchester.ac.uk

What next for STEM organisations and businesses?

- Encourage the schools you link with and your membership to get involved
- Suggest resources/ideas or opportunities you have that could stimulate children's learning in science that they can share as part of the Great Science Share
- Promote 19th June 2018 on your website – GSSfS are happy to share logos with you!

What if 19th June 2018 is a difficult day for us?

Having a key date for us all to work with has real power and where possible events and activities should aim to run on this day or as close to it as you can. Of course we don't want to exclude anyone, so if a slight variation helps then don't worry.

Share your interest and planning using Twitter @GreatSciShare #GreatSciShare

To find out more about what happens visit www.greatscienceshare.org

CLICK HERE TO WATCH LAST YEAR'S VIDEOS

Common Misconceptions

Electricity

Kate Redhead, PSTT Regional Mentor, tells us how she helps children understand the **Principles of Electricity.**

kate.redhead@pstt.org.uk

What children need to know:

- *A simple circuit consists of a series of conductors.*
- *That some materials, such as metals, are conductors and others, such as plastic, are insulators.*
- *A circuit needs to be complete to work.*
- *The number and voltage of cells in a circuit, affect the brightness of the bulb or loudness of the buzzer.*
- *The reasons for differences in how components behave in a circuit.*
- *The different symbols that represent a simple circuit.*

Common misconceptions – often children may think that:

- *Different coloured wires affect how the circuit works.*
- *Wire is made of plastic.*
- *If a circuit is broken, energy goes off into the air.*
- *Electricity comes out of both sides of the battery and leads to both sides of the component.*
- *Current, voltage and electricity are all the same thing.*
- *Current gets less as it passes through components.*
- *Electricity is an object that can be seen.*

As teachers, if we're honest, there is always an area of the curriculum that we find 'challenging' to cover; the one we need to go over more thoroughly before we can facilitate it with full aplomb in the classroom. In science, for me, it has always been electricity.

WHY ELECTRICITY?

The abstract nature of energy being passed around a circuit seems to be the root of the cause; children can see the result (a buzzer sounding for example) but not what is making it happen; it is invisible. Research suggests that with abstract concepts like these, if we are not adequately able to encourage children to recognise what is happening, then they may leave the lesson having said all the right things and seemingly taken on board the learning, but actually still hold onto their own ideas about 'what is really happening' (Harlen and Qualter, 2006).

As with all science topics, the common use of words or phrases can also lead to misconceptions. We often refer to a single cell as a battery and speak of 'turning a light on' rather than making a bulb light up.

MY OWN REVISION!

The fear of passing on my own possible misconceptions to the children, drives me to go back to basics before teaching the topic. Key terms and definitions, appropriate for primary level, are my starting point (see Table 1).

Electricity	A form of energy.
Charge (electron)	An electric current flows when electric charges move through a wire. Just as in a flowing water system, the charge is analogous to the amount of water in the system.
Current	The movement or flow of electrical charges. This is measured in amps (A). The greater the charge that flows, the bigger the current. Just as in a flowing water system, the current is analogous to the flow of water.
Voltage	The voltage provides the force that pushes the current around the circuit. A voltmeter measures voltage in volts (V). The higher the voltage, the more current is passing through the component and if this is too high, a bulb could blow. Just as in a flowing water system, the voltage is analogous to water pressure.
Cell (electrical)	This generates the electrical energy (e.g. through chemical reactions that occur within the cell). When a cell is connected to a complete circuit, it provides a flow of electrical current to the components.
Battery	One or more than one cells joined together.
Components	The different parts of a circuit, for example: bulb, buzzer etc.

Table 1: Key terms and definitions

Whilst the curriculum may not dictate that children are clear on all of these formal terms when electricity is first introduced, I always use them in context as a way of slowly introducing science vocabulary that can be build on at key stage. However, I do exclude the use of the term 'electron' as this is not included in the curriculum until key stage 4.

WHERE TO START IN THE CLASSROOM

Give children a set of circuit equipment and usually, they can make a component work without much difficulty. However, I prefer to start with a 'wow' and for this I use an 'energy ball', 'energy stick' (Figure 1) or 'circuit maker breaker', which literally provides a hands-on approach to exploring circuits. Each contains an open circuit that produces light and/or sound when completed – the children should offer explanations as to how this works.

Figure 1: Energy stick

These devices are cheap to source, and work when the metal strips are touched on both sides and a connection is made across the surface of the skin (impurities in the sweat on our skin carry the current). In a class situation, they are an excellent tool to involve every child by forming a 'magic circle' (slowly increasing the number of children holding hands in a circle whilst keeping the connection on the metal strips). There are numerous possibilities for extending the learning in this: exploring whether different materials are electrical conductors and considering how switches work are just two examples.

EXPLORATION AND TAKING OWNERSHIP

Next steps for me are to give the children chance to explore; baskets of equipment on each table (including bulbs and cells that are separate from their holders) and a variety of prompts at the ready for those that need it (Can you make a bulb light? Can you change the direction of the motor? Does it matter which way around the cell is? Etc.). As the children explore and make their own discoveries, I prompt them for predictions and explanations (see Figure 2). The aim is for the children to take ownership and begin to pose their own questions to investigate.

Post-It notes of the children's discoveries placed on a learning wall are a useful tool for identifying misconceptions and if time permits, I encourage the children to investigate further; often they will then reassess their findings as their explorations progress. I also use this time to encourage children to recognise what is inside a wire, ensuring they know that the plastic is the coating and not the conductor.

ASSESSING FINDINGS AND USING MODELS TO ADDRESS MISCONCEPTIONS

Children are usually able to say what they think happens in a circuit and how they can change its results, but less clear on what is making it happen. Practical activities and models are excellent tools to address misconceptions, and if all children can be physically involved in a demonstration, they are much more likely to develop a thorough understanding. Whilst we all have our favourites, there is no perfect model, all having limitations and the children should be encouraged to identify these.

