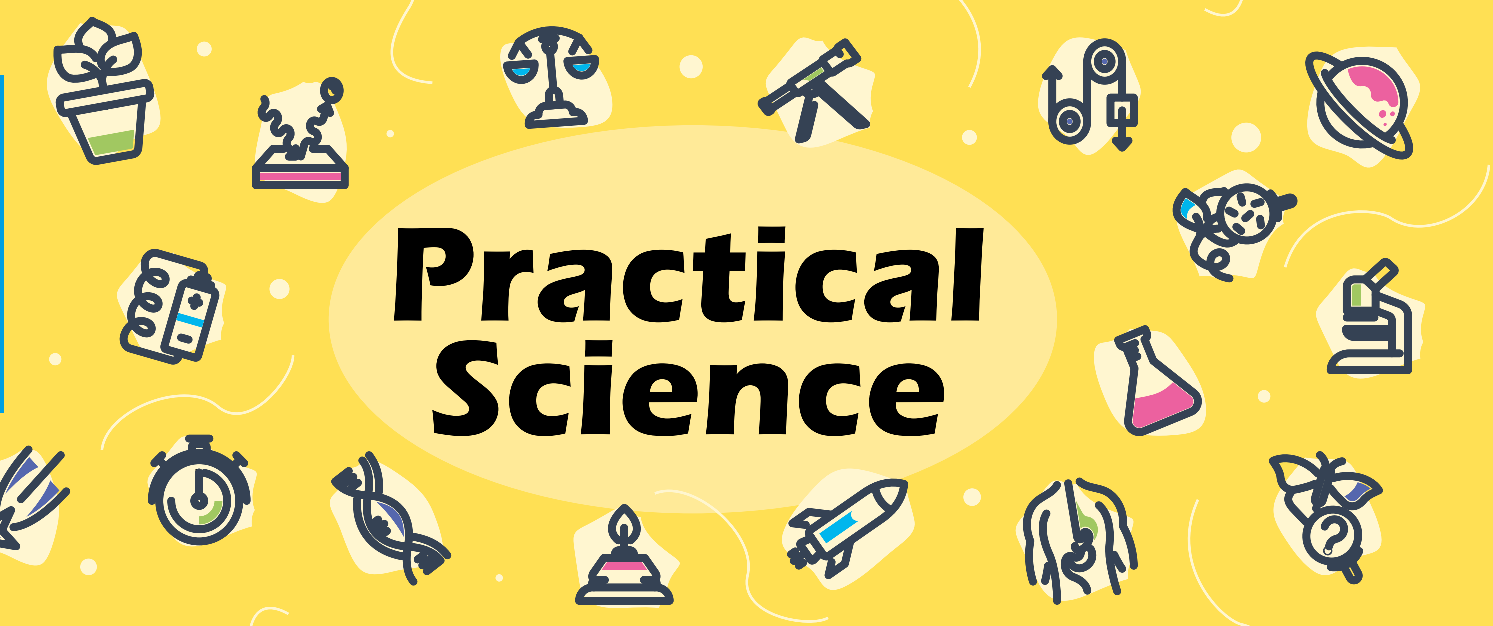

Keeping Science Practical – Wolfson Project

Sarah Longshaw

As we enter the last term of the academic year, and we near completion of the support offered to our first cohort taking part in the above project, let's pause and reflect. This year has, once again, been anything but normal, and educators have once again risen to the challenges, in spite of higher levels of absence (both staff and students) in schools. So, keeping science practical has again often been challenging. There are gaps in every year group – in both knowledge and skills; this is inevitable but this is also where having a practical policy and a well-sequenced curriculum, showing how skills are developed (alongside knowledge), is beneficial.

Subject leaders taking part in the project have considered this and decided on next steps, according to the needs of their particular setting.

We can probably list a myriad of different ways in which technicians support the delivery of good practical work – many of these are centred around the equipment, although we shouldn't overlook their role in staff training and support. Because the role is so wide-ranging and varied, the opportunity to share good practice and ideas with others is invaluable. In some schools, technicians can also act as demonstrators – and the role of demonstration in practical work is also key to students developing their understanding and skills.

