



# Cutting-edge science in primary schools: Support for classroom practitioners and the development of teacher guides

PSTT Fellows with backgrounds in science research describe a new PSTT project: introducing resources to support primary teachers and children to engage with cutting-edge science research

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## Cutting-edge Science in Primary Schools Project

In the *Journal of Emergent Science* (Trew et al, 2019), we have previously described a new Primary Science Teaching Trust (PSTT) project, which created a set of articles called *I bet you didn't know...* These articles show how cutting-edge science research can be linked to the primary curriculum. Each article is based on a recent, peer-reviewed published paper about an interesting area of scientific research. The articles present a summary of the research, interwoven with ideas about how to make them relevant and appealing to primary children. Supporting practical activities are also suggested.

### The Cutting-edge Science Webpage: *I bet you didn't know...*

PSTT has launched a new page on their website ([pstt.org.uk/resources/curriculum-materials/cutting-edge-science-primary-schools](http://pstt.org.uk/resources/curriculum-materials/cutting-edge-science-primary-schools)) where new *I bet you didn't know...* articles will be published, at least once a month, along with a Teacher Guide to support primary practitioners using the suggested investigations and sharing the cutting-edge science research with primary children. One of the articles will also be included in each of PSTT's termly newsletters. On the webpage you will find:

- The rationale for using the cutting-edge research approach (why and how);
- The articles about the cutting-edge research;

- Teacher guides in the form of PowerPoints – one to go with each article; and
- Biographies of the authors of the articles.

The articles are not grouped according to any curriculum theme, to make them accessible to an international audience and because, due to the interdisciplinary nature of science research, some articles include aspects of biology, chemistry and physics. This is worth pointing out to the children and it might also be interesting to share with them that the scientific research was carried out by both female and male researchers, sometimes working in groups drawn from across a range of different countries.

# Teacher guides: Providing support for primary teachers

The primary school teachers attending our PSEC 2019 seminar were very enthusiastic about the project, recognising that teaching children about cutting-edge science research provides opportunities for children to make connections with real scientists and deepens their understanding of the nature of science research and its relevance to everyday life (Trew *et al*, 2019).

Acting upon feedback from primary teachers at the PSEC 2019 seminar, we have produced a Teacher Guide as a PowerPoint, structured as follows:

*'We start with a list of the authors of each paper and their locations. We think that it is interesting for children to see that papers can be written by one or two scientists or by large teams of people who sometimes work in different countries, as revealed in "I bet you didn't know...How to calculate the age of a shark"'* (Shallcross, 2017) (see Figure 1).

The next slides introduce and describe the recent science research: What did the scientists know? What did the scientists do? What did the scientists find out? The PowerPoint is intended to be a guide for teachers for their reference, but we have included images to illustrate the main points on these slides because teachers may wish to show certain slides in the classroom. For example, to describe what scientists already know in the Teacher Guide that accompanies *I bet you didn't know... How to clean water using a molecular sieve!* (Shallcross, 2018), we included images of graphene and of people collecting water at a pipe in a developing country (see Figure 2).

After describing what the scientists found out, a 'Quick Activity' and a 'Longer Investigation' are suggested (sometimes two) that children could do in the classroom to mirror the research and investigate as the scientists did. For example, in *I bet you didn't know... How to grow a new skin* (Trew, 2018), we suggest that children could investigate how much skin they would need to cover their bodies using large rolls of paper, and this is illustrated on a slide in the Teacher Guide (see Figure 3). The investigations vary in complexity and are suitable for different ages, but all pose a question for the children to investigate and list the resources that will be needed to carry out the investigation.

The final Teacher Guide slides give some key questions to prompt discussion about what the children have found out from their investigations, and we have also included slides suggesting 'Questions for further learning', maths links and writing links. We do not intend that teachers follow these ideas as a lesson plan or a sequence of work. We hope that teachers will adapt what we have provided to suit their pupils' interests and questions, and we would welcome any feedback from teachers who use these Teacher Guides.

