Why&How? Magazine

Spring 2024: **Issue 20**

You can't be what you can't see:

addressing inequities in science education

Brand new FREE resource linking science and art

Supporting excellent teaching and learning in primary science
Why & How? is the magazine of the Primary Science Teaching Trust

In this issue...

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

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Welcome

Welcome to this issue of the Primary Science Teaching Trust's termly magazine, Why and How? We are extremely proud to share the **news** that Explorify won the 'Primary Free Digital Content App or Open Educational Resource' Award at BETT 2024. The competition was strong and we couldn't be more delighted that the inspiration and dedication of the PSTT Explorify team has been recognised with this award.

You may have registered the title of this term's magazine: "You can't be what you can't see". The publication of the third ASPIRES report, a 14 year study of the factors shaping young people's STEM aspirations and trajectories, has brought into sharp focus the continuing pattern of social inequality in STEM education and careers, and the significant role identity plays in who chooses a STEM pathway. The report's findings are stark and the need for the sector to be responsive to these is clear. In the **Wider Collaborations** section of this issue, the ASPIRES team at UCL share a summary of the report, ending with suggestions about how to begin to address the issues raised in the primary science classroom. To support practitioners, we are delighted to be offering an **Equity Compass professional learning webinar** and a **Primary Science Capital Teaching Approach introductory course**. We follow the ASPIRES article with a closer look at representation in STEM careers, highlighting how the additions of new videos to PSTT's resource **A Scientist Just Like Me** can improve visibility of different groups with the aim of supporting children to see themselves in some of the scientists who are profiled.

In other news, we share further details of PSTT's new strategy, our theory of change, and our definition of what we believe to be excellence in primary science. We also congratulate four of our College Fellows who have recently been awarded national accolades.

This issue contains our regular features, including resources where we are delighted to launch PSTT's newest free resource **Sketchbook Science**: an exciting collection of projects that offers creative and rigorous learning experiences in both science and art. Our **Picture for Talk** stimulates children to draw on and connect their learning across all science topics to identify possible advantages and disadvantages of a 'living wall'.

Our **Climate Science** section features the National Education Nature Park, outlining how schools can get involved in this national initiative to increase children's connection with nature by turning their own school grounds into a nature park.

Don't miss the **Explorify** page where you will see details of an exciting competition which challenges children to show their science learning through creating a piece of artwork. Winning entries will have their masterpieces made into a Start with Art activity that will be published on the Explorify website, reaching over 120,000 users!

Readers will also see that the I Bet You Didn't Know section has been re-named **Did you Know?** The previous articles have been rewritten to be suitable texts for older primary children to read, and the accompanying teacher guides offer suggestions for questions and practical investigations to enable the children to replicate the work of cutting-edge scientists.

Please do keep sharing Why & How? with anyone who would like to receive free resources, classroom guidance, and updates from PSTT and other organisations who support primary science.

Primary Science Teaching Trust

News

Explorify Wins at BETT Awards 2024

Explorify, known in the sector for stimulating science curiosity in early years and primary, has won the 'Primary Free Digital Content App or Open Educational Resource' Award at the **BETT Awards 2024**.

The BETT Awards recognise creativity and innovation found throughout technology for education each year. Explorify's winning category recognises exemplary free digital and online resources which ensure that teachers working in the early years and primary sector have access to quality educational materials. Explorify had strong competition as the resource was shortlisted alongside many other notable organisations.

Explorify's website is packed full of content designed to get children talking and thinking about science. It is dedicated to making sure teachers feel supported and confident with their science subject knowledge by offering over 800 free curriculum focused activities, planning support videos, an engaging podcasts collection, ideas for taking science lessons further and much more.

The team behind ensuring Explorify is making an impact throughout UK science lessons, comprises the Primary Science Teaching Trust (PSTT) and STEM Learning, supported by a grant from the **Wellcome Trust** who are the original creators of the resource.

Alison Eley, PSTT's Director of National Programme, said that "the Explorify team have put so much into developing new content that's really relevant for teachers." Elizabeth Hooper, STEM Learning's Resources and STEM Centre Lead, said, "Explorify stands on the shoulders of giants – the biggest giants are the classroom teachers who are delivering every day."

Explorify has over 120,000 active users and is engaged with more than 15,000 UK primary schools. The website is always developing and growing based on the needs of teachers. Share award-winning resources with your school and **sign up to Explorify** today.

PSTT's new strategy

Over the last 25 years PSTT has supported primary science education across the UK. Through building a network of outstanding primary science teachers, working closely with schools and science subject leaders, investing in relevant research, and developing new resources and programmes, we have worked towards our vision of seeing excellent teaching of science in every primary classroom.

This year we introduced a new strategy to refine our approaches and better measure our effectiveness, as well as to ensure we remain financially sustainable.

Find out more:

- Visit the '**Vision and Strategy**' page on our website.
- Read our **definition of excellence** in primary science.
- Take a look at our '**Theory of Change**' one page summary, or **interactive slideshow** to understand how we are working towards our vision.

Why & How? reader questionnaire

Thank you to all our readers who took the time to respond to our questionnaire. PSTT gained valuable insights into how you currently use the magazine and what you would like to see in future issues.

56% of readers highlighted their priority as supporting teachers to continue developing substantive and disciplinary knowledge.

43% of readers are seeking content on how to teach sustainability and climate action in primary schools.

Equity, diversity and inclusion are high on readers' priorities with 62% of readers highlighting at least one of these themes in their responses.

PSTT will continue to seek feedback from readers to ensure Why & How? meets the needs of science educators.

Congratulations to our prize winners! Rachel Dixon and Rachel Bennett both won £50 vouchers for Ethical Superstore.

The Education Endowment Foundation new guidance report – Improving Primary Science

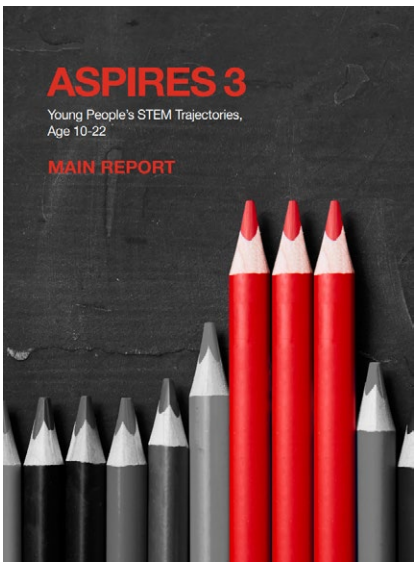
The Education Endowment Foundation (EEF) has published a new guidance report, Improving Primary Science. The report, which provides six actionable recommendations about how to make meaningful improvements to primary science teaching, is underpinned by a systematic review of international evidence around effective primary science teaching practice. The recommendations are designed to support teachers and school leaders to make improvements to their existing science provision, including how to develop pupils' scientific vocabulary, and relate new learning to relevant, real-world contexts.

High-quality primary science teaching builds pupils' curiosity and critical thinking, helping them to build a coherent understanding of the world around them. It's also crucial from a social mobility point of view, opening children's minds to the opportunities they could pursue in later life.

Each recommendation includes models, worked examples and suggested strategies to illustrate what the evidence could look like in practice in the primary classroom.

The report – which is **free to download** from the EEF's website – is accompanied by additional resources designed to support pupils' independence when working scientifically and prompt meaningful discussions around science professional development for staff.

Explore our **Theory & Practice** page to learn more about resources that make a real difference to children's learning.