The benefits of a network include having others in similar situations of whom you can ask questions and seek advice from, and the use of asynchronous tools enables this to happen remotely, so that expertise is distributed across those taking part in the project.

Early Career Teachers (ECTs – those in the first years of their practice) have perhaps suffered the most disruption, with periods in the last two+ years having required teaching to be delivered remotely, or in 'bubbles', with limited or no practical work and restricted interaction. Firstly, I think we should acknowledge the resilience of our ECTs in adapting to these changes.

Understanding why, when and how to get the best from practical work is essential, but having practical strategies to support this is equally important. We have already touched on demonstrations and, whilst many ECTs will have delivered practical work this way during the restrictions of the pandemic, they may not have had much opportunity to unpick and examine the components of success.

We are very much looking forward to discussing the impact of the project with our participating schools and finding out on which aspects they have focused – the successes, the challenges and their next steps. We're also keen to discuss how they have benefited from the ASE Science Department membership, both as a collective and as individual members.

We will shortly be recruiting schools for our next cohort; if you are interested, you can find out more and register your interest at https://ase.org.uk/your-secondary-school-eligible-our-keeping-science-practical-programme

Sarah Longshaw is co-project lead for the ASE Keeping Science Practical Programme.

Teaching primary science outdoors

Helen Spring

As a primary science and outdoor learning consultant and author, I am clearly an advocate of teaching science outdoors. There are many benefits of outdoor learning; these include health benefits (Twohig, Bennett & Jones, 2018; Engemann *et al*, 2019), wellbeing, enjoyment and engagement (Waite *et al*, 2016), as well as improvements in attainment (Education Endowment Foundation, 2021; Harvey *et al*, 2017; Hamilton, 2018). Personally, I think it is important to consider why we are teaching in a particular location – be it indoors or outdoors.

The outdoor space available should be seen as an extension of the available learning space. Sometimes, teaching outdoors is the right thing to do simply because the lesson is messy or noisy; sometimes the indoor classroom might be too hot, or the lesson is about something that is outdoors. Sometimes a lesson is better taught indoors – perhaps the weather is poor, and the children don't have appropriate clothing, or maybe equipment is breakable and needs to be handled with more care than might be possible outdoors.

When I lead CPD about teaching science outdoors, I encourage teachers to share the barriers that prevent them from teaching outdoors. Common barriers include the perception that it is harder to plan to cover curriculum objectives, to assess children and to record findings outdoors. A good lesson plan will include planning for assessment and, where appropriate, recording opportunities. It can be helpful to consider which objectives in a topic **should** be taught outdoors (often those that relate to plants and habitats, for example), and which objectives **could** be taught outdoors. I am a firm believer that almost every primary science objective **could** be taught outdoors (Spring, 2021).

Assessment for Learning

Discuss with the children how they will know whether the pixie house is waterproof (for example). Ask them how they might find out. Introduce the concept of carrying out a test. Ask questions to encourage the children to be systematic in their testing. What can we add to our design to make it waterproof? Which material worked the best?

Science Capital

Ask the children if they have made dens or shelters in the past. These might include shelters made outdoors as well as pillow forts or cardboard box dens. If there are any local shelters – e.g. woodland areas that contain dens, bus stops, bandstands, etc, discuss what materials these are made from and why. What about rabbit hutches or dog kennels? Discuss the materials that these are made from. Talk about people who might need to know about materials for their jobs, such as a builder, architect or clothes designer.

Support

Children may need to revisit the properties of materials in more detail. Give them the opportunity to explore the properties of the available materials – discuss which materials are soft, hard, bendy, etc. Children may need to be given more guidance/structure in carrying out a test.