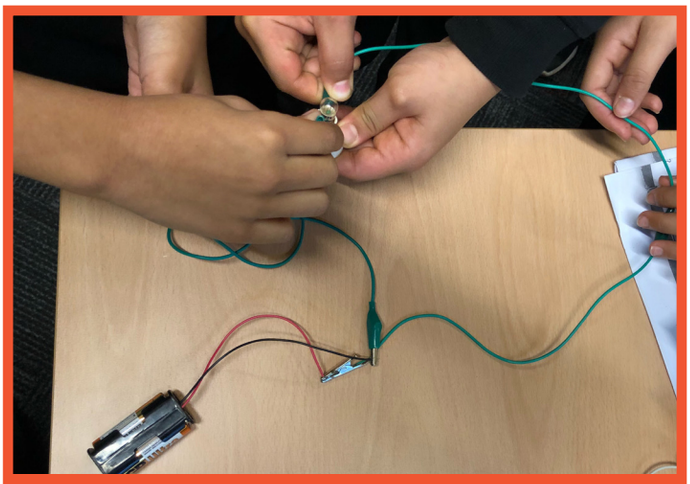


Figure 2: Children exploring with electrical equipment

The first model I share is controversial! Some might say, it deepens a child's misconception that there is only one charge travelling around the circuit and that the charge takes time to travel from the cell to the bulb. I would argue that it allows this misconception to be addressed head on.

I start with the **'whole-class circuit'** and have a 'two stages' approach:

1. 'Passing the squeeze' around the circle first introduces the movement of charge in the circuit. A child wears a 'cell' hat and another a 'bulb' hat (Figure 3). The cell calls, "Go!" as they start the squeeze and the bulb, "On!" as the squeeze reaches them. Children could decide how they can show the effects of adding extra components into the circuit.

I then encourage children to recognise that the bulb was calling, "On!" only when the squeeze reached them and pose the question, "Did the bulb go on and off in the circuits we made?" This is where the misconception is addressed, as children see the difference between the model (with a bulb lighting intermittently, whenever the squeeze passed through it) to the actual circuit they created (where the bulb was lit whenever the circuit was complete). By

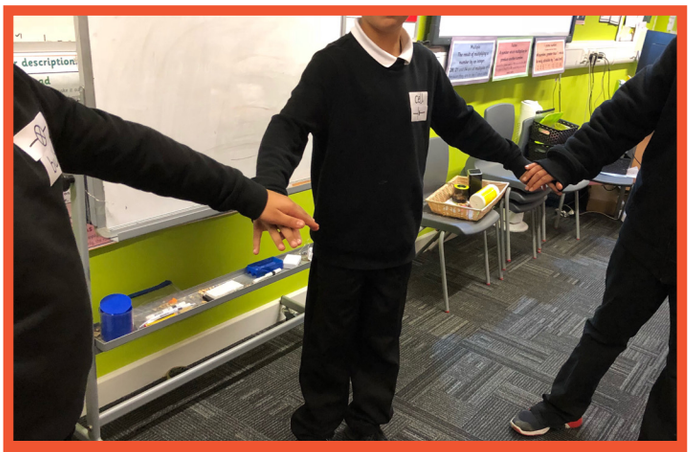


Figure 3: Children holding hands in a circle

demonstrating and underlining these differences, children see that there is not just one charge.

2. The 'Paper Game' helps the children understand that the charges are in the wires and all components. Each child in the circle is given a piece of scrunched up paper (or similar item) on which each child writes 'charge' and told they cannot not pass it to their neighbour until their other neighbour is ready to give them theirs. The cell and component hats are still used, but now have 'On' written on the reverse sides. Children determine when to turn them, depending on the movement in the circle.

In moving the model forward, I want children to recognise the following:

- *Electricity does not travel by a single charge to the component and then away again, but that there are many charges that all move simultaneously when the cell introduces the push force, and all stop when the circuit is broken.*
- *Current flows through components and is the same when it exits as when it enters (it is not 'used up').*

TAKING IT FURTHER: A REASON TO INVESTIGATE

I then give children a reason to investigate further and apply their understanding. Electricity lends itself brilliantly to construction-based projects and wherever possible I link this to their Design Technology topic. A prompt based on a problem, (e.g. "Adam is struggling to do his homework because his light isn't bright enough...") or a story ("The Lighthouse Keeper's Son" in 'Science Through Stories' by Jules Pottle and Chris Smith) are possible approaches. Children can then plan and carry out their own construction based on their new knowledge and go on to discover how changes to cell voltage and numbers of components affect how these behave.

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 that 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 children printed copies. Ask the children to discuss, in groups of three, the following questions:

WHAT DO YOU THINK THIS IS?
WHY DO YOU THINK THIS?

Other questions to generate and promote thinking and explaining

Is it a living creature? How do you know? What else could it be?

Where do you think it lives? Why do you think this?

What does it eat? How does it catch its food? What do you think might eat it?

What do you think the red and yellow glowing parts are? Why do they glow?

At this point, tell the children that it is a type of jellyfish but scientists know very little about it.

What is known:

It is a type of jellyfish that was discovered in 2016 at a depth of 3,700 metres in the Mariana Trench (the deepest part of the Pacific Ocean). The water pressure at this depth is 1000 times greater than at sea level.

Scientists believe, but don't know for sure:

Its two sets of tentacles (short and long) are to help it ambush its prey.

The red lines are part of its digestive system and the yellow spheres are for reproduction.

It glows to attract its prey.

It is an ambush predator that feeds on small fish, shrimps, sponges and coral.

It probably gets eaten by seadevil anglerfish and other large fish.

Once the children have talked about the above, ask them:

What do you think it is like in the Mariana Trench?

How do living things survive there?

What else might live there?

How do you think scientists discovered this animal?

How will they find out more about it?

CLICK HERE FOR MORE INFORMATION

© 'National Oceanic and Atmospheric Administration (NOAA) | Office of Exploration and Research (OER)'

CLICK TO DOWNLOAD IMAGE FROM NOAA.GOV

CLICK HERE FOR VIDEO

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 try.

It is specifically designed to encourage 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 a **RUBBER BAND POWERED CAR**. You may have tried versions of this before, but have you used it as a **whole school competition?**

Rubber band cars – whose goes the furthest?

WHAT TO DO

Make two opposite holes at each end of the cardboard tube and thread the dowel or skewers through them to make the two axles (Figure 1). They should be free to move but not too loose. Cut four pieces of drinking straw to fit exactly between the cardboard tube and the end of the axle where it will attach to the wheel (Figure 2).