ASPIRES 3 Summary Report Launched

In November the ASPIRES research team launched the summary report of their findings from the third phase of the ASPIRES study examining young people's STEM trajectories from age 10 – 22.

Read more about the findings in our ASPIRES 3 article.

We are delighted to share the recent achievements of some of our College Fellows

Teach Primary Awards 2023

PSTT would like to congratulate **Kathryn Horan**, Fellow and Area Mentor for the East Midlands, on winning the Teach Primary Award within the STEM category.

Wow! But why?, by Kathryn Horan, helps primary teachers build on the curiosity of their students to develop learning of primary science knowledge and skills. To learn more about Kathryn's approach to teaching and learning click **here**.

We extend our gratitude to the Teach Primary Awards for celebrating unique educational resources within STEM and all other categories. Discover all winning resources in the Teach Awards 2023 **here**.

2023 Excellence in Primary Education Prize

Congratulations to Fellow **Stuart Naismith** for winning the Royal Society of Chemistry's Excellence in Primary Education Prize. Stuart has been recognised for developing an entrepreneurial approach to STEM subjects, using a variety of media, to encourage students to engage with learning.

STEM with Mr N., a popular YouTube channel, focuses on engaging STEM projects that are ideal for teachers to use in their classrooms or for parents to use at home. View STEM with Mr N.'s channel **here** with over 300 videos.

Find out more about Stuart and the 2023 Educational Prize winners **here**.

ASE Book of the Year 2023 Winners

Congratulations to PSTT Fellows Jules Pottle and Rufus Cooper for winning the ASE Book of the Year 2023 primary category with Gary Vity. Gary Vity covers the topic of gravity through an emotive story. It's the story of Rosa whose mind is always busy. The mysterious Gary Vity is playing tricks on her and she wonders what she can do about it. With the help of her grandmother, she goes in search of Gary Vity and what she learns changes her life forever.

Jules and Rufus are both co-founders of **Artful Fox Creative**s. Between them they have written and illustrated numerous STEM themed picture books designed to inspire young minds.

Find out more about the award and Gary Vity **here**.

Science Council CPD award 2023

Congratulations to PSTT Fellow Bryony Turford for winning a Science Council award. The Science Council provides the quality assurance system for those working in science and their annual CPD Awards celebrate the professional development delivered by those registered with them, including Chartered Science Teachers (CSciTeach).

Bryony works extensively with teachers to support their professional development. She is a Senior Regional Hub Leader for the **Primary Science Quality Mark** (PSQM), and is also the co-founder and director of **My Science Club** which provides high quality science club resources and support for educators.

Climate Science

The National Education Nature Park

The National Education Nature Park (NENP) explain their new scheme which supports young people to increase the biodiversity on the site of their educational setting (nursery, school or college) by viewing it as a Nature Park.

Whilst the scheme focuses on England, the process and resources are available to all nations. The partnership, which is led by the Natural History Museum and includes the Royal Horticultural Society and the Royal Society, aims to put nature at the heart of education by empowering young people to make a positive difference.

The scheme gives children and young people the opportunity to transform their learning sites for nature and become part of a network of nurseries, schools and colleges that form the National Education Nature Park.

The scheme aims for young people to 'action implementable change at their setting' by engaging in a five-step process:

- Getting to know your space
- Identifying opportunities
- Making decisions
- Making change happen
- Recording change

Getting to know your space

The first step asks the question 'Where are we now?' and is about gathering data using observation skills. This might include gathering data on what can be found on your school site – from trees to wildflowers, from birds to mammals. By observing the land, nature and features of their setting from a scientific and geographical perspective, the children build up an understanding of the strengths and opportunities of their school site. All children are encouraged to participate and share their perceptions of the locality.

Identifying opportunities

Using the data from 'getting to know your space' children then ask 'Where do we want to be?'. Children are encouraged to think about what is right for their local environment, what flora, fauna and people need to thrive, and what they would like the site to be like for future generations.

Making decisions

This step asks 'How do we get there?'. The emphasis in this step is on making decisions together and working collaboratively to solve problems using plants and nature. During this step, children develop a project plan to increase biodiversity by deciding what they want to do, why they want to do it and how they will achieve it through the whole education setting working together.

Making change happen

At this stage children focus on action by implementing interventions or taking steps to increase biodiversity and turning ideas into a reality. These steps could include planting, growing, habitat creation, habitat improvement, fundraising or communication campaigns. Suggested funding opportunities are highlighted on the NENP website. They are presented in different categories such as biodiversity projects, outdoor learning equipment, tree or hedgerow funding, water body or pond funding.

Recording change

At the end of the project children record and evaluate data to establish whether a difference has been made, whether biodiversity has been positively impacted, and if people enjoy the site more. This is also an opportunity to reflect on what has been learnt to inspire others by sharing the story of developing their Nature Park.

Case studies of settings which have engaged in the five-step process are available on the NENP website and, as the Nature Park expands, so will the bank of case studies.

The scheme is built on the importance of engaging the younger generation so that they develop a meaningful connection with nature, and are equipped with the skills and confidence to improve biodiversity. A strength of the initative is that it gives young people agency to choose which interventions will be appropriate to increase biodiversity in their particular setting by drawing on science research and taking positive action to improve spaces for nature.

A suite of **free resources** is available to support schools, through the NENP website. This includes free apps for the children to use to collect biodiversity data. The resources are cross-curricular, supporting educators to embed nature focussed teaching and learning across the curriculum.

All English schools are eligible to register to join the National Education Naure Park, thereby adding themselves to a vast network of settings working to boost nature in education. They will then appear on a map which highlights all the schools who have committed to increasing the biodiversity on their school site. Schools outside England are still able and welcome to access the wealth of free resources.

Useful links:

- **The National Education Nature Park**
- **The Natural History Museum**
- **The Royal Horticultural Society**

Climate Science

Register your class for The Big Plastic Count 2024

From 11th to 17th March, thousands of schools, households, community groups and businesses across the UK will be coming together to count their plastic waste.

The count will reveal how much plastic the participating groups are throwing away. There will also be an investigation into what really happens to our plastic waste afterwards. Greenpeace will use the results to communicate with UK ministers about the reality of plastic waste and recycling in the UK, and to work towards eliminating plastic pollution.

Teachers who sign up will get a teaching resource pack with a number of features.

Resources to get started: a simple teacher's guide, a PowerPoint presentation for lessons or assemblies, classroom activities and template letters to staff and parents.

Resources to help your class count at home: a 'How-To' explainer video, Printable tally sheet to make counting really easy, and a **Plastic ID Tool** to help categorise plastic.

Plastic footprint action toolkit: you can generate your plastic footprint as individuals, a class and for the whole school. There is a downloadable certificate for taking part, a guide on how to become a Plastic Clever School, and a guide to hosting a results event.

By your class joining the count, you can empower them to make a real difference and help shape the future of the planet. You can sign your class up at **Greenpeace Big Plastic Count**.

Resources

Picture for Talk

Click to download image

Figure 1

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 enquiry. 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 children of any age. The activities can be done as a quick ten-minute starter, or extended into a longer and more in-depth lesson.

Click to download image

Fig. 2

Click to download

Fig. 3

What to do

Download the image in figure 1 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 can you see in the picture?

What kind of building do you think it is?

Why do you think this?

How many different plants can you see in the picture?

How do you think the plants got there?