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Assessment outdoors is exactly the same as assessment indoors. Teachers should plan in opportunities to speak to children about their ideas and understanding, make time for observing them carrying out practical activities and consider how children might share their understanding with others. Consider using ideas adapted from Explorify, such as discussing which of three leaves is the odd one out and why, or which pixie house is the best and why.

Children can use natural materials or chalk on the playground to represent their ideas – this works particularly well when the topic requires modelling, such as the circulatory system or parts of a plant. Children could photograph or draw what has been created outdoors if a permanent record is needed – this could even be annotated back in the classroom (https://www.springlearning.co.uk/assessment/).

Uses of everyday materials

Conceptual knowledge: In this activity, children identify and compare the suitability of a variety of everyday materials.

Working scientifically: In this activity, children perform simple tests.

Assessment: Children meeting the conceptual knowledge objective will be able to say why they have chosen the materials that they have, for example, "I have chosen leaves and plastic for the roof because it is waterproof; I have not used sticks for the roof, because the gaps let the water in". Children meeting the working scientifically objective will be able to say how they know which material is 'best' for a purpose. For example, "I know that leaves and plastic are waterproof because I poured water over my pixie house and it stayed dry inside. When I poured water over the pixie house with the roof made of sticks, it got wet inside".

https://www.springlearning.co.uk/publications/

Don't forget that writing is also allowed outdoors! Alternatively, you may want to follow up an outdoor science lesson with a literacy lesson that uses the practical science as the context.

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Science Ninjas – helping primary teachers engage with practical science

Jason Harding and Maria Pack write:

The science national curriculum (NC) has always strongly emphasised practical work in all its guises. For some time, we've pondered: why is it that, despite the various versions of the science NC prominently featuring scientific investigation, enquiry and practical work, they are notably less well addressed in primary science lessons than scientific concepts?

So, we asked primary teachers why they thought this is the case. What the teachers said is best summarised as:

- They feel overwhelmed by Working Scientifically (WS).
- They feel more able to plan lessons based on scientific concepts and far less confident about incorporating or using WS.

We wondered, what was problematic in understanding which activities helped primary children learn through practical work? So we asked primary teachers what they thought the Key Stage 1 (ages 5-7) WS statement *'observing closely, using simple equipment'* meant. The two most popular responses are best summarised as:

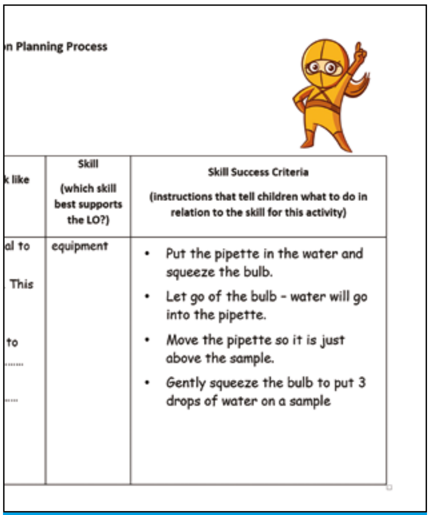
- *Look at something for longer.*
- *I don't know.*

On reflection, it is not surprising that primary teachers may find this aspect challenging. Looking for learning opportunities within specific activities that can be shaped into appropriate learning objectives for practical work is tricky.

While watching lessons, we've seen this played out many times. Commonly, we hear instructions such as *'Make sure you observe closely'*, but there's