Figure 1

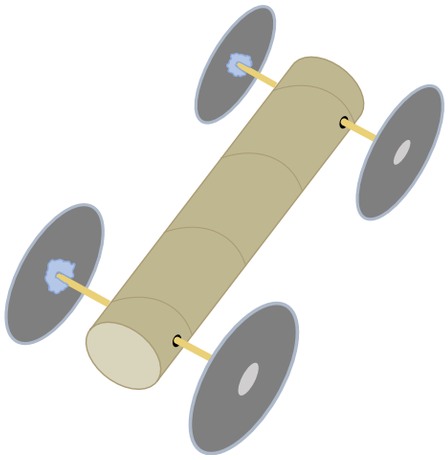
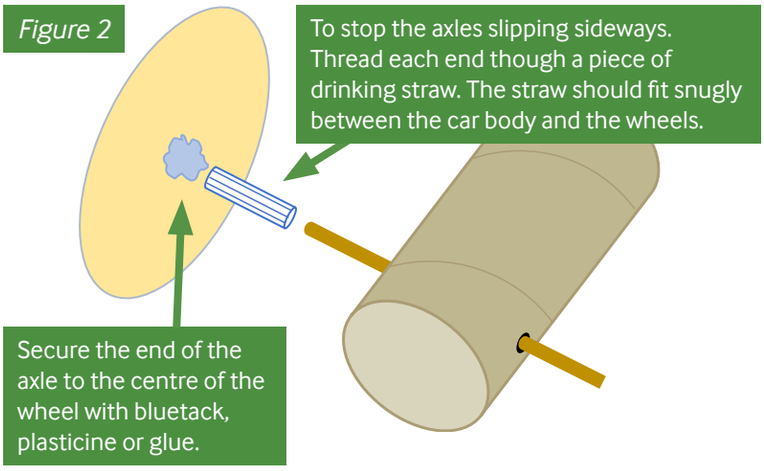


Figure 2



Loop the first elastic band around one of the axles and thread it back through itself to secure it to the axle (Figure 3).

RESOURCES

<u>The same for everyone:</u>

30cm long thick cardboard tube (for the car body)

2 x wooden dowels or skewers (for axles)

Drinking straws (for stoppers to keep the axles from slipping)

4 identical elastic bands

Paper clip

Scissors

Plasticine or bluetack

Glue

<u>Children choose:</u>

A range of materials to make the wheels, e.g. card, bottle tops, CDs, wooden discs, buttons, styrofoam, cotton reels...

Thread a second elastic band through the first and loop it back through itself to make chain. Repeat with two more elastic bands so there is a chain of four. Attach a paper clip to the end of the rubber band chain and drop it down into the tube. Pull the paper clip through the other end of the cardboard tube and clip it to the end of the cardboard tube. The elastic band chain should be inside the tube, attached to the axle at one end and paper clipped to the tube at the other end.

Now for the wheels – this is the part where the children can experiment to find what kind of wheels will make the car go the furthest. They can try changing:

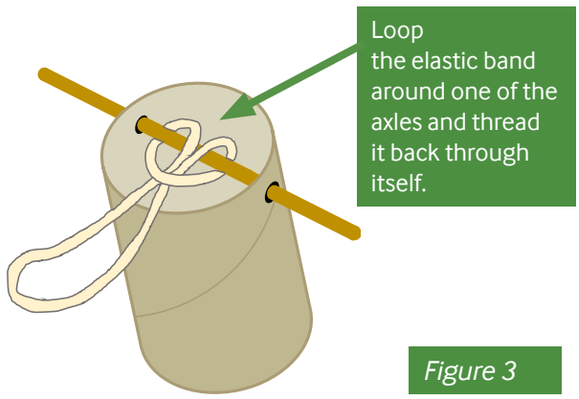


Figure 3

- *the objects/material used for the wheels*
- *the size of the wheels*
- *the position of the wheels on the axle*

When the first set of wheels to test in place, wind up the car by holding the tube and turning the axle where the elastic bands are attached until the elastic is wound multiple times around the axle. Still holding it taut, put the car on the ground and then let go.

The children will need to find a way of making sure that the wheels are securely attached to the axle so the whole thing moves properly. Small amounts of plasticine or bluetack will help with this. For wheels with large holes in the centre (such as CDs) pieces of styrofoam can be cut to fill the hole and hold the axle effectively. Once the children have decided what makes the best wheel they could then glue them securely in place.

Tell the children about the whole school competition and that, as a class, they are going to produce **one car**, that **goes as far as possible**. This will then be their **class entry** to the competition.

RULES FOR THE WHOLE SCHOOL COMPETITION

- *all cars have to be made from the same size and type of cardboard tube with the same kind of axles*
- *all elastic bands used must be the same with four per car*
- *only the wheels can be changed – they can be any size and made of any material and placed at any point on the axle*
- *extra materials to help hold the wheels in place are permitted*

Here's how you could structure a whole school science challenge day:

Morning

Quick assembly to introduce the competition

Children in their own classes, working individually or in pairs/ threes to make the best car they can, ready to race them against the other cars in their class.

After break

Each class holds their own races to decide on their competition entry – only one per class

Afternoon

Whole school to hall for the grand competition. This is best done as a knock out. Two classes at a time race their cars against each other in a best of three. The winner is the car that goes the furthest and this one goes through to the next round and so on.

Free resources

From PSTT's own collection

Let's Go! Science Trails

EXCLUSIVE FREE SAMPLE for Why & How readers

Let's Go! Feet

WHICH ANIMALS HAVE FEET AND WHY DO THEY NEED THEM?

ages 4 - 11

INTRODUCTION

Science Trails are designed to enthuse, inspire and support any teacher to deliver science in thought-provoking ways. The Trails have been developed and written by practising teachers, who have created an invaluable CPD resource with a huge range of materials and ideas to promote outdoor learning throughout the primary school.

This sample trail aims to help children develop close observation skills and to consider why animals have particular features. It focuses on a range of animals' feet and children are encouraged to identify similarities and differences between them. It challenges children to notice the wide variety of functions that feet can have, and to think about how its feet enable an animal to survive in its particular habitat.

THEMES & CONCEPTS EXPLORED

- The similarities and differences between animals
- How animals are adapted to their environments
- Animals need feet for a range of purposes (moving, balancing, catching food, defending themselves, regulating temperature, grooming, reproducing)

LOCATION

- Zoo or safari park
- Farm
- Pet shop

SCIENTIFIC SKILLS

- Observation
- Questioning
- Classifying and identifying
- Linking evidence to explanations

PREPARATION

Ask the children to:

1. Draw what they think their own foot looks like.
2. Take off their shoes and socks and observe their own feet. Questions to encourage close observation: *How many toes do you have? How many joints are in each toe? Is this the same for all your toes? Why do we have toes? Are they all the same? Why do we have toenails? What if we didn't have toe nails? What if we didn't have toes? What if we didn't have feet?*
3. Look at some pictures of animal footprints and talk about how much they can find out about the animal from just its footprint. The pictures could be a set of footprints of the animals that they will see when they go on the trail, or it could be a more general collection of animal footprints.
4. Look at pictures of different habitats and ask the children to think about what kind of feet an animal would need if it lived there. Ask them to choose one habitat and think about exactly where in it the animal might live (e.g. for a woodland: underground, at ground level, in the trees, on other animals) and what difference this would make to the kind of feet it would need. Again, the habitats chosen could be the same as the habitats they will see on the trail, or a more general group of habitats.

