Primary Science

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The Association for Science Education

The ASE's journal for primary science

FREE ASE supplement inside!

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Executive Editor ***Helen Johnson***

ASE editorial contact ***Jane Hanrott***

Design/page makeup ***Colin Barker*** *ndd*

Advertising ***Rebecca Dixon-Watmough***

The Association for Science Education

It is with great pleasure that we welcome you to this special edition of *Primary Science* themed around 'leading change'. In a change to our normal '*Focus on*...' piece, which is a collation of thoughts from the Editorial Board on the theme of the issue, because of the 'special' nature of this issue we have taken on guest writers.

So what is 'special' about this issue? Regular readers will see all the usual features, including one that has been reinstated in response to readers' requests. What makes this issue 'special' is that it has been delivered to every primary school in the UK and includes an eight-page supplement to give us the space we need to share with you how the Association for Science Education (ASE) is 'leading change' in primary science.

As it continues its long history of supporting science, both in the classroom and at Government policy level, the ASE has been influential in shaping the new curriculum about to be introduced in England, especially the 'Working Scientifically' programme of study. The ASE has worked hard at ensuring that primary science remains enquiry-led, practical and engaging, and is now using the collective expertise within its membership to translate that curriculum into inspiring teaching and learning, while continuing to represent the interests of members and of science education at the highest levels. At a time when support and guidance can be costly, the ASE offers a strong and supportive community for all those involved in science education, where members can engage at different levels depending on their needs and experience.

It can be a lonely job being the science subject leader in a busy primary school, with other subjects and priorities competing for your time and attention. Being part of the largest subject association in the UK ensures that you are never isolated, that you are instead part of a vibrant community of like-minded professionals, who want to make sure that the children you teach, and the colleagues you lead, have access to the best possible science education in the primary years. Being a primary member of the ASE is a bit like being science subject leader in a primary school: we think our bit is the most important, we have the most fun (but don't tell secondary colleagues that!) and we know that we make a difference.

The ASE provides opportunities for networking and developing skills in leadership and professional development. Its events have much in common with a good science lesson: always enjoyable and you learn a lot. These events range from local face-to-face 'Teachmeets' and other activities, through to regional and national conferences and to virtual meetings, via *Facebook*, *Pinterest* and *Twitter* (including #ASEchat every Monday evening between 8pm and 9pm). Being a member of ASE doesn't stop when the school day ends! There are many opportunities to share ideas and enthusiasm for science with colleagues from neighbouring schools, local providers and national figures, including the people who write your favourite ASE books and articles.

By becoming involved in the local and national committees, you have the opportunity to help in the planning of these events. Not only that, but your voice can be heard in the shaping of policies and bringing ideas to fruition. These committees are where you as a member can make a difference to your Association, while gaining valuable experience and contacts. 'Leading change' through discussion with colleagues is incredibly important to ASE and providing these opportunities is key to you leading successful change.

Sometimes there is a need for more than 'talk'. This is where other aspects of ASE can support you and your colleagues in school to grow and develop. For instance, publications such as *Education in Science*, the highly respected and informative ASE 'house' journal, and, of course, *Primary Science*, can be invaluable in keeping you informed and giving you the opportunity to share your ideas with colleagues. There are a range of other resources for support as well, including very popular books, such as *Be safe!* and *Making sense of primary science investigations* and the more recent *It's not fair – or is it?* (published jointly with Millgate House), and teaching resources such as *Primary upd8*, which provide guidance on safe and high-quality primary science. Members, of course, are entitled to discounts on all of the ASE's publications and those from some other publishers too!

Whatever stage you are at in your education career, and whatever your subject background, the ASE has something to offer you and you have something to offer the ASE.

So, enjoy this special issue of *Primary Science* and experience being part of the ASE. Share it with your colleagues and then renew or take up membership of the ASE. You can even enjoy a taster of our flagship benefit by subscribing to *Primary Science* for one year only (see the enclosed supplement for details). Use the ASE to help you lead change in your school and you will be joining an influential and welcoming organisation.

We look forward to meeting you at an ASE event soon.

ASE Primary Science Committee and the Chair Trio of ASE (Pete Robinson, ASE Chair; Christine Harrison, Chair-Elect; and Liz Lawrence, Immediate-Past Chair)

noticeboard

Calling all minibeast enthusiasts

It's not too late! You have until 20 June to get your entries in for the **Great Bug Hunt 2014** competition! Find out more about the smaller wildlife in a habitat near you, draw or photograph them, record your findings and then send them off! See **www.thegreatbughunt.com/Home_Page.php**

And if you are really into insects why not follow this up by doing something in **National Insect Week** (23 to 29 June). See **http://nationalinsectweek.co.uk/about/overview.htm**

Want to go even further? Your pupils can be part of a real research project by taking part in the The **Big Bumblebee Discovery**. See **http://jointhepod.org/experiment-zone**

For other ideas and competitions – not necessarily related to bugs! – check out: **www.schoolscience.co.uk/competitions**

schoolscience.co.uk

Primary Science Quality Mark

Have you registered your school to take part in the Primary Science Quality Mark (PSQM) award programme yet? Ofsted recommend it as the best way to raise the profile of science in your school. Heads praise it because it is a cost-effective way to improve science teaching and learning. Teachers find the year-long process enjoyable and hugely beneficial and, most importantly, children just love doing more science! Registration for round 9 is now open, so go to **www.psqm.org.uk** and register your interest. It is the first step to an exciting year of primary science development (perfect timing with the new National Curriculum in England too!) and a future where the profile of science in your school will soar.

PRIMARY SCIENCE QUALITY MARK™

leading change

LEADING CHANGE IN THE PRIMARY SCIENCE CURRICULUM

Figure 1 Like-minded teachers working together to improve science

Nicky Waller and Chris Baker

believe that change can be a good thing and explain how their training has helped others

Key words:
CPD
Ownership

September 2013 was the month when teachers across England finally gained access to the definitive version of the new primary curriculum. '*Signed, sealed and now to be delivered*' was the strapline used for the Primary Policy Watch report (Pearson Think Tank, 2013) and this seemed to resonate well with the anticipation felt by many after wading patiently through the varied draft programmes of study that came before it.