After the children have shared their initial ideas about the picture, tell the children that the photograph is of a living wall on a library in Canada and encourage them to think about the advantages and disadvantages of living walls.

Further questions to generate and promote thinking and explaining:

- Why do you think it is called a living wall?
- Would you like to live in a building with a living wall? Why? Why not?
- What would be good about having a living wall?
- What might not be good about it?
- What sort of plants do you think would be best for a living wall? Why?
- What sort of plants would be less good for a living wall? Why?
- How would you look after the plants in a living wall?

Advantages of a living wall that the children might identify include:

- Cleaner air
- Reduction in greenhouse gases
- Better control of temperature inside the building/thermal insulation
- lower energy bills
- A habitat for small animals
- Improved biodiversity
- Captures rainwater/reduces puddles
- Sound insulation
- Nice to look at
- Improved overall well-being/ mental health

Disadvantages of a living wall that the children might identify include:

- Needs maintenance
- Overgrowth leading to blocking light
- Structural damage to the building caused by roots or excess water retention
- Leaves/seeds/fruit clogging drainage systems
- Damage caused by animals living in the plants
- Fire risk if plants die/dry out

You might like to show these additional views of the building (figs. 2 and 3)

Resources

Sketchbook Science

- What do artists and scientists have in common?
- What habits of mind do they share and what skills do they both use?

Artists and scientists have a great deal in common. Many great works of art and many scientific endeavours are the result of an intense curiosity about the world, careful observations, and creative approaches to testing and developing ideas. Sketchbook Science harnesses these common themes in a collection of exciting projects, where the rigour is maintained both in science and in art, giving the children opportunities to develop skills and understanding in each subject. Studying science and art in combined projects helps children to see the commonalities across the two subjects, and makes explicit how particular skills and learning habits can be developed and applied across both.

There are eight projects in Sketchbook Science, covering concepts across a range of science topics. Each offers opportunities to develop skills and techniques in art as well as skills in working scientifically. The projects are generally more appropriate for children aged 7 – 12 but they are flexible and can be adapted for different age groups.

Each Sketchbook Science project includes:

1

Concise and comprehensive information for the teacher about expected learning outcomes, resources needed, keywords, suggested artists to provide inspiration and where appropriate, health and safety reminders.

Learning outcomes

CONCEPTUAL UNDERSTANDING IN SCIENCE

The children will develop ideas about:

- The different stages of the life cycle of a flowering plant
- Different methods of seed dispersal and how these are related to the appearance of the seeds

ARTISTS AND THEIR WORK

The children will create their own work taking inspiration from the work of:

- Yayoi Kusama
- Henri Matisse

KEY WORDS SCIENCE

life cycle
reproduction
seed formation
seed dispersal
germination
pollination
flowering plant
fruit
ovary
flower
seed
circumference
height
width
mass
length
estimate

SCIENCE ENQUIRY

These activities provide opportunities for:

- Observing and measuring the similarities and differences between fruit using a variety of scientific equipment
- Deciding how to gather, record and present data in tables

TECHNIQUES IN ART

The children will develop and apply skills in:

- Drawing and pen work using repeated patterns
- Creating sculptures using clay
- Making adaptations and refinements in response to feedback

Resources

SCIENCE

- A range of different fruit - peppers, kiwi, oranges, tomatoes, squash, pumpkins, melon or cucumbers work well
- Tweezers
- A sharp knife and chopping board for an adult to cut the fruit in half
- Measuring tapes
- String
- Rulers
- Magnifying lenses
- Weighing scales

Note: be mindful of food waste and discuss with the children the best way of ensuring as little food is wasted as possible. Try to use fruit that are in season at the time of completing the investigation.

ART

- A selection of A4 and A3 paper in different colours (including black)
- A selection of A4 and A3 card in different colours (including black)
- Black fine liner pens
- White fine liner pens
- Crayons

For the sculptures:

- Acrylic paint in a variety of colours
- Black marker pens
- Air-drying clay
- Modelling tools (including cutting wire)
- Newspaper
- Acrylic pens

KEY WORDS ART

outlines
contour lines
clay
modelling tools
rolling
shaping
smoothing
joining
painting
colour blocks
varnishing
repetition
reflections
patterns
shape
polka dots
line
space

HEALTH & SAFETY NOTES

- Check for allergies.
- Ensure that the school policy regarding the use of knives is followed; consulting health and safety advice from CLEAPSS primaryscience.org.uk or SSERC: sserc.org.uk is recommended.
- Particular considerations include:
  – the consistency of the fruit being cut;
  – the children's experience with knives;
  – the children's maturity; and
  – the benefits of adult supervision.

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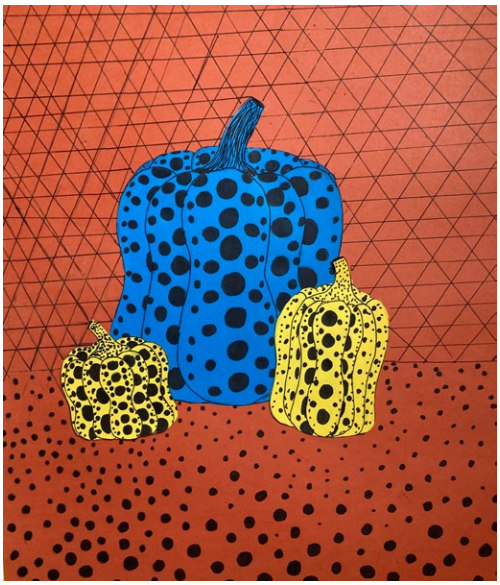
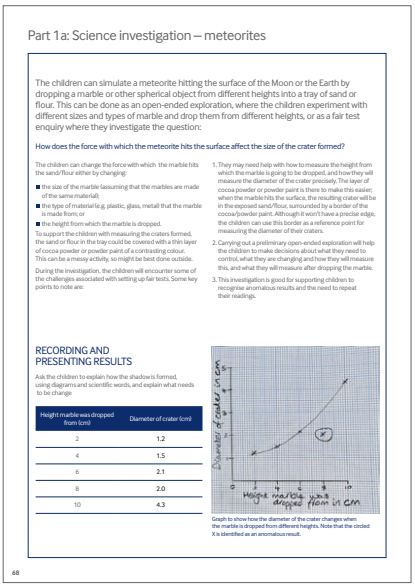


2

An initial science investigation to develop and practise new knowledge and skills. Suggestions are given for recording and presenting results.



Part 1a: Science investigation – meteorites

The children can simulate a meteorite hitting the surface of the Moon or the Earth by dropping a marble or other spherical object from different heights into a tray of sand or flour. This can be done as an open-ended exploration, where the children experiment with different sizes and types of marble and drop them from different heights, or as a fair test enquiry where they investigate the question:

How does the force with which the meteorite hits the surface affect the size of the crater formed?

The children can change the force with which the marble hits the sand/flour either by changing:

- the size of the marble (assuming that the marbles are made of the same material);
- the type of material (e.g. plastic, glass, metal) that the marble is made from; or
- the height from which the marble is dropped.

To support the children with measuring the craters formed, the sand or flour in the tray could be covered with a thin layer of cocoa powder or powder paint of a contrasting colour. This can be a messy activity, so might be best done outside.