WHAT TO DO

1. Once at the site, choose one animal and ask all the children in the group to record how many feet it has and to draw one of the feet.
2. Ask the children to observe the animal for five minutes and record what it does with its feet during this time.
3. Repeat the above with a range of different animals that the children select themselves. Direct the children towards particular animals or areas in the location to help them see a good variety. Encourage them to choose a range of animals and to include different sizes and species (e.g. invertebrates as well as vertebrates, birds as well as mammals). Also encourage them to include animals with different numbers of feet (including no feet at all) and to look at different habitats.
4. Once the children have recorded their observations, ask them to consider how one of the animals they looked at would survive if:
   - It was moved to another habitat
   - It didn't have any feet
   - It swapped feet with another animal

Ask the children to think about, discuss and agree in their group which animal most relies on its feet for survival and why.

RESOURCES

Each group needs:

Identification sheets (photos of feet to spot on the trail and footprint pictures)

A chart to record features of different animals' feet

KEY QUESTIONS

- What does this animal use its feet for?
- What would happen if the animal lost a foot? All its feet?
- Do its feet have joints? Fur? Claws? Pads? Why do its feet have these features?
- Do bigger animals have bigger feet than smaller animals? Do bigger animals have more feet than smaller animals?
- Can you work out from looking carefully at an animal's feet where it might live?

BACK IN THE CLASSROOM

- Group and classify the feet they have seen on the trail (e.g. number of feet, number of toes, claws or no claws, fur or no fur). Encourage the children to decide on the groups themselves.
- Group and classify the animals they have seen on the trail. What do they notice about the groups they chose for whole animals and the groups they chose for feet?
- Make classification keys for the above.
- Have another look at their own feet and compare with other primates' feet they have seen. Talk about hands – how are these different to feet? In humans? In other primates? (Use pictures if other primates were not seen on the trail).
- Design a foot! Give the children criteria for an animal (e.g. its size, its preferred habitat, the food it eats) and ask them to draw and label what its ideal foot might be like.
- Discuss why humans wear shoes. When did humans first start wearing shoes? What different materials are used to make shoes?

I bet you didn't know...

How to grow a new skin

Dr. Alison Trew, South West PSTT Area Mentor, links **cutting edge research** with the **principles of primary science**

alison.trew@pstt.org.uk

"SCIENTISTS GROW REPLACEMENT SKIN FOR BOY!"

But how much skin did they need and how did they stick it on?

It wasn't until I began work as a research scientist, in the Department of Dermatology at the University of Newcastle, that I heard the skin described as an organ.
I always thought of organs as internal structures (heart, lungs, liver and so on), each having its own special function. Well, we all do indeed have an external organ – the skin, and it, too, has important functions (see Figure 1). **This is something we can ask primary school children: what do you think the skin is for? What would happen if your skin came off?**

Children will probably suggest that skin is necessary to keep everything inside and stop their insides falling out. This is true, but what else? With a little prompting to look closely at the similarities and differences between skin from different areas of their bodies (get out the magnifying glasses), between different humans, or between different animals (a few photos will stimulate a discussion), children can develop their scientific literacy and by learning to justify their ideas, recognise that there may not be a single correct answer.

What colours are skins? Does the colour ever change? Does colour matter? Why does skin sometimes feel wet? Where does this wetness come from? Do you have hair everywhere? What is it for? What makes it grow? Can you stop hair growing? Why does it change colour? If scientists knew how to make hair grow, would we see any bald people? There are certainly scientists working on this, but also claims that have little scientific support! A discussion like this helps children appreciate that science cannot always give all the answers.

So, skin is amazing and does more than you first thought, but sometimes it doesn't work properly. Very recently, a nine-year-old Syrian boy was in the news because scientists were able to grow a replacement skin for him (see Figure 2) [1,2]. The boy was suffering from a rare illness called junctional epidermolysis bullosa (JEB) which caused the loss of 80% of his skin, leaving him covered in untreatable, infected, life-threatening wounds. JEB is caused by a mutation in a gene (LAMB3) that produces a protein (laminin 332) which anchors the epidermis (the top layer of cells) to the deeper layers of skin cells beneath. Without this protein, the skin blisters and the surface layer can be lost. You could share a short film clip with your class which introduces the boy and explains what happened to him [3].

Every child has experienced losing a part of their skin, often through falling over in the playground. They will be able to talk about how this felt and imagine what it might be like to have a wound over almost all of their body. So, why did the boy's skin fall off? Let's start by thinking about why our skin doesn't skin peel off if there is a hole in it. It is because the skin is made up of layers of cells. Normally the layers are 'glued' together by special proteins. We can model this in the classroom: layers of coloured paper or card can be glued together and compared with layers that are not glued – the top layer will slide off. Children may come up with other models using Lego, bricks, plasticine, etc. The main point to emphasise is that the top layer of skin slides off easily if the anchor protein is missing.

How does our skin repair itself? Normally, the top layer of skin cells is constantly renewed by stem

cells contained in the deeper layers of skin. The turn-over of cells is about a month (see Figure 3).

Next, consider what the scientists have achieved. How did they grow the new skin in a laboratory? I know that this is difficult because I spent almost two years growing epidermal cells in culture flasks. It can take days, working in sterile conditions, to cover a 250 ml flask with cells, and then discover a fungal infection has rendered the flask useless! The team of Italian Scientists used a 4 cm^2 sample of boy's healthy skin (about the size of a postage stamp) and used a virus to insert the healthy LAMB3 gene into the stem cells' nuclei. This meant that the missing anchor protein could now be made. These genetically modified stem cells were grown into sheets of skin of 50 - 150 cm^2. In two surgeries, another team covered the boy's arms, legs, back, and some of his chest in the new skin. Two years later, the boy has no blisters and is living a normal life.