In the same month, at the National Science Learning Centre (NSLC) in York, we led the first residential period of our course 'Leading Change in the Primary Science Curriculum'. This course aims to explore the implications and associated challenges of leading staff through change, and this one focused on the introduction of the new primary science curriculum. Although the course has been run for some years now, it seemed better placed than ever amongst its rival titles in our primary course brochure to promote a renewed interest and enthusiasm – and it did! One course participant, classroom teacher Anna Bentley, described her reasons for attending:

I know there are huge changes that will need to be implemented in the upcoming year. I was keen to gain a clear understanding of what was changing and get some ideas on how to disseminate this information in a positive way that would engage and enthuse the whole school.

How do we feel about change?

Consider these teachers' responses from our course:

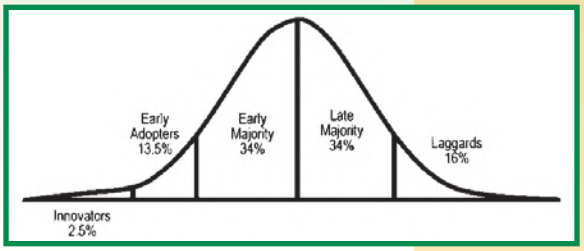


Figure 2 Where is your school in terms of change? (From Rogers, E. M. (1995) *Diffusion of innovations*, 4th edn. New York: The Free Press)

Box 1 Kotter's 8-step process for leading change

Step 1 Establishing urgency
- crises / opportunity

Step 2 Creating ownership
- a team approach

Step 3 Vision and strategy
- what does it look like?
- key strategies

Step 4 Communicating the vision
- taking every opportunity
- role modelling

Step 5 Empowering action
- changing systems
- getting rid of obstacles
- encouraging risk taking

Step 6 Creating short-term wins
- planning wins
- celebrating wins

Step 7 Consolidating gains
- reinvigoration

Step 8 Embedding in the culture

- **Change is natural:** *yes*
- **Change is good:** *well it depends*
- **You cannot prevent change:** *probably not*.

The responses echo those of teachers in primary schools throughout the country. Asked to expand on them, our teachers explained that change that evolves naturally from teachers' reflection on practice, leading to new, interesting and effective ways of learning, is good. On the other hand, change imposed by those distant from the classroom, be they senior leaders or, as is more often the case, politicians, is less good and, at worst, can be downright daft. They feel that it is often ill thought out, impractical and, at best, results in 'reluctant acquiescence': we will do it because we have to, but our heart is not in it. In his book *Leading change*, Kotter (1996) states that 70% of change initiatives end in failure – a point not missed by the staffroom sceptics!

Box 2 Imagining change

1 Imagine that your planned change is working perfectly. In your mind's eye you are in the corner of a classroom observing the new and improved practice.

- Describe what you see – What are the children doing? What is the teacher doing? How are they standing/sitting/interacting?
- What do you hear – from the children and from the teacher? What intonation do you hear in their voices?
- What feelings do you pick up from being an invisible observer in this classroom?

2 Repeat the above, describing what you see, hear and feel from the perspective of the children.

3 Repeat again from the perspective of the teacher.

Change and a new curriculum

So how will colleagues with responsibility for introducing the new curriculum choose to operate? Surrounded with echoing cries of '*They've changed it* all *again!*', how do you move forward?

Of course *all* has not changed, as a careful analysis will demonstrate: facts and progression in learning will not change – children don't learn to run before they can walk and plants won't suddenly not need water in order to grow! The fact that there is a new curriculum creates one of Kotter's eight requisites for successful change, namely **urgency** (see *Websites* and Box 1). The National Curriculum tends to focus on *what* is to be taught but teachers know that it is *how* it is taught that makes a difference.

If we think in this way, the new curriculum becomes a great opportunity to implement more effective teaching, learning and assessment strategies. These are the strategies that the real experts – classroom teachers – know will make a difference.

How can change be made meaningful and productive?

Real change happens twice: once in the leader's head and once in reality. Leaders know that change has to be sold, awareness raised and interest gained before any planned change has a chance. Meaningful change occurs not because leaders say it will, but because teachers make it happen. It is this ability to imagine the changes and to be able to describe how they will benefit everyone involved that creates a powerful force to help make the change successful. The steps shown in Box 2 may help.

You are now in a position to communicate your vision in a way that brings it alive to others. By describing in detail what people will see, hear and feel in the improved situation, *vision* and *strategy* are established and *communicated*. Remember to use the present tense and describe the future as if it is happening now.

This leaves the next challenge of creating *ownership* to kick in.

Establishing a *team* to trial the change is the next priority. It is amazing how much change is attempted in schools without anyone trialling the ideas on a smaller scale – basic science surely? How else do we know whether the change is worth adopting?

Leaders need to support the team and empower their action by encouraging risk taking, without judgement. They need to help the team to overcome obstacles to bring about initial short-term gains that can be celebrated, and built on.

Having shown the change to be worthwhile, leaders should ensure that the improvement is locked in by incorporating the change into their school's systems, such as schemes of learning and the way teachers and pupils behave. This embeds the change into the culture and ethos of the school.

Successful change

Teachers on the course identified the changes they wanted to make and used the 8-step process, and other tools such as the balloon model (Figure 3), as planning guides to help turn vision into strategy. The balloon model involves a simple comparison of your vision with reality (how things are now) to enable you (and perhaps your team) to identify the key strategic areas you need to work on and the main obstacles that need to be overcome.

The teachers also discussed obstacles and possible solutions to the changes they were intending to make (Box 3).

The key to successful change is the rapport that leaders have with their team; this is not the same as friendship, which can be quickly gained and quickly lost. Rapport is a state of mutual respect and stems from the leader taking a genuine interest in what is important and what matters to members of the team. People

understand that self-confidence is important to a leader but they often fail to understand that what is more important is a leader who has confidence in others. A good leader allows others to try their own ideas and supports them when it goes well – and when it does not go so well. Our course at NSLC allows participants to hone and practise these 'people skills' in sessions on coaching and dealing with 'difficult' colleagues.