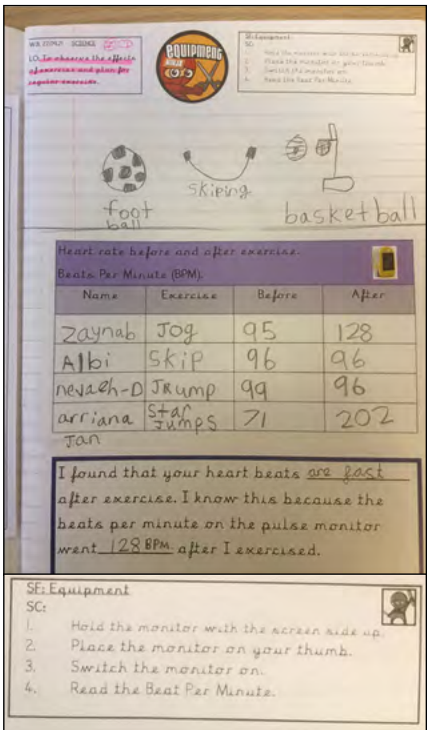
To explore the effects of water resistance. To investigate the effects of friction.	Make boats with streamlines to promote speed. Once boats are created, chn to put them in water see how long the boats take to cross the water tray.	Recording Observation	• I can describe streamline objects • I can make observations • I can record my observations	Differentiated recording sheets SEN to be given wordbank to create pupil voice and describe their boats	Go through PPT and discuss air resistance and how it is affected by design of objects. Explain the task to chn: create a boat with stream lines, show example and model how to label their creations.

Excerpt from Y5 Forces SOL: both observing and recording are mentioned but nothing in the planning about how either will be supported.



Excerpt from Y1 Everyday materials SOL, where the practical lesson planning explicitly supports the children to correctly use a pipette.

rarely any support for how to do this. Speaking to teachers about such lessons leads us to believe that it's because they haven't considered what close observation looks like in the particular instance, or that planning to observe successfully in one activity



Y2 child's write up of a practical lesson about exercise while learning about the topic 'Animals including humans', including a 'Ninja moment' where the children are supported to correctly use a pulse rate monitor.

can look very different to successful observation in another.

So, what could we do to help? Our approach was to try to find a simple way to fix this problem as we knew that we may also need to introduce teachers to new ways of working, as well as possibly introduce new activities or rethink old and trusted ones.

This was how our Science Ninjas action research project came in to existence.

When planning a practical lesson, we ask our Ninja teachers to make simpler WS choices by focusing on just one of four skills:

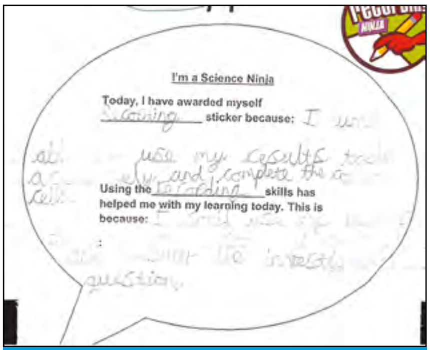
- Using equipment;
- making measurements;
- making observations; or
- recording observations/ measurements.

They select the best skill to focus on based on what the activity is and what they want their children to learn – the lesson's 'Ninja moment'. The teachers make sure that the Ninja moment includes specific support about the skill.

Time to appreciate how using the skill has helped the children is built into the lesson and, when the children demonstrate the skill successfully, this is celebrated.

We've been supporting our Ninja schools to use this approach for the past four years and notable improvements have been seen:

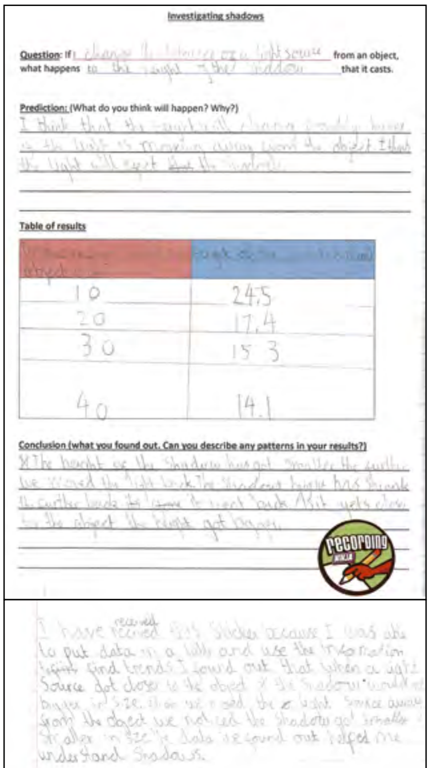
- More practical work happens in the schools.
- The children and teachers feel more ownership of their science lessons.
- The science leaders are becoming increasingly skilled and confident in critiquing, improving and providing their staff with feedback about practical lessons.
- The teachers have stopped considering WS a barrier, have gained confidence in teaching science practical activities and now