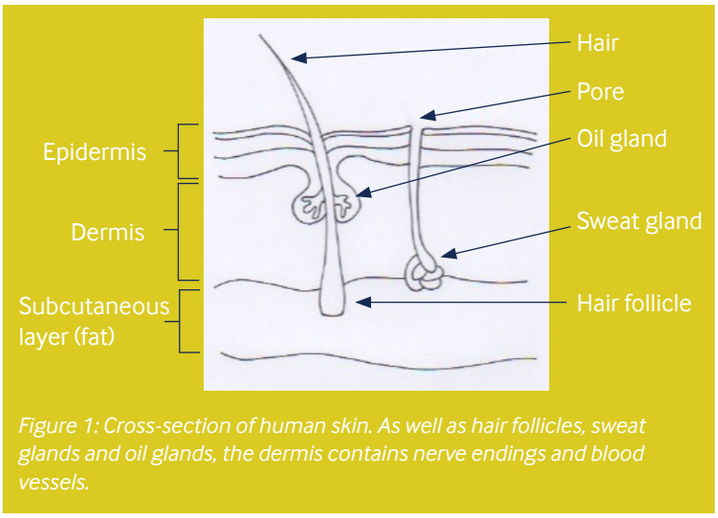


Figure 1: Cross-section of human skin. As well as hair follicles, sweat glands and oil glands, the dermis contains nerve endings and blood vessels.

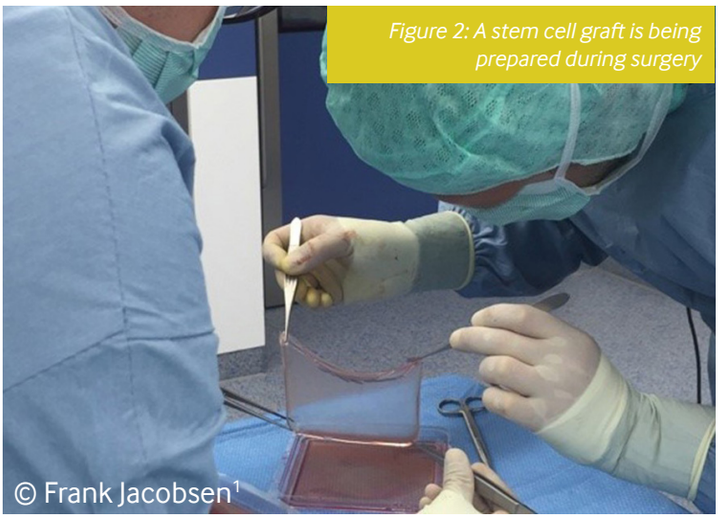


Figure 2: A stem cell graft is being prepared during surgery

To give children an appreciation of the size of cells, it would be worth looking at some cells[2] down a microscope (borrowed from a local secondary school or the Royal Microscopical Society has a lending scheme if you don't have your own). Then consider what size of skin is needed. Younger children could explore this by simply wrapping large pieces of sugar paper or fabric around their trunk and limbs and laying it out on the floor to see what their surface area looks like. Older children could measure the circumference and length of each limb and central body to calculate an approximation to the actual surface area of their body.

Whilst genetically modified epidermal cells have been successfully transplanted onto a patient's legs before, this is the first regeneration of an entire human skin from transgenic stem cells. It is possible, that in the future, other genetic skin diseases may be treated by targeting stem cells.

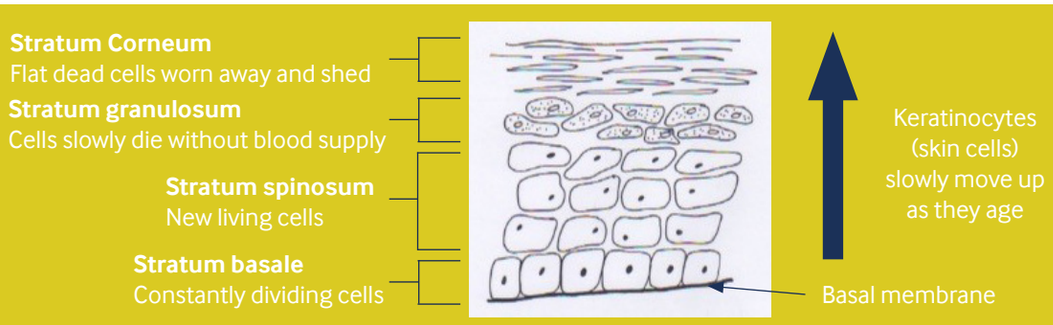


Figure 3: Cross-section of human epidermis. Stem cells in the basal layer (stratum basale) are responsible for the constant regeneration of the different layers of the epidermis.

References

[1]. T. Hirsch, et al. Nature 551, 327–332 http://dx.doi.org/10.1038/nature24487

[2]. https://www.newscientist.com/article/mg23631514-400-boy-with-a-genetic-disease-has-had-almost-all-his-skin-replaced/

[3]. https://www.youtube.com/watch?v=ZIjWJcz86PI

[1] Use of this image only permitted in connection with reporting of this activity. http://news.rub.de/english/press-releases/2017-11-08-worldwide-unique-boy-given-new-skin-thanks-gene-therapy

[2] CLEAPSS have a recommended procedure for looking at cheek cells http://science.cleapss.org.uk/Resource/PP033-Staining-and-observing-cheek-epithelial-cells.pdf

However, this is not permitted in Northern Ireland.

In conversation with...

Dr. Sophie Franklin, PSTT Cluster Director, talks with College Fellow **Nina Spilsbury** about the importance of putting children first and supporting teachers in the primary science classroom.

- *Retired in 2014 from Malcolm Sargent Primary School in the Georgian town of Stamford, Lincolnshire*
- *Science Subject Leader and Member of SLT*
- *40 years teaching*
- *Primary Science Teacher Award 2011*
- *Area Mentor for the PSTT*

Nina has taught in a wide variety of schools in the East and West Midlands, from Nursery to Secondary, including a young offender's school. Nina's early career focused on literacy and multicultural education; she was part of a very successful reading support team called O.W.L. Our Way of Learning, who were responsible for training teachers and TAs to deliver a Reading Recovery Programme. She was also a Literacy Consultant for several years working for Lincolnshire LEA. Nina has contributed to a book by Belle Wallace on Thinking Skills using TASC (Thinking Actively in a Social Context), and a paper on boy's underachievement in literacy in which she explored a variety of possible approaches to tackle this in the primary classroom.

With a career spanning 40 years, we weren't short on topics to discuss.

What are your favourite topics to teach in science?

I have so many favourites but definitely it is the outdoor learning I love best. Visits to the beach to map the habitats, identify shells and watch the tube worms; running down the dunes to fly kites and build sand castles to remain standing against the incoming tide; or visiting the local woods to find fairy drinking cups and fairy writing on logs. My main subject at teacher training college was Biology. I loved finding out how things worked and in particular finding out about plants and animals. I think that love grew when I was a child in London and whenever I could I would visit the Natural History Museum.

You've had a very varied and interesting career. Does experience help with teaching science?