Impact

Formal feedback at the end of this residential period showed that participants had gained fresh ideas about how to start implementation as well as how to support staff and help them become more confident about change. They also commented that they had benefited greatly from having time for personal reflection, meeting like-minded teachers and knowledgeable presenters, sharing resources and building links. Some even told us that they were returning to school feeling energised!

We spoke again, more recently, to primary teacher, Anna Bentley, about what she has been doing in school since attending this part of the course. She talked enthusiastically about a successful whole-school science enquiry day to assess current standards and identify any gaps in children's knowledge, skills and understanding. Anna then described how individual teachers will be using the findings to inform planning for the rest of the year. She has already started to support year groups, with resources and ideas from the course, to target improving these aspects of working scientifically. Anna was keen to add:

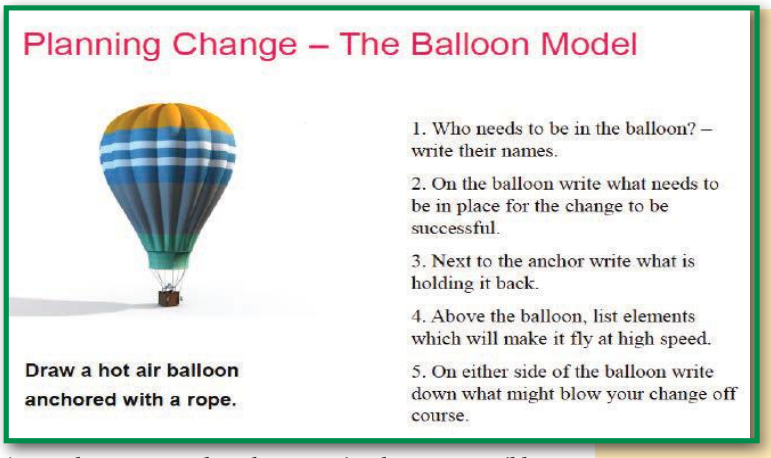
This is the first time we have done anything like this and the feedback from staff and children has been overwhelmingly positive.

This course was unique in the way it encouraged us to build relationships with other attendees and supported us to manage an action research project. We were guided at every step: what change to implement, possible challenges, how to overcome them and how to evaluate its success.

Already looking forward to the second residential period later this year, Anna is just one of the many teachers taking advantage of the Enthuse Awards (see *Websites*), which help to cover the cost of attending continuing professional development courses offered by the National Science Learning Centre.

For further information about this course and others running in the run-up to September 2014, please go to **https://www.sciencelearningcentres.org.uk/cpd/**.

Figure 3 Using the balloon model as a planning guide



Box 3 The teachers' solution planner – obstacles to change and possible solutions

OBSTACLES	SOLUTIONS
Time – lack of INSET/staff meetings on science.	Alternatives to staff meetings: year group trialling; key stage trialling; individual CPD (target it to support year group).
Science taken off School Improvement Plan.	Raise profile: with evidence from Ofsted; seek funding opportunities; science day/week. Put primary science back on the School Improvement Plan.
Other school subjects/issues being given priority over science.	Cross-curricular work. Put in planning. Use science as focus for planning a week.
New curriculum still being altered, even up to September 2013.	Rename topics but with science theme. Use academic year 3013–14 to trial and train. Use it as an opportunity for trying out 'risky' ideas.
Resources and finance.	Look for alternatives: company support; Enthuse Awards; links to secondary schools; free resources (ask volunteers to source and from parents). Buy in theme scheme of work with science as focus. Share/plan as science cluster.
Assessment – how often in science? Is it necessary to have data for Ofsted? Would prefer to do Assessment for Learning (AfL).	AfL to inform teacher assessment. Teacher assessment as summative assessment.

References

Kotter, J. P. (1996) *Leading change.* Boston: Harvard Business School Press.

Pearson Think Tank (2013) *Primary policy watch – signed, sealed and now to be delivered.* Available at: http://thepearsonthinktank.com/2013/primary-policy-watch-curriculum-2014-signed-sealed-and-now-to-be-delivered/

Websites

ENTHUSE Awards: **https://www.sciencelearningcentres.org.uk/about/bursaries/enthuse-awards/**

Kotter's 8-step process for leading change: **www.kotterinternational.com/our-principles/changesteps**

Nicky Waller is an advisory teacher with CIEC Promoting Science based at the University of York. Email: ciec@york.ac.uk
Chris Baker is an independent consultant. Email: chris@mdl-ed.co.uk

Thanks to Anna Bentley from Blenheim Primary School and Children's Centre, Leigh on Sea, Essex.

Figure 1 Making bird biscuits in reception

leading change

Going for GOLD!

Louise Parks describes how she led change in her infant school, including activities and impacts, to achieve the PSQM Gold Quality Mark

PRIMARY SCIENCE QUALITY MARK™ GOLD AWARD

Science has always been a valued subject in our infant school, but embarking on the Primary Science Quality Mark (PSQM) programme in September 2012 has had a huge impact. It has greatly increased parents' awareness of the importance of science in the primary curriculum and has refreshed staff and children's passion and enthusiasm for the subject. Through auditing existing provisions, action planning for development, and training, support and mentoring (helped by the hub leader, Janet Barnett) all the staff have been involved in the process of change and development.

A key part of achieving the Gold Award is demonstrating that the school is involved in science beyond the school gate, as well as sharing good practice with other schools, to support the criteria that '*There is evidence throughout the school and from the wider community that science is valued and enjoyed*'. Our challenge was to build on existing good practice with the links we already had, which included schools in two neighbouring local authorities where I had helped develop their enquiry approach to science. It also meant involving parents and members of the community with science activities.

Some solutions

Developing links with our local residents' association led to a simple project linked to the science topic of 'plants'. The children designed and planted hanging baskets that were then donated to elderly residents with full instructions on caring for them written by the children. This was really thrilling for all concerned.

Parents of reception-class children were invited to bring their pets along to a question-and-

Key words:
CPD
Types of activities

answer session in school when the children were learning about animals. The children found out about the needs of each type of animal and how they were cared for at home. They then 'practised' their skills in a vet role-play area set up in the classroom.