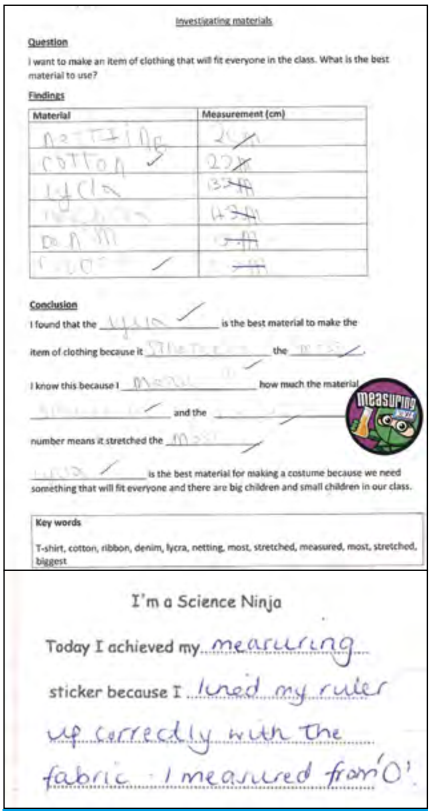
Reflection from a Y3 child on how recording has helped them organise and use their observations while learning about plants.
"Today I have awarded myself a *recording* sticker because: *I was able to use my results table accurately and complete the correct cells.* Using the recording skill has helped me with my learning today. This is because: *I could use my results and answer the investigation.*"

see the benefits of engaging with science learning through working scientifically.

Our goal is for primary teachers and their children to have ownership of WS.



Y6 child's write-up about shadows while learning about light, including their reflection about how recording has helped them learn.



Y2 child's work while investigating the stretchiness of different materials as a part of learning about 'Uses of everyday materials', and their understanding of what good measuring means for the activity.

Working with our Ninja schools has shown us that:

- Teachers need to feel confident that the WS portion of a practical lesson makes sense to them and is useful, not burdensome or hidden.

For this to happen they need: support that helps them to work out how one element of WS specifically and explicitly applies to the activity in that lesson.

- The science leaders need CPD on how to look for evidence that their and their colleagues' lessons and the children's work show that the practical activities have supported learning.

For this to happen they need peer-to-peer, non-judgemental forums supported by science education professionals, where they can discuss how their/their colleagues' practical lessons went, so that the science leaders and their teachers can decide if an activity and/or the planning is appropriate, good or bad, and how they'll adapt, amend or choose to replace it.

We couldn't be prouder of our Ninja schools, leaders, teachers and children. They're living proof that the primary community can successfully engage with primary science. They also realise that this is a learning journey for them and that they need ongoing support that recognises where they are, which helps them to move forward from that point, at a pace that they're able to sustain.

Jason Harding is the Section Leader for Biology and Primary at CLEAPSS and chairs the ASE Primary Futures Network in London, and **Maria Pack** is the Lead Primary Consultant at CLEAPSS. Jason and Maria run the Science Ninjas action research project in collaboration with Professor Christine Harrison and Lucy Wood from King's College London.
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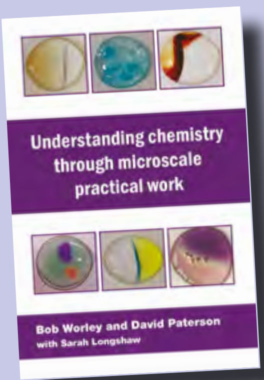
Microscale chemistry – are you teaching it?