Well it makes it quicker to do, you've seen things done many times. I think teachers are great squirrels, we see good ideas, tuck them away, tweak it and make it work for us. It doesn't always work, but when things don't work, you know why and you can change it next time. Experience has taught me how important it is to remember children are individuals, you have got to know that child and do your best for that child, and that's hard when you have thirty children in a class.

You must have seen a large shift in the classroom environment over this time. What do you think has been the biggest change?

Too much of dialogue in classroom is command, with pace. Children are not able to ask as many questions as they should be able to. When I started teaching I had 44 year 5/6 children in a class and no TA! You have to engage with every child. I had lollipop sticks and every time I engaged with a child, I took the stick out of the pot. Nobody went home until their stick was out of the pot, because I believe every child deserved for me to talk to them as an individual at least once a day! Not all children learn every day, some children consolidate their learning, and some children need to opt-out for the day.

What is your favourite age group to teach?

Year 2 – I just think that's when children are like little sponges. I love teaching science in year 2 as they hadn't had much science at this point, so you can really go big with the WOW.

How have your strengths in literacy, numeracy and working with challenging children influenced your science teaching?

I did science (Biology) as a major when I did my teacher training, so I've always had an interest in science. With my husband being a metallurgist – this gave me the interest in Chemistry and Physics, but I didn't engage with science at all earlier in my career, it was all multicultural education. When I was at Malcolm Sargent, nobody would take on science and I got round to thinking that numeracy needed to be more relevant to children, so I said 'OK, I'll do science', and I knew where we needed to go with it.

I had all the skillsets for being a good teacher. For science, vocabulary has always been very important to me. If you understand a word and know that word, you can use that word. But what is wonderful about science is how it is all so relevant to children. Science is a great vehicle for teaching literacy and numeracy, but also children with special needs like dyslexia or poor writing skills can shine in science because they can solve problems. There is one approach for teaching children and that is making it engaging and relevant, whether its literacy, numeracy or geography. It's making the subject something they want to learn about. In primary education, that's the secret to good teaching, it's easy really! (laughs)

What are your drivers?

Children. A Head-teacher said to me once 'children always come first with you' and I said, "Yes!". I think every day, no matter how down you are, children will make you laugh, they will help you see things differently. There is no greater gift than to be able to teach children to be able to read, to be able to reason and to be able to challenge and question. You have a unique opportunity to change young minds and build the future I think. It allows you to see through children's eyes, you can see awe and wonder with them. Helping parents out and building long-term relationships with them is great as well.

What is not in the science curriculum that you would like to see?

I've never felt limited by the curriculum. You twist and turn it to suit the children who are in front of you at the time. I've always had the approach that if the children wanted to learn about it, then we would look at it. The driver has always been the children and what they found interesting.

Your role as an Area Mentor sees you supporting teachers at many different stages of their careers. How do you approach supporting them?

The most common issues I get asked for help on are assessment, action planning, questioning and developing working scientifically. I think the best thing is to do to support teachers is a Learning Walk; the new ASE Primary Science Survival Guide takes you through how to do this. In the guide there is a list of things you need to look at. Sometimes what SSLs think is happening in the school, actually isn't and a Learning Walk can help to highlight that.

Another good tool is the PSQM learning map. I help teachers find three things they can work on, and we talk about those, and prioritise, looking at what is feasible to do. Everyone needs to experience success as a science leader and know they can achieve.

Where do you find your ideas?

Everywhere: the internet, the PSTT, other teachers and children. Wellcome's Explorify is marvellous. Every teacher I've spoken to, no matter how they feel towards science, has really enjoyed Explorify. STEM Learning also has a huge number of ideas! There are so many recycled ideas out there, teachers just need to know where to find them, such as the TASC wheel which I've been working with for many years. It's such a fundamental resource - We tell our children 100 times a day to stop and think about things, but have we ever taught them how to think? That's where TASC can help support.

Who are your influences?

I have several people and places that have influenced my career.

Alison Wright was my head teacher at South Witham who really inspired me to develop children's love of science and outdoor learning

Belle Wallace showed me how to use her TASC wheel to develop children's thinking skills. Her training was a light bulb moment for me and its impact in the classroom was amazing.

Finally the STEM centre in York and their marvellous Primary Science Leader course run by Tanya Shields where I met so many Fellows who were on the same journey as me.

> *"Everyone needs to experience success as a science leader and know they can achieve."*

What exciting projects are you currently working on?

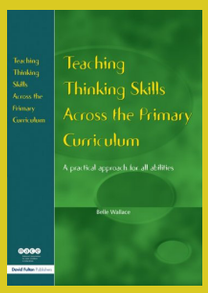
As mentioned previously, I am supporting science leaders to develop their skills in schools across the East Midlands. I'm also encouraging schools to apply to the Edina Trust for a science grant, which can be used to promote the teaching of science and gardening. Science in My Pocket is a resource I have developed with the PSTT to empower and support TAs working on a one-to-one basis with children with emotional and behavioural difficulties. I'm looking forward to sharing that with more teachers across the UK.

Finally, what did winning the Primary Science Teacher Award mean to you?

It was like a magic gift; it meant so much to me. I can remember getting the phone call. I'd never won anything in my life. To be recognised for a careers worth of work, it felt like it was the sum of everything I've done in my career, and somebody had finally recognised it. I've kept a diary of the award in a scrap book, it meant the world to me, and my father and my family. They still talk about it now! It's such a wonderful thing to be recognised when you've put all that effort in.

Being part of the College has allowed me to meet so many wonderful people who can share their knowledge too – I am like my year 2 children, I'm still a sponge! Every day is a school day.

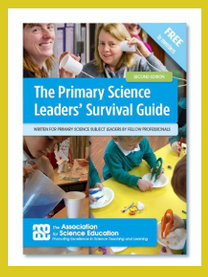
Nina's suggested resources (click on resource/image for more information):



Teaching Thinking Skills Across the Primary Curriculum: A Practical Approach for All Abilities

by Belle Wallace (editor)

ISBN-13: 978-1853467660



The Primary Science Leaders' Survival Guide

Written for primary science subject leaders by fellow professionals

Free to ASE members

Good Science in Primary School Learning, Teaching, Leadership

University of Hertfordshire

Free to download for all

https://explorify.wellcome.ac.uk/

https://www.stem.org.uk/

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

nina.spilsbury@pstt.org.uk

Research Update

Sarah Frodsham shares a summary of her PhD thesis

'Developing creativity within primary science teaching. What does it look like and how can classroom interactions augment the process?'

Why was this research important?