During our 'health and growth' topic, we had a visit from a local dentist and a talk about how to keep teeth healthy. This inspired the children so much that we created 'Daniel Dazzle', a superhero who needed some help at a school we named 'Plaque Primary'. This spilled over into literacy when the children created their own 'healthy teeth' booklets. The children carried out an investigation to find out what the children of Plaque Primary must be drinking too much of to have such rotten teeth. Hard-boiled eggs were use to represent tooth enamel and we observed the effects when they were left in different drinks for a period of five days. The health theme was further enhanced by our school meals provider, who ran a 'healthy food workshop' where children tasted and learned about different fruit and vegetables, encouraging them to try new foods.

I also made links with our local STEM Ambassadors office (see *Websites*). During our fossils topic we were put in touch with an Ambassador who was a geology lecturer. He brought a vast collection of fossils to show and discuss with the children – enhancing the topic by making use of the wider community.

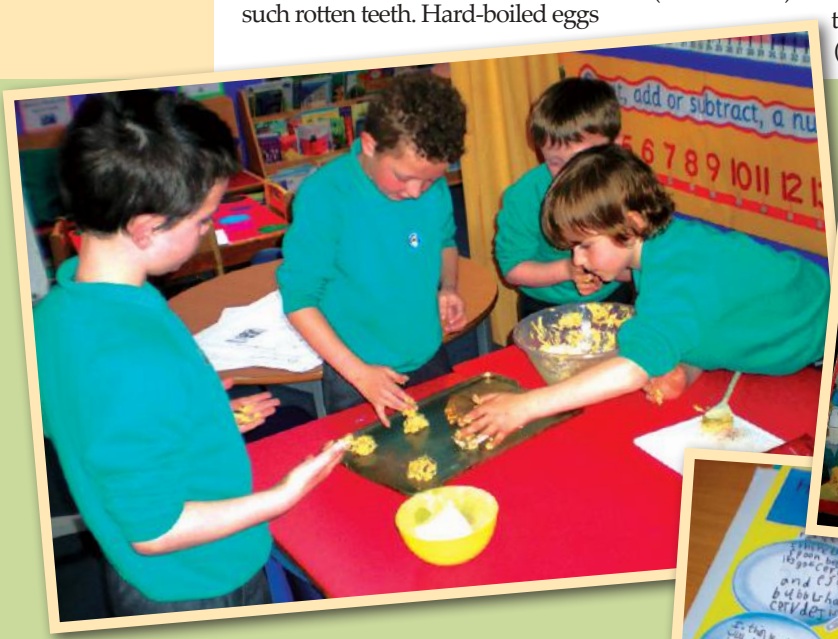


Figure 2 The best chocolate to bake in biscuits doesn't melt – how shall we test this?

Figure 3 The 'big books' have remained a source of inspiration

Biscuits and Bubbles

One of the key events illustrating the impact of working towards the Gold Award was our whole-school science week, loosely based around the theme 'Biscuits and Bubbles'. Our normal curriculum was collapsed, making way for a series of science investigations and 'wow-factor' science activities, such as making simple lava lamps and observing how the liquids react together. There were then activities that led up to our 'Biscuit Day': reception children (ages 4–5) made 'bird biscuits', amending their recipes if the mixture was too sloppy or hard (Figure 1), and year 2 (ages 6–7) explored Ruth Wakefield's accidental discovery (see *Websites*) of the best chocolate to use in cookies (Figure 2)!

Biscuit Day

Biscuit Day was a huge success, with each year group's activity being contextualised to provide purpose.

Nursery children (ages 3–4) helped a pirate discover what happened when he dipped his biscuits in his tea. The teacher supported them in making simple observations and recorded their responses in their 'learning journals' to assess their use of appropriate scientific vocabulary and observation skills.

Reception children (ages 4–5) helped a friend with a new puppy that couldn't eat solid dog biscuits. They investigated which shaped or coloured dog biscuit would be the best to buy, and to soften in milk or water for him to eat. They used a sand timer and recorded their ideas in pictorial form.

Year 1 (ages 5–6) looked closely at different shop-bought biscuits and made predictions as to which would last the longest in warm water, recording their observations in simple written form.

Year 2 (ages 6–7) children met 'Granny Smith', who loves to dunk biscuits in her tea, and conducted an investigation to find out which biscuit would last the longest. They made predictions, discussed how to keep the investigation 'fair' and decided how we could test each biscuit. They ranked five biscuits in the order they thought they would last and gave reasons for their predictions. One child thought it would be a good idea to look at the structure of each biscuit under a magnifier, while others broke up the biscuits to observe the texture and crumbs each biscuit produced. The results were gathered using standard measures and were presented in block graph form, providing practice in maths skills. The children then composed a letter to Granny Smith informing her of the best 'dunking biscuit' to buy.

Other investigations

Two days of the science week were devoted to whole-school investigations, involving all the children from nursery through to year 2. One of these was 'Bubbles'. The nursery children, for example, simply explored ways to make bubbles of various sizes, using a range of tools, and were encouraged to discuss their findings. At the other end of the school, year 2 children carried out an investigation to find the

'bubbliest bubble bath' from a selection of shop-bought bottles and then emailed a hotel to tell them which one to buy.

Impact

The 'Biscuits and Bubbles' days had a huge impact on both staff and children. The staff from each year group worked together to record their results in photographic, pictorial, graphical and written form. These records were then collated into a 'big book' to show the progression of enquiry skills from nursery through to year 2. Careful planning of the skills progression helped staff to focus on the development of enquiry skills at an appropriate level for the children in their class, supporting their own development (Table 1). Crucially, linking the presentation and recording skills back to maths helped staff to see their place in the development of enquiry skills. It also highlighted the importance of being aware of children's ability levels in other curriculum areas that are used and practised in science – a major breakthrough in encouraging all staff to see and become involved in the changes in science in our curriculum.

More importantly, the investigations enthused and excited the children. Even now, six months later, they love to flick through the big book, which encourages discussion about the science that has taken place (Figure 3). Some children even took the investigation ideas home and involved their parents. We received more and more questions and comments from parents about their child's love of science and expressing their amazement at the way the children could explain what they had done.

Science stay and play

Our year 2 parents became highly engaged with the biscuit investigation on the last day of our science week when we held a 'Science stay and play' (a key event providing evidence of science being shared and enjoyed beyond the school door). Families were invited to bring their homemade biscuits to the event and have them tested (as fairly as possible of course!) to see whose could be dunked the longest in tea without collapsing, with a prize for the 'best dunker'.