During the investigation, the children will encounter some of the challenges associated with setting up fair tests. Some key points to note are:

1. They may need help with how to measure the height from which the marble is going to be dropped, and how they will measure the diameter of the crater precisely. The layer of cocoa powder or powder paint is there to make this easier; when the marble hits the surface, the resulting crater will be in the exposed sand/flour, surrounded by a border of the cocoa/powder paint. Although it won't have a precise edge, the children can use this border as a reference point for measuring the diameter of their craters.
2. Carrying out a preliminary open-ended exploration will help the children to make decisions about what they need to control, what they are changing and how they will measure this, and what they will measure after dropping the marble.
3. This investigation is good for supporting children to recognise anomalous results and the need to repeat their readings.

RECORDING AND PRESENTING RESULTS

Ask the children to explain how the shadow is formed, using diagrams and scientific words, and explain what needs to be change

Height marble was dropped from (cm)	Diameter of crater (cm)
2	1.2
4	1.5
6	2.1
8	2.0
10	4.3

Graph to show how the diameter of the crater changes when the marble is dropped from different heights. Note that the circled X is identified as an anomalous result.

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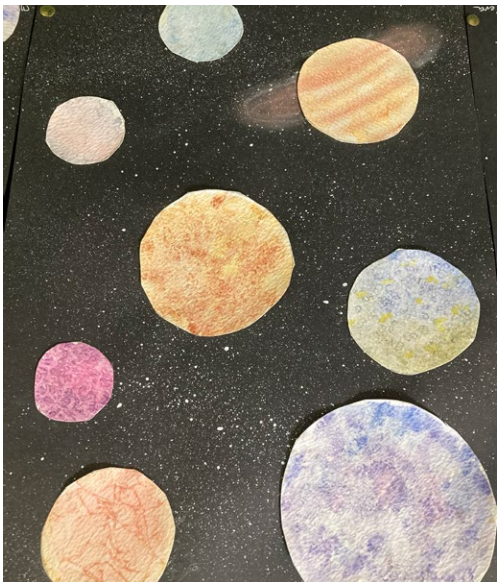

3

Development of art skills and techniques with step-by-step instructions.

Part 2: Techniques in art – capturing movement

Alberto Giacometti's famous sculptures are very simple, with the details stripped away. He believed that, by making the figures thin and without detail, he could show their innermost feelings. Children could look at photographs of some of his sculptures, and also some of Louise Bourgeois' later works, and decide whether they think that they are portraying confident, shy, quiet, or nervous personalities. Using their findings about the proportions of the human body, they should use pencil and paper to complete quick life drawing sketches.

KEY TECHNIQUES TO TRY:

- Look carefully at a friend, who could be standing still, in a pose or in a balance.
- Quickly sketch a series of 4 stick drawings of them in different poses.
- Remember to elongate the figure as Giacometti did, making the neck, legs and arms longer than they appear in real life.
- Try to capture movement by drawing the subject in different slanted or curved positions.

The children then need to analyse the different sketches to see how well a feeling of movement has been captured.

This is an ideal opportunity to carry out some activities to check that the children understand how bones and muscles are involved in movement. A simple model can be used to demonstrate the role of bones, muscles and tendons, and simulations can be used to check understanding (see Useful links for how to model the role of muscles and bones). The children can think about the poses that they have chosen and explain how their muscles helped their bones move into each balance position.

"Maman" (2002) by Louise Bourgeois.

"Walking Man II" (1960) by Alberto Giacometti.

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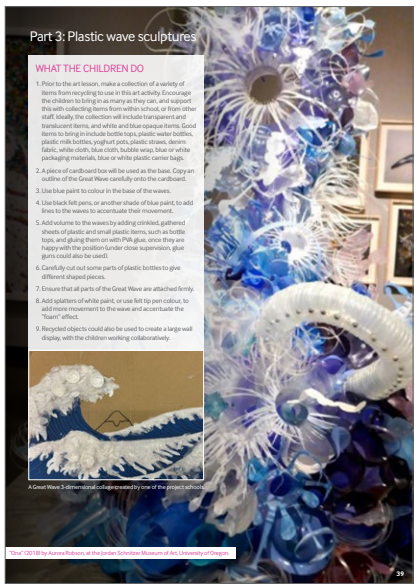
4

A final project piece where children combine their learning in both subjects.



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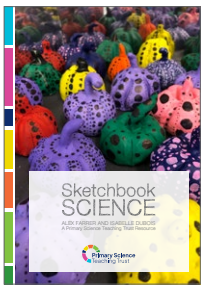
Supporting information, including an explanation of the background science for teachers, notes about the inspirational artists and their work, and useful links to other resources. Links to related Explorify activities and in particular the Start with Art Explorify activities are also included.



Find out more and download your FREE copy of Sketchbook Science today!

The Sketchbook Science projects align with all UK primary science curricula. For more information, please download the 'Curriculum coverage' document here.

To learn more about using Sketchbook Science in your setting, you are warmly invited to attend a professional learning webinar on 7th March 2024, from 4.00 – 4.45pm. Find out more and register for your free place **here**.

Explorify

Don't miss out on the Explorify art competition!

Explorify's Start With Art activities celebrate creativity and curiosity in children's science learning.

Ideal for use in the middle or at the end of a science topic, these activities encourage children to find connections between a work of art and what they've been learning about in science. Check out **this** helpful read to find out more about **Start With Art**.

The **Explorify Art Competition** invites children to create their own Start With Art artwork. They could draw or paint a picture, make a model or a sculpture, create a collage, design a print, take a photograph... whatever they choose. Here's a purposeful opportunity for them to put those skills into practice. Can they find a way to show their science learning through their art? Can they create something that will spark a science conversation among other children who look at their artwork?

The winning works of art will each be made into a new Start With Art activity that will be published on the Explorify site, ready to be used by more than 120,000 teachers with their classes of children in schools around the world. The winners will also receive a £50 book token.

- Further details of the competition are available **here**
- Download the competition flyer **here**

Help influence Explorify's next steps by telling us what you think!
By completing our 15 minute **survey**, your opinion will contribute to the ongoing evaluation into our reach and impact.

Professional Learning Opportunities

We are delighted to be offering a number of exciting professional learning webinars and online courses. Course outlines and details are given below. Capacity is limited so book early to be sure to secure your place!

Using the Equity Compass

The Equity Compass is a tool, developed by the Primary Science Capital Teaching Approach team, that can be used to help you think critically about social justice and equity. It can be used as a tool to point your school in the right direction and help you reflect, plan and track progress towards a more equitable approach. The compass highlights 8 key dimensions of equitable work and the questions help you evaluate your practices in relation to all the dimensions to ensure you are engaging with and supporting underserved communities.

Using the Equity Compass – course details		
Length of course	45 minute webinar	**Find out more about the Equity Compass** **Click here to reserve your place!**
Dates and times	Tuesday 27th February 4 – 4.45pm	
Delivery	Online	
Cost	Free of charge	
Course facilitators	Jo Moore and Ruth Shallcross	

Did you know? Introducing climate science research to children

Find out how children (aged 7-12) can learn about contemporary scientists' research through practical, curriculum-related classroom activities and investigations, and learn how this can impact children's learning and their attitudes to science. We will share examples of Did you know? articles which explain cutting-edge research in language that primary children can understand and suggest questions for children to consider. We will share Teacher Guides (slide shows) which can be used in the classroom to introduce the scientists' work and describe practical investigations that

children can do to mirror the scientists' research. All the resources are free to access from PSTT's website.