The timely nature of this project resonated with two recent reports by the Confederation of British Industry ('Tomorrow's World' and 'Inspiring Growth'). These reports describe creativity as an essential component in fostering skills that contribute to the nation's economic future success and prosperity. The Organisation for Economic and Co-Operative Development also emphasised how it is crucial to develop creativity in the classroom so that young people (as future citizens) will be able to resolve global issues through their collective innovation(s). However, characterising creativity is challenging and there is no common agreed definition of this elusive entity. Thus, during my research I examined current views and practices in primary school science in an attempt to capture what creativity is and how it can be nurtured. Additionally, I also critically examined and synthesised the various ways that teachers support the development of their pupils' originality, inventiveness and imaginative thinking.

Who did it involve?

My research study involved over a hundred teachers. These included PSTT College fellows and those involved in the Primary Science Quality Mark (PSQM) scheme. Their views and practices relating to creativity in the primary science classroom were collated and analysed through a survey and via interviews. Interestingly, a surprisingly wide range of innovative approaches to teaching science became evident. Subsequently, a more focused in-depth approach (including classroom observations) examined the pragmatics of these practices.

What did I do that was original?

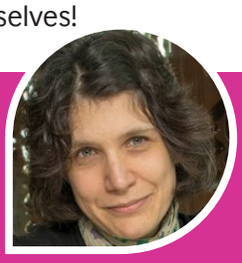
The results of this research project were visually illustrated in new and novel ways. These graphical representations displayed how teachers engaged in and mediated the children's learning about science and promoted opportunities to nurture creativity. In addition to the visual displays of teacher practices, I also paid attention to the verbal exchanges to try and capture 'creativity-in-learning'. Furthermore, I also considered how assessment for learning could be seamlessly embedded into the flow of a science lesson designed to develop children's creativity.

What did I find out?

The findings from this study suggested how aspects of practice such as the nature of dialogic exchanges, the nature of the task, and the nature of the formative assessment employed by different teachers could encourage creative thought, action or pragmatic outcomes. For example, critical and constructive mutual negotiations of ideas can demonstrate, and possibly unlock, the creativity of young learners.

What am I doing now?

I am now working with Prof Deb McGregor at Oxford Brookes University on another PSTT project. In my current role as a Post-doctoral Research Assistant, I, Deb McGregor and Polly Bell (a new research student) are examining what creativity looks like at different moments and in different places in science education. To this end we are endeavouring to capture the experiences of being creative in science through the perspectives of teachers, children and professional scientists. The hope is that our findings will inform (and perhaps even suggest ways to improve and augment) science practice that will 'fire-up' young people's imaginations, not only to be more scientifically literate citizens, but also to become so passionate about science, that they want to become a scientist themselves!



Interested in finding out more? Please contact Sarah by email:

sfrodsham@brookes.ac.uk

Sarah Frodsham's PhD was jointly funded by the Primary Science Teaching Trust and Oxford Brookes University.

Research Update

The Journal of Emergent Science: Outdoor Learning

Click here to find out more about our Let's Go! books

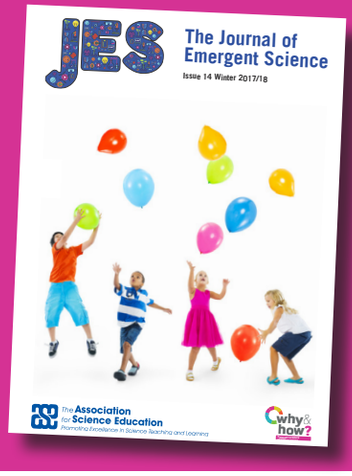
Go to **page 14** for 'Let's Go! Feet' - a free sample of one of our Science Trails.

Using outdoor Science Trails to develop understanding of the physical sciences in early years and Key Stage 1

Outdoor science trails can be used to explore a wide range of topics in science at primary school, but are often viewed as being more relevant to environmental and biological topics than the physical sciences. Research by Morgan et al (2017) shows how taking the children outside can also prompt them to think about electricity, energy, sound and light. The series of trails provided young learners with a range of experience which underpinned the development of their understanding of electrical circuits, sound and light. The research noted that successful outcomes depend on the effective use of discussion before, during and after the trails. After using the trails, teachers reported increased confidence with assessing the children's understanding as well as with making the best use of the outdoor environment.

Download the full paper here: Morgan, J., Franklin, S. and Shallcross, D. (2017) Let's go and investigate physics outdoors at Foundation and Key Stage 1 level (4-7 year olds) Journal of Emergent Science, Issue 13, p31-36

Another approach to outdoor learning is described by Wenzel and Scheersol (2017) in their paper 'Exploring a wildlife park with the 'Discovery Cart – Materials to promote interest among primary school classes' (JES issue 14, p16-27). Their study showed how teachers could plan and design resources to enable children to be more self-directed with their learning outside the classroom



The latest issue of The Journal of Emergent Science (Issue 14 Winter 2017/18) is now available. It can be downloaded for free at www.ase.org.uk/journals/journal-of-emergent-science

Project Update

Looking for Learning

This project explored the potential of video-stimulated reflective dialogue (VSRD) to improve peer feedback in scientific enquiry. During a whole class investigation in science, each group of children was filmed. Afterwards, each group was able to watch the film and to observe how they and other groups had approached the task and what the outcomes were. In a second viewing, the children were invited to call, "Stop!" when they had a comment to share and this provided a catalyst for dialogue between the children, either as a whole class or in groups. This approach is called child-initiated video freeze-framing (CIVFF).

Looking for Learning outcomes - using CIVFF:

- enables direct and effective peer assessment where the children are offering feedback on the basis of evidence that is available and visible to all involved
- supports children to identify other children's misconceptions
- provides unexpected starting points and ideas for potential investigations.
- supports gradual development of understanding and articulation of ideas

Things to note

- Filming can be done on an iPad or smartphone, a Flip or other video camera.
- Working in this way takes time to be genuinely effective. The children need practice in choosing appropriate times to stop the film and in how to articulate the feedback.
- Trust and good relationships between the children and also with their teacher are essential

Example from the project: year 2 children investigating the best material to make a tent for Teddy.

The activity took place outside in the school's woodland area. The children were filmed using an air-zooka or a tarpaulin to create gusts of wind, spraying water and then pouring water onto different fabrics hanging over a tent frame under which Teddy was lying inside a paper sleeping bag. Before going outdoors, children had designed and conducted tests of their own design on a range of fabrics. They had also had to make sure that the fabrics they selected could fit inside Teddy's rucksack. Immediately after the activity, the children were able to say which they thought was the best material. They could link this to evidence about how wet Teddy's sleeping bag was and also to properties of the material. However, they did not offer any analysis about or identification of errors in their chosen methods. When they watched the video with other groups, another child spotted that the fabric that had let most water in had in fact collapsed rather than allowed the water through it. The discussion that followed was instrumental in the improvement of the children's understanding of working scientifically.