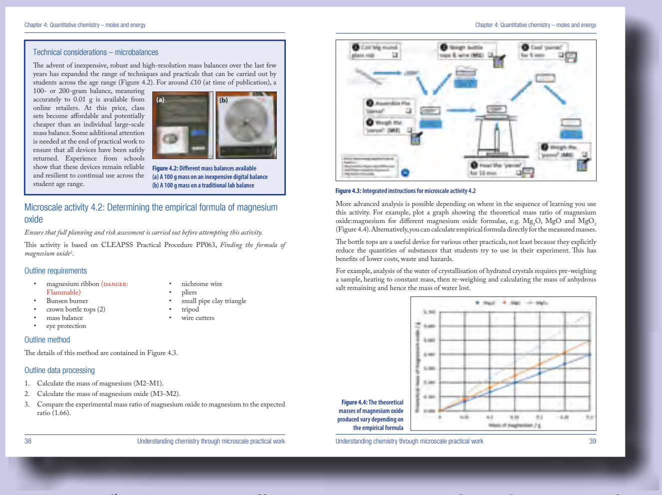


You may have already seen details of ASE's new *Understanding Chemistry Through Microscale Practical Work* (Worley & Paterson), which is proving to be very popular.

We would love to know if you are adopting microscale procedures in your teaching and, if so, whether you are using the book and how useful you are finding it?

Please let us know at info@millgatehouse.co.uk and we will use your feedback to inform future editions of the book!

Author David Paterson CSciTeach is presenting a session at the ASE South East Conference at the University of Surrey on June 29th where he will discuss the benefits of microscale chemistry and demonstrate some common practicals. To find out more visit: https://www.ase.org.uk/Events



The book is available to purchase at www.millgatehouse.co.uk

Science on Stage 2022

Frances Evans, ASE Field Officer, writes:

Science on Stage Europe brings together science teachers from across Europe to exchange best practice, teaching ideas and concepts with passionate colleagues from over 30 countries. The festival happens every two years and is a great opportunity to work with colleagues in different countries. The UK sent 11 teachers to Prague in March to be part of the event.

There was a great buzz around the conference floor, with each delegate having a stand from which to showcase their project/ideas. This meant that each teacher had an opportunity to visit other stands, share ideas and set up links to develop ideas further, with the possibility to present a joint project at a future festival. There were also workshops and some larger presentations to the whole audience.

There are opportunities to apply for a travel scholarship to meet with a colleague to continue the work and develop a joint project. Science on Stage also publishes teaching materials, developed by teachers for teachers, which can be downloaded free from www.science-on-stage.eu/teachingmaterials

The UK delegation won two awards this year: Emma Crisell for her project on 'Food for the 21st century – making a difference', and Ian Robinson won the Czech Physical Society award for his project 'Geophysics on a budget – Open source research level Earth Science projects for school and home'.

Anyone can apply to be part of this amazing experience and submit a project idea for the next festival in Finland in August (5th – 8th) 2024. We can offer support. Full details about the themes and the application process will be available later in the summer.

Quotes:

'Science on Stage 2022 has been one of the most valuable and immersive science CPD experiences of my teaching career. I have shared my project on making snowflakes and climate change, but learned so much more from the amazing teachers from across Europe. Their enthusiasm and passion for science is infectious, so I return to the UK with a suitcase of ideas to share with others and have a go with my students. I would say do it!!! Get involved and start your Science on Stage journey today' (Sam Ireland)

'I have had the most amazing immersive CPD experience, made friends from across Europe and am now looking forward to meeting a colleague from Italy on Monday to start working together with our schools on something really exciting. Please can I come back again?' (Sophie Brace)

'I feel so incredibly lucky to be here. Met some amazingly inspirational people. Thanks you all so much. When can I come back?' (John Cochrane)

'Wow, what an experience! I have met so many amazing people. I am looking forward to collaborating with them. Thank you!' (Jenny Petrie)

'Science on Stage has been a joy. Everyone here is passionate about teaching and so willing to share ideas. I have loved telling my stories and making friends. The whole event has been inspiring' (Jules Pottle)

The UK delegation.