When you leave this session, you will be able to:

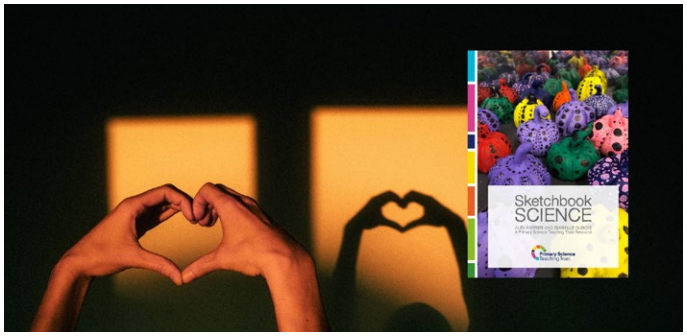
1. Share child-friendly articles about climate research with primary children
2. Explain cutting-edge research linked to primary science topics
3. Introduce related practical investigations that develop children's subject knowledge and skills

Did you know? – course details		
Length of course	45 minute webinar	**Find out more about Did you know?** **Click here to reserve your place!**
Dates and times	Thursday 29th February 4 – 4.45pm	
Delivery	Online	
Cost	Free of charge	
Course facilitators	Katharine Pemberton and Alison Trew	

Sketchbook Science

Join us for a professional learning webinar on PSTT's latest free resource Sketchbook Science. This resource contains eight projects which connect science and art, enhancing conceptual understanding and skills in both subjects.

During the webinar we will explore the resources, share how some of the 18 project schools were inspired by and further developed the projects, and consider ideas for whole school planning. Whilst some of the activities are more suited to older primary children, many of the project schools used the ideas with younger children, so teachers working with children of all ages will find ideas in the Sketchbook Science resources useful.



When you leave this session, you will:

- Understand a range of strategies to link science and art
- Have reflected on how the Sketchbook Science activities might be used in your own setting

Sketchbook Science – course details		
Length of course	45 minute webinar	**Find out more about Sketchbook Science** **Click here to reserve your place!**
Dates and times	Thursday 7th March 4 – 4.45pm	
Delivery	Online	
Cost	Free of charge	
Course facilitators	Alex Farrer	

Introduction to the Primary Science Capital Teaching Approach

This course will introduce you to the primary science capital teaching approach (PCTSA) which helps teachers reflect on and develop new ways to promote children's engagement and identification with science. The approach focuses on children who see science as something that is 'not for me', and their identities, experiences and what matters to them and their communities are put centre stage in science lessons.

The PSCTA is a reflective approach that builds on good primary science teaching and is based on the ideas of equity and social justice. The focus is on changing teacher practice rather than trying to change the child and this introductory course will help you tweak your practice to broaden what and who 'counts' as science.

Introduction to the PSCTA – course details		
Length of course	6 one-hour sessions	**Find out more about the Primary Science Capital Teaching Approach** **Click here to find out more and reserve your place!**
Dates and times	Tuesdays, 4-5pm on the following dates: 12th March 16th April 30th April 4th June 18th June 2nd July	
Delivery	Online	
Cost	£150*	
Course facilitators	Jo Moore, Katharine Pemberton and Ruth Shallcross	

*** Full price £200**
SPECIAL OFFER FOR SPRING 2024 – 25% discount!

Explorify Hosts...

Be sure to catch up on Explorify's podcast series where an Explorify Engagement Leader hosts a conversation about an aspect of primary science with a guest expert. You'll hear stories, tips and tricks and find out about the latest support opportunities and great resources.

Find all episodes here or through your favourite podcast provider.

Wider Collaborations

ASPIRES 3: Tracking young people's STEM trajectories from primary school and into the workforce

In November the ASPIRES research team published a new report, summarising findings from our now 14-year mixed methods study into young people's STEM aspirations and trajectories, led by Professor Louise Archer at UCL. A summary of the report is shared here by Emily MacLeod, Jen DeWitt and Louise Archer.

The project was where the concept of '**science capital**' first originated, and is a sister-project of the **Primary Science Capital Teaching Approach project.** It sits within the wider **STEM Participation and Social Justice Research team** at UCL.

To date, the ASPIRES team has collected survey data from over 47,000 young people and conducted over 760 interviews with young people and their parents; tracking young people between the ages of 10 and 22. Our aims are to study the educational and employment aspirations, choices, experiences and outcomes of young people in England, and generate new understandings about how young people's trajectories in (and out of) STEM are shaped by gender, race and ethnicity, and social class.

As the cohort of young people are now in their early twenties, part of our focus was on who studies STEM post-16. First, we conducted analyses of National Statistics and UK Higher Education Statistics Agency (HESA) data sets, and found that participation in STEM subjects at A Level is high, with mathematics consistently being the most commonly taken (by around 30% of students). This trend changes at undergraduate level, however, as engineering and computing are consistently the most popular type of STEM degrees in England (excluding medicine). At both A Level and degree level participation in STEM subjects is patterned by social inequalities. For example, we found that women comprised around 32% of STEM undergraduate students in England in 2021/22. And when it came to completion of STEM undergraduate degrees, we found that 6.5% of first-year STEM undergraduates from England aged 18 to 24 left their course with no award during, or at the end of, their first year; with racially minoritised students more likely to leave their courses than White students.

In terms of why young people do (or do not) pursue STEM, our longitudinal data revealed that liking their subject was the most common reason reported by young people studying for STEM degrees, followed by feeling competent and 'good at' the subject. In terms of those not pursuing STEM, our analyses found that a disinterest in STEM was the most commonly reported reason for not choosing a STEM degree, followed by feeling 'not good' at STEM subjects.

The survey included:

47 000
young people between the ages of 10 and 22

760
interviews with young people and their parents

The ASPIRES research comprises three consecutive stages, tracking a single cohort of young people (born between September 1998 and August 1999) and studying their educational and employment aspirations, choices, experiences and outcomes. It was a 14-year mixed methods investigation of the factors shaping young people's trajectories into, through and out of STEM education. It collected survey data from over 47,000 young people and conducted over 760 qualitative interviews with a longitudinal sample which tracked 50 young people (and their parents/carers) between the ages of 10 and 22.

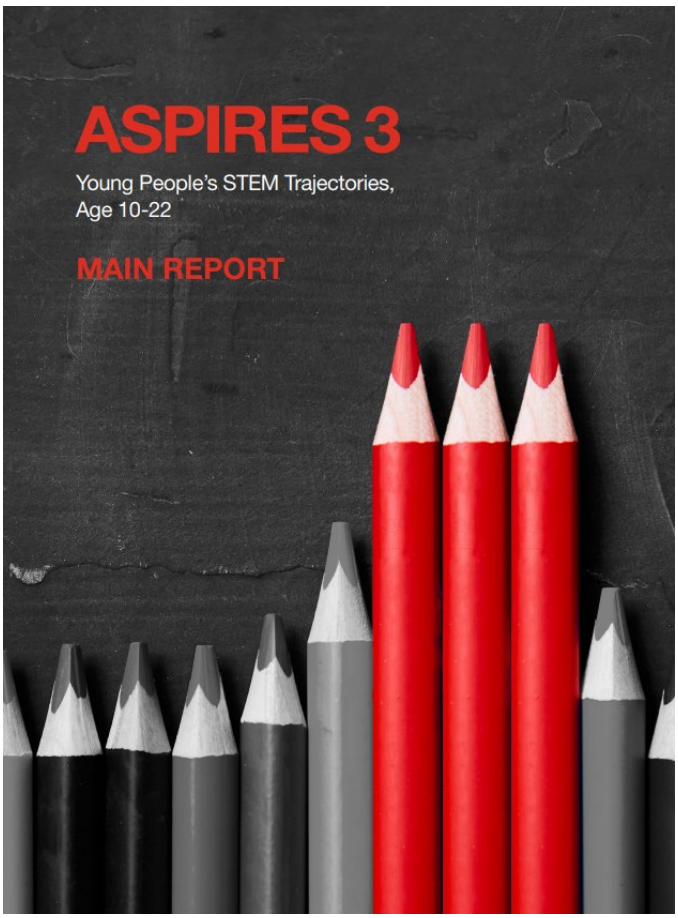
Inspired by the field of sociology, and in particular the work of sociologist Pierre Bourdieu, our findings also found that identity, capital and field all play a key role in young people's STEM trajectories. In this way, how a young person identifies (their identity), the social and cultural resources they have access to (their capital), and wider practices in STEM education (the field) all influence whether and how they pursue STEM, and maintain this trajectory. For example, with regard to identity, where a young person experienced alignment between their (gendered, classed, racialised) identity and a given STEM discipline, this strongly supported their STEM trajectory. Conversely, experiences of misalignment were associated with dropping or changing a given STEM trajectory, even when a young person was highly interested and capable of pursuing this route. In terms of field, we also found that restrictive entry requirements, assumptions about who STEM is 'for' and the costs of Higher Education participation can limit access to STEM qualification routes; particularly for those from less privileged social backgrounds.