If you would like to find out more about 'Looking for Learning' please contact Robin James on

robin@exeterroad.devon.sch.uk

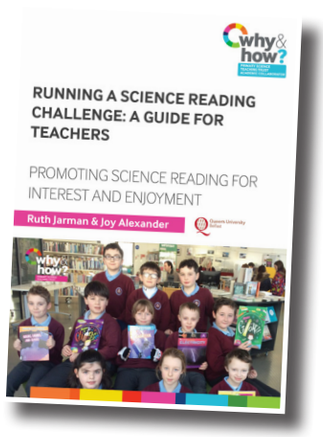
Project Update

Project 500 & SEERIH

Project 500

The focus of Project 500 was to explore ways of encouraging children to read science books for their own interest and enjoyment. Led by colleagues at Queen's University, Belfast and funded by PSTT, the project studied the habits and preferences of children in relation to reading science texts. The initial survey found that only about 16% of children regularly read science books on a free-choice basis. The children who did not choose to read science books tended to view them as boring or difficult, and to say that only children that they perceived as 'clever' or 'smart' would read them.

Project 500 worked with teachers to trial a range of strategies for motivating children to access the wealth of wonderful science books published for children. By the end they reported a marked change in the children's attitudes to and engagement with science books. The project directors, Ruth Jarman and Joy Alexander, have produced a very comprehensive guide to support other teachers with how to introduce children to reading science books for pleasure.



The guide, which can be downloaded here, also includes ideas and instructions for how to run a science book reading challenge

SEERIH

After three years of exploration, experimentation and, of course, tinkering, the University of Manchester's Science and Engineering Education Research and Innovation Hub (SEERIH) is delighted to be able to share what they have learnt about doing great engineering in schools. Based on their seven principles of engineering education, SEERIH colleagues have written and trialled over 20 lesson plans for teachers to use, and have compiled a range of publications for wider reading.

Please click logo below to visit the tinkering for learning website.

tinkering FOR learning

SEERIH encourages you to try out the lessons and would love to hear your feedback. Please tweet about it #tinkeringforlearning @UoMSEERIH

You may also be interested to read SEERIH's ASE Special Issue Journal about Tinkering-for-Learning which can be accessed at:

https://seerih-innovations.org/tinkering4learning/justgoodstuff/

Key Dates

PSTT's international Primary Science Education Conference (PSEC)

6th - 8th June 2019

Edinburgh International Conference Centre (EICC)

Save the date and join us in Edinburgh for our international Primary Science Education Conference (PSEC)!

We are determined that there should be no barriers to every child receiving an outstanding education in primary science, and we are committed to our vision that teachers are the key to making this happen. Through crossing boundaries between the classroom and academia, between policy and practice, and between one nation and another, our conference in 2019 will empower educators to develop excellence in primary science.

Primary Science Teacher Award Deadline

13th July 2018

Click Here to Nominate

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.

Manchester University Great Science Share

19th June 2018

University of Manchester #GreatSciShare

Save the date so that you can be part of this nationwide campaign to raise the profile and engagement in science and engineering. Last year 10,000 young people were involved in sharing their science learning with new audiences. Be part of making this year even greater!

The Great Science Share for Schools is a national campaign developed by The University of Manchester SEERIH team. It places children at the centre of celebrating their science learning in a non-competitive and inclusive environment. The central event is taking place on 19th June 2018 and this year's aim is to involve even more schools across the UK. But if you only have half an hour, or prefer to do something on a different day, you can still join in and be part of it - the main thing is to be involved. Why not link with other local schools, and ask STEM Ambassadors and STEM businesses/ organisations to support you?

British Science Week

9th - 18th March 2018

@ScienceWeekUK #BSW18

The Big Bang

UK Young Scientists and Engineers Fair

14th - 17th March 2018

Birmingham NEC

INTERNATIONAL PSEC Primary Science Education Conference

Outstanding Professional Development for all Primary Science Educators

6 - 8 June 2019

Edinburgh International Conference Centre (EICC)

REGISTER INTEREST

APPLY TO EXHIBIT OR SPONSOR

THE PROGRAMME

PSEC will offer the very best professional development for teachers, school leaders, academics, and organisations involved in primary science.

Renowned physicist and science communicator JIM AL-KHALILI will be giving our opening keynote talk on 6th June 2019

Professor Al-Khalili has presented science inquiries on the tv and radio since 2004, and we are eagerly looking forward to hearing him speak at PSEC in 2019.

DELEGATE TICKETS

Tickets to PSEC 2019 are competitively priced in response to the tight budgets faced by many schools. Each pass is inclusive of lunch and refreshments.
*10% Discount for all teachers attending from the same school use code: SS10**

**Applicable to Teacher Rate tickets only.*

PSEC Delegate Tickets	1 Day	2 Days	3 Days
Standard excl. VAT.	£150	£250	£300
Teacher excl. VAT.*	£110	£190	£240
Trainee Teacher incl. VAT	£50	£90	£120

* NB PhD students are eligible for tickets at the Teacher Rate.

If you have any queries about PSEC or eligibility for discounts, please contact us on info@primaryscienceconference.org

The rich programme will provide a daily combination of session including:

- Keynote talks
- Practical workshops
- Interactive talks
- Reflective practice seminars
- Science shows

The main daily themes for the conference are outlined below. Conference sessions will also address:

Outdoor learning, emotional well-being, SEND, cross-curricular science, EAL, teachers as researchers, gender bias, science capital and transition.

DAY 1 - THURSDAY

Engagement and enjoyment, working scientifically, assessment

DAY 2 - FRIDAY

Neuroscience and how we learn, play and early years, creativity

DAY 3 - SATURDAY

Subject leadership, STEM, information technology

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"School leaders were genuinely surprised at the change in culture Trails brought to their settings."

A holistic way of looking at science in the world around us using the local environment

The Science Trails in this book are designed to **enthuse**, **inspire** and **support** every teacher to deliver science in thought-provoking ways. Let's Go! Science Trails is not just about taking science lessons outside, but **using the outdoor environment to discover and understand science concepts** in primary school.

The Trails have been **developed and written by practising teachers.** They have created an invaluable CPD resource with a huge range of materials and ideas to **promote outdoor learning** throughout your primary school.

The book includes:

- 29 Full Colour Trails
- Curriculum Grid
- Cross Curricular Links
- Full Scientific Glossary
- Biology, Chemistry & Physics topics

Let's Go! STEM Trails coming soon!

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