Figure 1. 'Who are the scientists?' slide in the Teacher Guide for article: *How to calculate the age of a shark*

Figure 2. 'What did the scientists know?' slide in the Teacher Guide for article: *How to clean water using a sieve!*

Figure 3. 'Longer investigation' slide in the Teacher Guide for article: *How to Grow a New Skin* (including symbols to indicate which type of enquiry is being used and which enquiry skills will be utilised)

# Enquiry approaches and skills

The activity slides also include symbols that refer to the different types of enquiry approaches (see Figure 4a) and the enquiry skills that pupils will use (Figure 4b). These enquiry symbols could be useful for teachers and pupils to refer to when talking about different investigations and

the nature of science research. The symbols can be downloaded from the PSTT website

([pstt.org.uk/resources/curriculum-materials/enquiry-approaches](http://pstt.org.uk/resources/curriculum-materials/enquiry-approaches) and [pstt.org.uk/resources/curriculum-materials/enquiry-skills](http://pstt.org.uk/resources/curriculum-materials/enquiry-skills)).



Figure 4a. Symbols for different enquiry approaches



Figure 4b. Symbols for different enquiry skills

## Access to cutting-edge science research in primary schools

Teachers can access the Royal Society partnership grants, which enable students, including primary-aged children, to carry out science, technology, engineering or mathematics (STEM) projects with scientists and engineers (Royal Society, 2019). At PSEC 2019, Paul Tyler and Dudley Shallcross described the impact on children of a project investigating 'What is in our atmosphere?' funded by a partnership grant from the Royal Society, supported by the University of Bristol and delivered by Hi-impact Consultancy. The Institute for Research in Schools (IRIS) works with universities and research institutes to make cutting-edge research projects open to school students and their teachers, so that they can experience the excitement and challenge of science (IRIS, 2019). There are also numerous citizen science research projects with which the public are

encouraged to engage; many are listed by the Natural History Museum (NHM, 2019) and Zooniverse (Zooniverse, 2019).

Research scientists at the PSEC seminar highlighted the work of the National Co-ordinating Centre for Public Engagement (NCCPE, 2019), which encourages primary children and their teachers to take part in real science research. Across the UK, there are over fifty science and discovery centres and museums that work with researchers from local universities and industry to provide opportunities for school children to 'meet the experts', attend curriculum-based workshops and careers events, and become involved in large-scale experiments. These centres employ over 5000 professional science engagement specialists, who have the skills to create and deliver fun and engaging activities for all parts of society. With such a wealth of hands-on resources, why might we need

further cutting-edge science projects in the primary classroom? From personal experience, we know that there are many challenges in getting a class of primary children out of school: an already packed timetable, time-consuming form-filling and cost. Many UK science centres charge entry fees (except for the national museums) but, even if entry were free, the cost of transport to the centres can be prohibitively high. The NCCPE has identified a range of strategies to reach out to new audiences (Manners & Owen, 2018) but, for schools situated long distances from science centres and universities, for schools that have limited funds, and for teachers who feel unable to explore grant applications or pursue local university outreach programmes, our *I bet you didn't know...* articles provide a no-cost, simple, supported and effective way to engage children with cutting-edge science research.

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# Summary

Our articles explain cutting-edge science research and suggest science-related activities for primary children to investigate in the classroom. We believe that there is value in producing these resources, because it is important that children recognise that the science they do in the classroom uses the same processes followed by real scientists, and that children see that there is a purpose to studying science: to help to understand the world around them and see the potential for a future career. Teachers may not have the confidence, or time, to apply for funding to take part in science research projects, so these resources help with this.

Our articles introduce a wide range of scientists and cover different areas of the primary science curriculum. Over time, as we create more articles, teachers will be able to choose something that fits with the themes that they are teaching. The Teacher Guides are intended to support teachers who are planning to use cutting-edge science articles in the classroom; they are mainly for teacher reference, although teachers may wish to show particular slides to the children.

Research scientists have expressed interest in working with us to write some materials for the webpage and we look forward to working with them to do this. Indeed, the next stage of the project is to have schools interacting with the actual scientists and being able to pose questions. We would welcome your comments on this paper, the *I bet you didn't know...* articles and the Teacher Guides being produced. If you have subject areas about which you would like to have a cutting-edge science research article, please e-mail PSTT at [info@pstt.org.uk](mailto:info@pstt.org.uk)

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