Even for those who did pursue STEM degrees, we found that on average 6.5% of first-year STEM undergraduate students in England left their course in their first year. Non-completion rates varied between STEM subjects, however; with the lowest rate (4.2%) amongst physics students and the highest (9.4 %) amongst computing students. We also found that men STEM undergraduate students had a slightly higher rate of non-completion than women (6.3% vs 4.5%), and that White students were less likely to leave their degrees than racially minoritised students.

Despite these barriers, analyses of survey responses from STEM degree students showed that most were planning to enter full-time work or postgraduate study, and to stay within their subject area. This varied between subject areas, however; around two thirds (67%) of chemistry students to three quarters (75%) of maths students planned to get a full-time job after graduation. When asked whether or not they planned to stay in their disciplinary specialism after graduation, however, 82% of engineering students indicated that they planned to stay in the sector, compared with just 21% of chemistry students who planned to continue within a chemistry-related route after graduation.

So, how can primary educators support more, and more diverse, young people in their STEM trajectories?

Our research indicates that educators in primary settings might find pedagogical approaches and resources such as the **Equity Compass** and the **Primary Science Capital Teaching Approach** helpful for building understanding of the issues and scaffolding critical professional reflection towards action. In particular, they may use such approaches



to identify and implement ways to actively support and augment young people's STEM identities and capital, helping them to find meaningful connection with STEM and see the relevance of STEM learning to their current and future lives.

- **Download the ASPIRES 3 Summary Report: Young people STEM trajectories, age 10-22 here.**
- **To read updates from the wider STEM Participation and Social Justice Research team at UCL sign up to their newsletter here.**

- Join our Equity Compass professional learning webinar on 27th February from 4 to 4.45pm. Find out more and register for your place **here**.
- Sign up to our Introduction to the Primary Science Capital Teaching Approach 6 session course **here**.

Authors: **Emily MacLeod**, **Jen DeWitt** & **Louise Archer**

Wider Collaborations

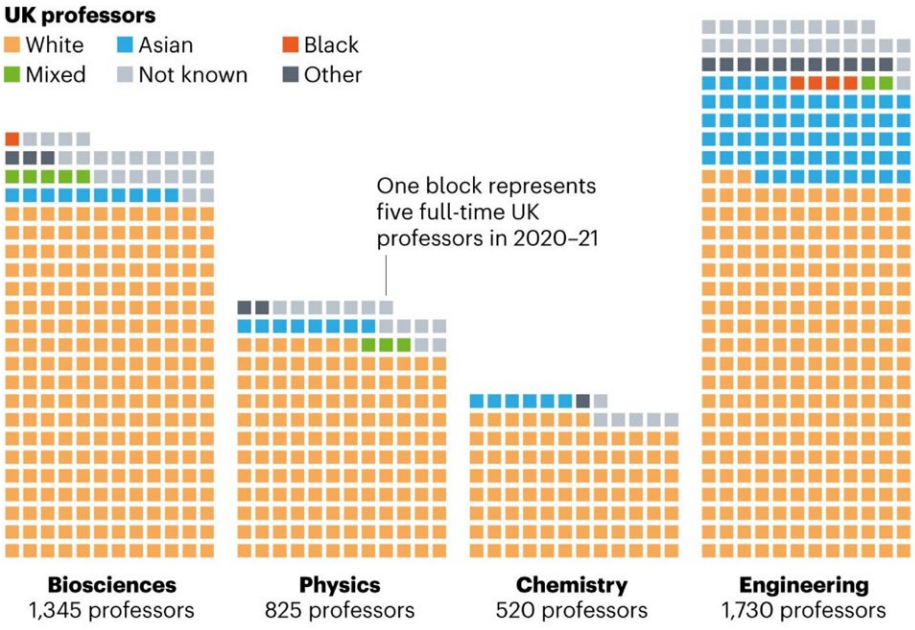
"You can't be what you can't see."

Following the previous article that highlighted the latest findings from the ASPIRES research, this article takes a closer look at the representation of ethnic groups in STEM careers, and highlights how the resource 'A Scientist Just Like Me' can raise awareness of diversity in science-related jobs.

Children's attitudes towards science and their identity with science become established from an early age and many children leave primary school thinking STEM subjects are not for them. Changing this mindset requires carefully planned and explicit action, and primary schools have a key role to play. By challenging some commonly held stereotypes, e.g. that science is done by clever white men, and by sharing with children the faces and stories of a diverse range of contemporary scientists, children will be more able to recognise that there is a place for everyone in the world of STEM.

Looking at the statistics, the picture is bleak. For example, **Professor Robert Mokaya** discovered that he was the only Black chemistry professor in the United Kingdom. For a decade, he had assumed there were others who he had not encountered, until investigations by the Royal Society of Chemistry revealed his lonely status.

In Professor Mokaya's words: "Somebody said to me, 'You're an endangered species. When you retire, there won't be any.' It is a terrible statistic."



As the graphic above demonstrates it is not just chemistry where Black people are severely under-represented. **There are fewer than five Black physics professors in the UK**, no more than ten in the biosciences, and in engineering they represent only 1% of all professors. There are greater numbers of professors across STEM subjects who identify as Asian or mixed heritage than there are Black professors, but overall this group are also still woefully under-represented.

To find out more, see, 'How UK science is failing black researchers – In nine stark charts' by Elizabeth Gibney (2022).

The importance of children engaging with role models from an early age is clear. In the words of children's rights activist Marian Wright Edelman "You can't be what you can't see." Stereotypes of what a scientist looks like and what they do need to be challenged so children recognise that scientists are not exclusively white, male or only found in laboratories and nor do they all wear white lab coats. Much good work on this is taking place, some of it stemming from the Royal Society of Chemistry (2015) campaign: **Not all chemists wear white coats**.