The afternoon started with a brief presentation, sharing photographs and work from investigations and activities that had taken place during the week. This led onto a range of practical science activities with clear instructions and some science learning for mums, dads and families. These ranged from making bath bombs, observing the effects of absorption by making floating flowers that open to reveal a bug inside, to making different lengths of straws into simple oboes and comparing the results.

A popular activity with the parents that afternoon was working in our 'Science Lab'. This area was developed in our usual role-play area, after the School Council expressed the view that they wanted '*to do more science activities*'. A good root around in the science cupboard revealed a variety of resources, simple to use and engaging for the children to investigate with independently. Again, the area has promoted enthusiasm and raised the profile of science, with children becoming highly engaged with resources that they would not usually access regularly, such as simple microscopes, toy gyroscopes and old favourites such as magnifiers to look closely at animal skeletons.

Table 1 Progression planning grid for 'Biscuits'

Year/ level	Investigation	Change	Observe/ compare/ measure	Present data
Nursery Pre-NC	**Pirate Pete likes to eat his biscuits soggy. Which ones should he buy?** Testing a range of biscuits to see what happens when they are soaked in water or milk to find the biscuit that goes the softest/soggiest. Encourage and record the use of language to describe the changes – what happens when the food is left in for a short time, longer time or put into warm water?	Object/ property	Direct comparison – e.g. bigger smaller, more/less, soggy, dry	Observations, verbal presentation of ideas, photographic evidence, possibly pictorial (drawn by the children) or even simple written form (more able Reception?)
Reception Pre-NC	**Which dog biscuits?** Someone has bought a new puppy and he can't eat dry dog biscuits yet! Which dog biscuit would be the best to buy to soften in milk or water so he could chew it?	Object/ property	Direct comparison – e.g. bigger/smaller, more/less, soggy/dry, warm/ cold	
Pre-NC	**Which biscuit will make the best 'dunker'?** Testing a range of supermarket biscuits, predicting which will be the best, looking for simple commonalties between the best ones. Using sand timers to 'dunk' the biscuits for a given time; making simple predictions after testing and looking at each biscuit carefully	Object/ property relating to object	Using standardised ungraduated instruments, e.g. sand timers, as well as non-standard units to find the size of biscuits and compare them.	Pictorial, photographic, written, verbal explanations, simple tables and bar charts
Year 2 Level 2–3	**Which biscuit will make the best 'dunker'?** Testing a range of supermarket biscuits, predicting which will be the best, looking for simple commonalties between the best ones; measuring how long they can be 'dunked' before they go soggy using standard measure; presenting information in a block graph	Object/ property relating to object	Standard units – e.g. timers with minutes/ seconds, reading scales to the nearest division	Bar charts, tables, written, photographic

Our 'Budding Scientist' gallery within the lab, with photographs and mini articles written by the children about science experiences they have had at home, has encouraged others to try out and share science activities.

Parents not only gained an insight into our science curriculum and the level at which the children work with science topics in this age range, but thoroughly enjoyed taking part in their children's scientific experiences and learning. They loved sharing in their child's science successes in the final award ceremony, where we celebrated, among other achievements, excellent predicting skills, enthusiasm for the subjects, high levels of scientific knowledge and working well in teams.

Reviewing change and celebrating success

The examples above are just a snapshot of developments that have taken place in our science curriculum across the academic year and with our forward planning for the introduction of the new National Curriculum. 'Biscuits and Bubbles' is an excellent example of how the new curriculum will provide a more flexible way of working with a strong focus on developing 'working scientifically'.

The impacts of change and the success of achieving a Gold PSQM Award are far longer lasting. Staff, children, governors, parents and our local community are now much more aware of the excitement and enjoyment generated by primary science in our school and its capacity to help children develop into independent learners and thinkers, to allow practise of cross-curricular knowledge and skills and to enthuse and engage children in learning and finding out more.

Make as many links as you can with other science leaders and teachers from neighbouring schools. Share ideas, successes and links to provide a bank of resources to call upon. Embarking on the PSQM and networking with other schools participating in the programme was without doubt an excellent way to enrich and improve my knowledge and practices as a science leader. In fact, the whole experience led to gold!

Websites

Ruth Wakefield: **www.women-inventors.com/Ruth-Wakefield.asp**

STEM Ambassadors: **www.stemnet.org.uk/ambassadors/**

Primary Science Quality Mark: **www.psqm.org.uk**

Louise Parks is science leader, maths specialist teacher and KS1 leader at Lumley Infant and Nursery School, Chester le Street, Co. Durham. She is also a local authority advisory teacher and recent winner of the Primary Science Teaching Trust Teacher of the Year Award. Email: l.parks100@durhamlearning.net

leading change

Figure 1 Photocall for our school science ambassadors!

YOUNG 'SCIENCE AMBASSADORS' raise the profile of science

Katie Ridley appointed children as 'science ambassadors' and raised the profile of science across her school

Key words:
Types of activity
Ownership
Creativity

The inspiration for 'science ambassadors' came to me after embarking on the Primary Science Quality Mark programme (www.psqm.org.uk). The initial interviews with the children started me thinking about their perception of science. Many claimed that they did not do science very often, but examining written work and displays around the school and talking to other teachers suggested that this was definitely not the case. I realised that science was just not recognised as such by the children. They talked about scientific experiments they had done but did not mention topics they had covered such as 'teeth', 'light and shadows' and 'adaptation'. I knew then that I needed to do something to raise the profile of science across the school. I needed the children to know when science was taking place and to understand that science was not all about making a mess or using a stopwatch!

This seemed a huge undertaking and as I continued on my PSQM journey, it became apparent that this was something not to be done alone. The whole process was about working as a school to raise the profile of science. I had initially worked on getting the teachers to help. We had written our own set of science principles, agreed what a 'good' science lesson looked like and that a scientific investigation would happen within each topic. While all of these things would certainly help, I felt it was also important to involve the children more in the running of science across the school.