A Scientist Just Like Me – now including new videos of scientists

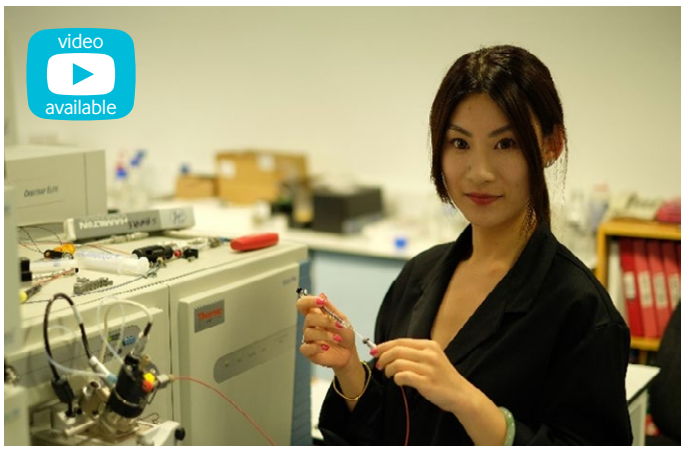
Michael Sulu, Biochemical Engineer, University College London

PSTT has worked closely with many scientists to create a free resource designed to raise awareness of diversity in science-related jobs and to provide illustrated examples of a wide range of science-based careers. A Scientist Just Like Me consists of a series of short slideshows, each one 'telling the story' of a particular scientist or person working in a science-related job. The people included share details of their work and their everyday lives, making their stories relatable to children.

We now have videos of twelve of these scientists. They were each filmed in their place of work and they talk about their typical day, the work they are doing and how they became a scientist. They share helpful advice as they talk about some of the challenges they have overcome while they were at school, in further education and in their employment.

The slideshows and videos can be found here.

Please note that PSTT has not specified a target age range for these resources and the decision about whether the content is appropriate for any particular group of children should be made by the teacher; we recommend viewing them in full before sharing.



Candy Jiang, Analytical Chemist, University of Bristol.

The A Scientist Just Like Me resources are intended to be used as discussion prompts, guided by a teacher. They can be used in different ways and for different purposes, for example:

- To show children an example of someone from a particular ethnic background working in a science job,
- To challenge gender or other stereotypes about science jobs,
- As part of a science topic that relates to the work of the scientist,
- As stand-alone fifteen-minute discussion activities,
- With a small group or the whole class,
- Or in a whole school assembly.

The resources focus on the skills, attitudes and habits that are needed to work in a particular field of science, rather than on any expert knowledge, which may be daunting or seem out of reach to children. Children are encouraged to imagine and discuss what it might be like to do the job of the scientist they are learning about. The full set of slideshows features scientists who work in many different fields of science. These include scientists who are neurodiverse or have physical challenges, and who come from a variety of ethnicities, genders, and sexualities. Using the search facility on the PSTT website, a slideshow can be selected on the basis of the job type, gender, ethnic heritage, disability, and whether they are STEM Ambassadors.

A Scientist Just Like Me slideshows and videos are freely downloadable here.

Neurodiversity Celebration Week is happening between 18 – 24 March 2024. This initiative, founded in 2018, celebrates different minds and aims to change the way learning differences are perceived. Find out more here.

Did you know?

Did you know science research can be linked to primary science topics?

For five years, PSTT has published regular **I bet you didn't know**... resources that explain cutting-edge science research to primary children. However, you might have noticed some changes in the most recent articles. Following feedback from teachers and scientists, we have kept the link to cutting-edge science but have made three key adaptations:

1. We have changed our name to **Did you know?** and have a new logo;
2. We have edited and redesigned five of our climate-related articles – they are shorter and more child-friendly;
3. We have revised most of the Teacher Guides (which can be used as classroom presentations) – each is linked to one primary science topic and develops one area of children's subject knowledge through an investigation related to the scientists' research.

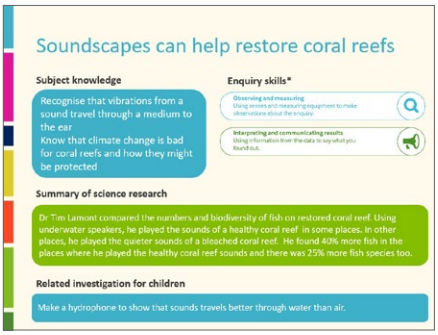
Why have we made these changes?

Through feedback, we have learned that teachers are keen to use science texts within their class reading lessons. We would like to encourage teachers to use Did you know? resources in reading opportunities during the school day to help children understand how science is applied in the world around them. This will support their learning in science and enables teachers to focus on developing substantive and disciplinary knowledge in science lessons. You can find these new 'Did you know?' articles, and your favourite old articles, here on the PSTT website.

The new articles are designed to be readable for older primary school children either independently or with some teacher support. Questions are included in the articles to help pupils reflect on the research or to guide teachers in leading a discussion. In providing children with the opportunity to read about scientific research, these new versions can improve science capital by encouraging pupils to believe that they are able to understand science when they encounter it in the media and wider world.

Using a readability formula to guide us, the sentence structure has been simplified and some of the background information removed. The key vocabulary is still included in a glossary and looking through this together as a class, before children read the article, will help them understand the research. In England, Ofsted has noted the benefits for children of providing opportunities like this for developing 'disciplinary literacy'. We will continue to write more articles in this new style.

Teachers also told us that the Teacher Guides that accompany our articles provided lots of ideas for practical science but that the links to the primary curriculum were not obvious. We have made the Teacher Guides simpler to use by linking the research to one primary science topic and one learning objective within that topic. The slideshow provides key vocabulary, a starter activity, background information on what the scientists already knew, what they did, and what they found out, as well as information about the scientist. Then it's 'Your turn to investigate' where children can carry out their own related investigations to copy or mirror the scientists' research.



Example of new 'Did you know?' Teacher Guide showing the primary science curriculum link on the cover slide and learning outcomes for both subject knowledge and skills on the following slide.

How can teachers use these resources?

The children could study the articles and become familiar with the vocabulary in reading sessions, before using the subsequent science lesson to carry out a follow up investigation. Reading the texts, in a supported setting, encourages the children to see how key vocabulary is applied in context and helps them to develop their own use of that scientific language in later discussions.

Comments from teachers who have trialled the Did you know? resources in their classrooms.

> The articles were a great way to introduce scientific vocabulary to the children and to explore the words in real life contexts. They allowed the children to make links between the new vocabulary and the scientific facts that they already knew, making it more likely that they would use them in their own explanations.
>
> **STOKENHAM AREA PRIMARY SCHOOL**

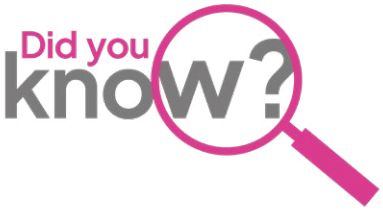
> The article was very accessible and we liked the process of reading about the science and then trying some of it practically ourselves.
>
> **MODBURY PRIMARY SCHOOL**

Summary of the new Did you know? articles

Article title (click on the box to go to the article)	**Science topic**	**This article provides opportunities to explore the following science concepts and climate-related learning**
Tree restoration now or never	Plants/Trees	■ Changes to environments ■ Greenhouse gases causing global warming and climate change; how tree planting can limit this change
Termites can help rainforests survive droughts	Food chains	■ Food chains, including decomposers ■ Effects of global warming on rainforests and how termites can protect them
It's raining all over the world	Weather	■ The water cycle, evaporation and condensation ■ The link between climate change and extreme weather events and how weather forecasts can help us
Geoengineering could slow the melting of Arctic ice	Properties and uses of materials	■ Uses of everyday materials, reflectivity ■ Effects of global warming on Arctic ice and how to protect sea ice
Soundscapes can help restore coral reefs	Sounds	■ Sound travelling, vibrations ■ Effects of climate change on coral reefs and how to protect them

To learn more about using Did you know? in your setting, you are warmly invited to attend a professional learning webinar on 29th February 2024, from 4.00 – 4.45pm. Find out more and register for your free place **here**

We hope you find the Did you know? resources useful and would be grateful for your feedback. Please email **alison.trew@pstt.org.uk** or send us your feedback via this **short survey**.



Did you know?

Soundscapes can help restore coral reefs

Topic: Sound / Climate change

Dr Rebecca Ellis, PSTT College Fellow, links cutting-edge research with primary science
rebecca.ellis@pstt.org.uk

The 'rainforests of the oceans'

Coral reefs are one of Earth's natural wonders (Figure 1). Healthy reefs are a habitat for millions of species, including sea horses, lobsters and sea turtles. The first coral reefs formed 240 million years ago. That's before the dinosaurs were alive. Today's reefs are thousands of years old. Corals attach themselves to the ocean floor so some people think that they are plants or even rocks. In fact, corals are made up of thousands of small animals called polyps. Polyps look like upside down jellyfish. They use their tentacles to catch food from the water. They live in groups called colonies.

Because corals are attached to rocks and don't move, what do some people mistake corals for?

Figure 1. A healthy coral reef in Sulawesi, Indonesia. © Tim Lamont

There are hard corals and soft corals. Hard corals are the 'reef builders'. They create **exoskeletons** which are a base for other corals. Hard corals also provide homes and carbon dioxide for algae. In return, these simple plants give the coral food and oxygen. Most of the colours that we see in corals come from the algae. This relationship is called **symbiotic**. This means that both living things benefit from living together.

Threatened habitats

Climate change is bad for coral reefs because:

- High levels of **carbon dioxide** gas in the **atmosphere** makes the water more **acidic**. This weakens coral and slows its growth.
- Climate change also brings more storms. This can destroy coral reefs.
- Corals become stressed when water temperature rises. They get rid of their algae and turn white (Figure 2). This is called coral bleaching. Coral can recover from this after a short **heatwave** if there are no more problems.

All types of water pollution are a problem for coral reefs. Surprisingly, lack of fish could also be a problem. Fish have important roles on the reef and can help them recover from bleaching. Fish bring nutrients to the reef. They eat the larger algae which can swamp the coral. Their nibbling shapes the coral and allows more species to thrive. Overall, a coral reef with variety of fish is more balanced and resilient.

Why do you think that rubbish in the ocean could be a problem for coral reef?

What does the word resilient mean?

Figure 2. Dead coral skeletons after bleaching on the Great Barrier Reef. © Tim Lamont.

Restoring the reefs

Scientists are using their understanding of animal life cycles to try to protect coral reefs. When reef fishes hatch from their eggs, they are tiny. Many are washed away into the deep sea. Once the fish have grown, they can return to the reef - but only if they can hear the reef. Healthy coral reefs are really noisy places! Turtles crunch. Shrimps snap their claws. Fish chatter, buzz and grunt. Sounds travel far under water and so fish can find their way back to healthy coral reefs.

How to fish miles away find their way to coral reefs?

Dr Tim Lamont (previously Gordon) built underwater microphones (Figure 3) to test the effect of sounds on fish. In some places he played the sounds of a healthy coral reef. In other places he played the quieter, reduced sounds of damaged coral reef. Then he measured the number of fish and biodiversity in all areas.

He found that there were 40 % more fish at the places playing the healthy reef sounds with 25 % more **biodiversity** at these sites too.

New research like this could help the coral reefs to recover. When discussing his findings Dr Tim Lamont says, "As we look to the future, let's learn to listen!"

Why do you think that Dr Tim Lamont chose the words 'learn to listen'?

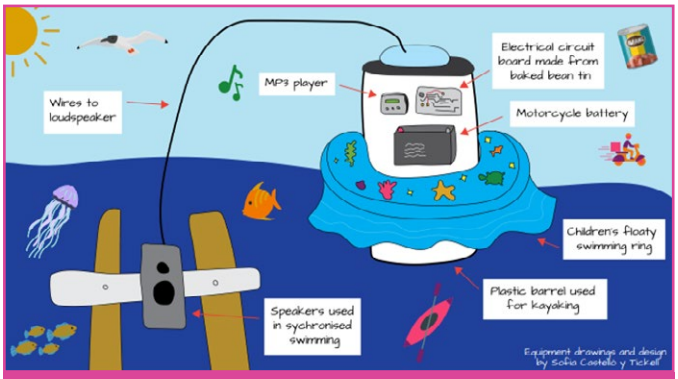


Figure 3. Underwater speakers play healthy coral reef sounds. © Conservation Optimism.

Can you use your voice to help other people to 'learn to listen'?

We can all help the coral reefs. Think about which of these challenges can you do easily? Which might be more challenging to achieve? Who could help us?

1. Pick up litter. If left on the streets, it will often get blown into rivers and drains. It could then end up in the sea.
2. Avoid plastic by using a refillable bottle for drinks and reusable bags and containers.
3. Don't waste water. This will mean that less wastewater will end up in the ocean.
4. Find out if your school uses energy efficient light bulbs. Can any improvements be made? This is an easy way to reduce emissions of **greenhouse gases** like carbon dioxide and stop the oceans from becoming more acidic.

Glossary

acidic – having the properties of an acid, a substance with particular chemical properties including dissolving some metals

atmosphere – the layer of gases surrounding the earth or another planet

biodiversity – the number of different species found in one area (an ecosystem)

carbon dioxide – a colourless gas with no smell that is naturally present in air. It is made from carbon and oxygen

climate change – a long-term change in the average weather patterns on Earth

exoskeleton – a hard covering on the outside of some types of animals, an 'outside' skeleton that supports and protects the body

heatwave – at least three consecutive days of unusually hot weather

greenhouse gas – a gas in the Earth's atmosphere that traps heat and contributes to global warming, e.g. carbon dioxide, water vapour, methane

symbiotic – a relationship where different types of living things exist together in a way that may benefits them all

The paper that inspired this work was:

Acoustic enrichment can enhance fish community development on degraded coral reef habitat.

By Timothy A. C. Gordon, Andrew N. Radford, Isla K. Davidson, Kasey Barnes, Kieran McCloskey, Sophie L. Nedelec, Mark G. Meekan, Mark I. McCormick & Stephen D. Simpson.

Published in *Nat Commun* **10**, 5414 (2019), last accessed 1.12.23

Acknowledgement:

This resource contributes to XAIDA – a project supported by the European Union's Horizon 2020 research and innovation programme under grant agreement No 101003469.

Investigations for children are described in the Teacher Guide which can be accessed **here**.

Key dates

3
MARCH 2024
World Wildlife Day

11-17
MARCH 2024
The Big Plastic Count

8-17
MARCH 2024
British Science Week

18-24
MARCH 2024
Neurodiversity Celebration Week

31
MARCH 2024
Start with Art competition deadline

22
APRIL 2024
Earth Day

23
MAY 2024
Outdoor Learning Day

11
JUNE 2024
Great Science Share

www.pstt.org.uk

The Primary Science Teaching Trust (formerly the AstraZeneca Science Teaching Trust) was fully endowed with a grant from AstraZeneca PLC

Primary Science Teaching Trust

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