Appointing the science ambassadors

I came up with the idea of science ambassadors as I thought that it would create a sought-after role within the school. Children who were selected would receive a clipboard and a white lab coat, complete with school logo and the title 'science ambassador'. The lab coats were to be worn by the children whenever a science lesson was taking place and they were to gather evidence (a science skill!) to be able to report on science activities in the school in termly meetings with me. I knew that all these features would appeal to the children and would give the role of the ambassador a high status across the school (Figure 1).

To introduce the science ambassadors we held a special assembly, all about science and the ways in which science influences our everyday lives. The ambassadors were called to the front to receive their clipboards and white lab coats. Two children from each class, from reception (ages 4–5) to year 6 (ages 10–11), were selected to take on the role. These children were chosen because they had shown an interest in science and were good role models within the class. They immediately felt very special: '*I feel like a real scientist*' said 5-year-old Scarlett.

Initially I was hesitant about dressing the science ambassadors in white lab coats as I felt this was a little too stereotypical. In the interviews the children had already expressed the view that science only happened when they were doing experiments and I did not want to reinforce that belief. However, the presence of the ambassadors in their lab coats has provided a real signal to the class that the lesson they are doing is 'science'. Some children have been quite surprised to learn that areas such as 'teeth', 'plants' and 'habitats' are all 'science' (Figure 2). It seems that they did have a stereotypical view that science was '*doing experiments*'! Now, when I ask, children tell me that they do '*loads of science*'. I don't think that the quantity of science lessons has increased over the year, but the children are more aware when they are involved in a science activity. The ambassadors love wearing their lab coats in the science lesson and feel a great sense of pride and importance as they know that they will have to report back on whatever science activity is taking place.

Figure 2 When are we doing science?

The science ambassadors' role

The science ambassadors wear their lab coats whenever science is taking place. They have a special report card to complete, detailing the lesson and identifying learning that has taken place. The younger children can record by taking photographs and, at our science ambassador meetings, they all discuss what learning is taking place.

It has been lovely to witness the children talking to each other about what they have done and sharing the joy and excitement that good science lessons bring. As a science coordinator, this has given me an invaluable insight into, and understanding of, the science teaching that is taking place across the school. I feel that if a child did not have anything to report to me on a termly basis, then I would be able to speak to the class teacher to find out why this was the case. It hasn't happened yet.

The photographs that the children take have formed a great portfolio of science across the school and this has saved me the termly job of asking teachers for photographs of science, waiting to receive them and then collating them all (usually late one evening!) into a portfolio.

Expanding the role – lab technicians

More recently, I have involved the year 5 and 6 (ages 9–11) ambassadors in the organisation of our science resources. They helped me to sort out and label the science area and have become responsible for assisting teachers in setting up the classroom for science investigations (Figure 3). This additional support has really helped the teachers in their lesson preparation and some have commented that they are doing more science investigations because '*they are easier to set up*', so removing one of the barriers to practical science.

Science week

The science ambassadors were also a great asset during science

Figure 3 Our junior 'lab technicians' have enjoyed their role and proved very helpful

Figure 4 The science ambassadors proudly displaying some of the school's work in Science Week

week. They were consulted about the types of science that they wanted to see being done, the visitors they would like to invite, and where they would like to go. Finally, they were involved in helping me to display all of our work (Figure 4). They wore their lab coats all week and visitors to the school recognised that these were 'special' children and asked them to explain their role. The children loved all this extra attention and were very keen and proud to discuss their role.

The future ...

New ambassadors have been selected for this academic year. It was lovely to see how keen all the children were to be given the role. This gave me the assurance that the role is highly desirable and sought after within the school.

I would like to use the ambassadors to develop the science section of our school website. I am going to use the termly meetings to teach the children how to upload photographs and create web-links. Further to this, I hope to teach the ambassadors to use the school's tablet computers to create videos of specific science topics. My plan is to upload these to the school website and give each video a QR code that can be stuck into children's books so that parents or visitors to the school will be able to watch the children enjoying science lessons.

I am incredibly proud of the science ambassadors and I believe that they have made a very positive contribution to helping me raise the profile of science across our school. I am even more thrilled that it is the children who have made this happen.

Katie Ridley is science coordinator at St Gregory's Catholic Primary School, Liverpool. Email: katie.ridley@yahoo.co.uk

leading change

'I would always find some useful idea or investigation that I could take back to my classroom'

WHAT HAS THE ASE DONE FOR ME?

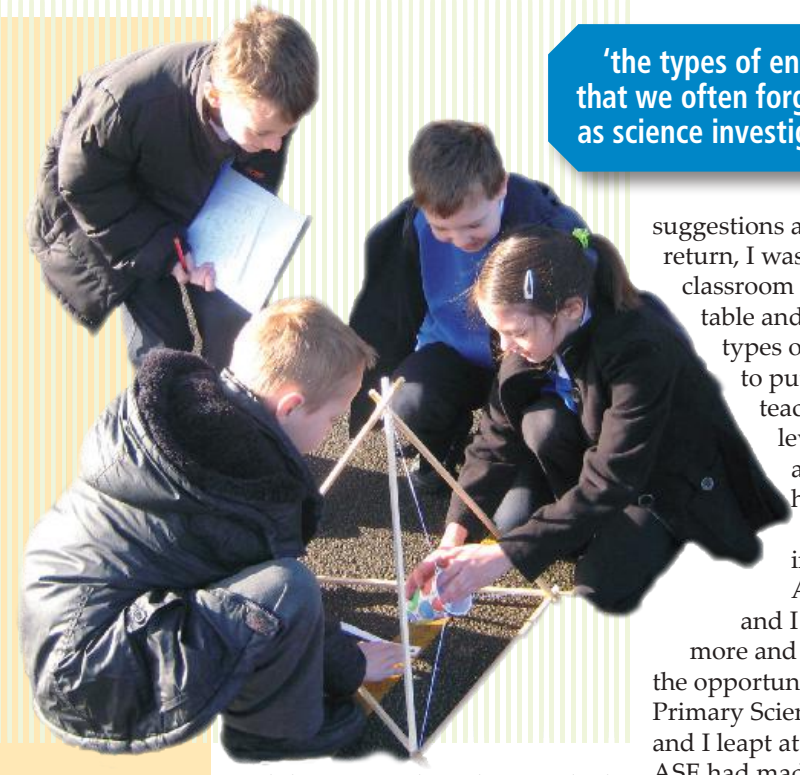
Lisa Newton, an ASE Primary Science Committee member, considers the benefit she has gained from joining and taking an active part in the ASE

Before 2007 I knew very little about the Association for Science Education (ASE), other than that it held a conference every year in January. Time and time again at coordinator meetings the science adviser would encourage us to become members of the ASE. '*What's the point?*' were my initial thoughts, '*What will it do for me?*' With a limited school budget, I was very reluctant to spend part of my science allocation on joining an association when I could be using it to buy much-needed classroom resources!

In 2007, however, all this changed as it was the year I became a primary science Advanced Skills Teacher (AST) and won one of the AstraZeneca Science Teaching Trust (now the Primary Science Teaching Trust) Teacher of the Year Awards. The award was presented to me at the ASE conference in Liverpool and as part of my prize I received a year's free membership, so beginning my relationship with the ASE.

During that year, I slowly began to realise what the ASE had to offer me, as a primary practitioner. Every few months, a copy of *Primary Science* would drop through my letterbox and, as I flicked through the pages, I would always find some useful idea or investigation that I could take back to my classroom or share with a colleague at one of the schools I was working with. The culmination of that year saw me attending the ASE conference yet again, but this time for a full four days. During that time, I attended numerous workshops and talks, explored all of the

Key words: CPD



'the types of enquiry that we often forget about as science investigations'

exhibition stands and networked with like-minded teachers and professionals. I left the conference with my head crammed with ideas on how to take primary science forward, not only in my school, but within other schools in the London borough where I worked.

Becoming an active ASE member

My AST line manager, Des Dunne (an active member of the ASE), encouraged me to attend some of the events put on by my local ASE section in north-east London and, before I knew it, I was nominated and elected as the committee secretary!

For three years I attended regional meetings, fed back information to my local section and helped to organise a number of different local events. These were well attended and provided good-quality professional development to other teachers.

In turn, this began to influence my own science practice back in the classroom: I was able to see the 'bigger picture' and, through attending the meetings and networking closely with other ASE professionals, I found that I was more knowledgeable about my subject and how best it should be led in school. At my fingertips, I had a group of people who I could turn to for ideas, suggestions and resources. In return, I was able to bring my classroom experience to the table and help identify the types of event we needed to put on to support other teachers. Even at this level, the networking and sharing of ideas had impact.

As my involvement with the ASE strengthened and I began to know more and more members, the opportunity to join the ASE Primary Science Committee arose and I leapt at the chance: if the ASE had made such a difference for me so far, how much more could it do for me if I increased my engagement? The timing coincided with the Government's decision to end the AST category and with my personal decision to move out of London and up to Cumbria – what did I have to lose?

At that time, I was worried about the future of science in the primary curriculum and how I was going to be able to ensure I was kept up to date with developments in primary science. How could I make sure the children I was working with were receiving the best possible science experiences? In schools, we were in curriculum limbo, unsure of whether or not science was still a core subject because of the apparent conflict between head teachers' ideas and what the Government was saying. Budgets had been cut and, as a result of the science standard assessment tests (SATs) being abolished and in the face of continuing pressure to improve maths and literacy results, it was fair to say that science was not a pressing concern for many head teachers. I was dismayed about the prospects for primary science and was really worried that I would no longer have access to training and resources or have any influence on how science should be taught in the classroom.

The work of the ASE Primary Science Committee

At the Primary Science Committee meetings I was relieved that I was finally able to air my concerns to an audience that listened. More than ever, it was essential that teachers had access to high-quality training and resources and I quickly learnt that these were high priorities for the committee. For example, as I started my committee membership, several other members were just finalising the publication *It's not fair – or is it?* (Turner *et al.*, 2011), a practical and easy-to-use resource that looks closely at progression in all areas of scientific enquiry. It particularly focuses on the types of enquiry that we often forget about as science investigations. I was very encouraged by this because, not only did I have a useful resource that I could take back to school and share with my colleagues, I was also confident that there were people out there who were clearly passionate about ensuring science was taught well in schools.

The Primary Science Committee also worked hard to raise the profile of primary science at the ASE annual conference by changing the programming of the primary workshops and lectures to ensure that they had a much bigger presence and were more accessible for primary members. This was hugely successful and the primary programme has now become a much more significant part of the conference.

We were also able to have significant input into the new National Curriculum for England, as we were asked to comment on the initial draft and make suggestions. The ASE is clearly a respected body and has the power to really influence Government decisions. Not only did we make suggestions, but these were listened to! Key members of the Primary Science Committee were directly involved with the Government reviews of the science curriculum, ensuring that enquiry/working scientifically became the key focus – as it

should. Similarly, in the time I have been on the committee, we have also put forward a response, in partnership with other bodies, to the initial consultation on assessment, which we know is a key concern for primary teachers in England. This was informed by the Nuffield Project on assessment in primary school science, led by Professor Wynne Harlen, with Jane Turner (curriculum adviser to the Standards and Testing Agency for KS2 science) representing the ASE.

Committee members represent all parts of the UK and have also engaged with recent consultations about curriculum change and implementation in Wales, Scotland and Northern Ireland.

The Primary Science Quality Mark (www.psqm.org.uk) is another initiative supported by the committee. This award scheme was designed to develop and celebrate the quality of science teaching and learning in primary schools and has been very successful in doing so. Since its inception in 2008, 830 UK schools have achieved the award and another 470 schools are currently working towards it. Although I have not yet had the opportunity to apply for a PSQM award, this is something that is definitely on my to-do list. It is yet another example of the way in which the committee works hard to raise the profile and improve the practice of primary science, both in schools and nationally.

My involvement

In no way can I take much credit for any of this work. Far more qualified practitioners than me on the committee, such as Brenda Keogh (sadly missed now) and ex-chair Anne Goldsworthy, have worked tirelessly on behalf of the ASE members. As a result of their hard work we now have a much-improved primary science curriculum. What I have been able to do, however, is to put forward my views and experiences as a current practising classroom teacher. As a busy year 6 (ages 10–11) teacher trying to ensure that every one of my pupils will make at least two levels progress in maths and literacy, in the face of higher demands from Ofsted, science can sometimes be the last thing on my mind. I have therefore been able to emphasise that changes that are put in place need to be purposeful, effective and teacher friendly. They need to be changes that schools can access and work with easily and that will have a positive impact on the children's learning. Without this, they will not work. The committee has listened to these points and made sure that the ideas put forward by the ASE are the views of teachers and not just people sat in offices.

'How could I make sure the children I was working with were receiving the best possible science experiences?'

So what has the ASE done for me?

On a personal level, it has provided me with support: access to resources and training that I would otherwise never have had. Through networking, reading *Primary Science*, having access to discounted resources and being on the Primary Science Committee, I have had the privilege to learn from highly influential and experienced practitioners who have inspired and educated me, impacting positively upon my practice in the classroom.

On a professional level, the ASE has given me the assurance that what I am doing in my school and what I am advising my colleagues and even my own head teacher to do, is the 'right thing'. We are not just making decisions because we are frightened of what Ofsted may think; we are making our decisions based on the collective experience and advice of a body of science education professionals.

Sometimes, as classroom teachers, we get so snowed under by the everyday things we need to do, such as marking, planning, organising trips, teaching engaging lessons, attending meetings and so on, that we forget about the world outside the classroom and can feel quite isolated. Time and again, we hear in the news about changes that the Government proposes to make to the teaching profession and it is easy to become quite cynical. In this professional climate, it is good to know that there are organisations actively working towards improving education by supporting change based on the experience and knowledge of those who know best – teachers. Organisations such as the ASE are really fighting behind the scenes to help ensure that children have the best learning experiences possible and to shape our education system for the better. They are leading the changes that we are asking for and need. For these reasons, I am proud to be a member of the ASE and am actively encouraging the other science coordinators and teachers I work with to become members too.

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Lisa Newton is a teacher and member of the ASE Primary Science Committee.
Email: lisahwood@hotmail.co.uk

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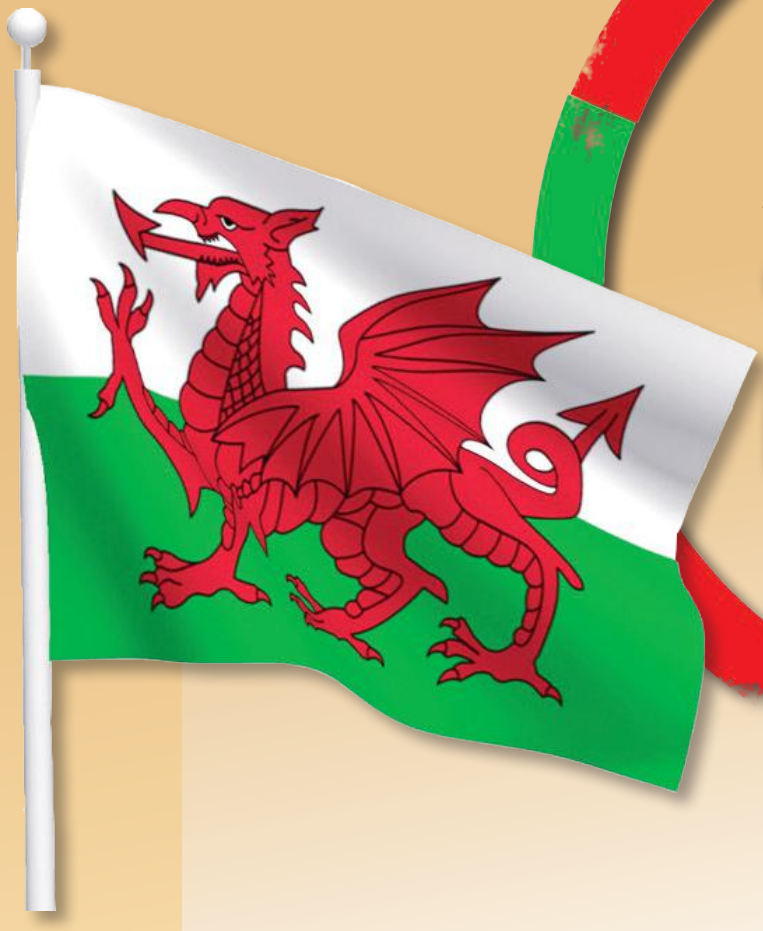

Curriculum change and raising standards:

THE WELSH PERSPECTIVE

Key Words:
CPD
Nature of science

Richard Watkins

highlights some of the key ways forward identified by inspections in Wales

The 2008 science curriculum for Wales marked a landmark change in the way teachers planned and delivered science in primary schools (DCELLS, 2008a). It was at the vanguard of the more pupil-centred style of curriculum planning and pedagogy that supported the dual initiatives of improving the quality of assessment for learning and thinking skills in all schools.

The key changes in the 2008 curriculum included:

- **the removal of science as a statutory subject in the foundation phase (up to 7 years of age);**
- **a significant reduction in the quantity of content knowledge (range) prescribed in the new key stage 2–3 (ages 7–14) orders;**
- **an increase in the focus on teaching and assessing science enquiry skills in all key stages;**
- **a consolidation of science assessment into three new sections in key stages 2–3: plan, develop and reflect;**
- **a removal of the requirement to report progress in science in the foundation phase.**

What were the challenges?

The challenge for schools and local authorities was to align both curriculum planning and pedagogy to reflect both the requirements and the ethos of the new curriculum. This included a renewed focus on improving the effectiveness of formative assessment and thinking skills in schools (a programme that had commenced several years earlier). There was also an indication

from the Welsh Government that schools were now free to organise and deliver the curriculum in a manner appropriate to their learners (DCELLS, 2008b). A number of local authorities invested resources into creating thematic-based schemes of work that integrated science into topics. There was wide variation in the response of schools to the dual challenge of curriculum and pedagogical change, including:

- **retaining existing curriculum planning in science and simply refining the range and skill content accordingly;**
- **creating new science schemes of work based on the 2008 orders;**
- **creating new thematic-based schemes of work integrating principles of thinking skills and assessment for learning.**

Although running concurrently with the curriculum changes post 2008 (and promoted as an integral part of the Government agenda to improve standards), many schools approached the 'curriculum' and 'pedagogical' changes as mutually exclusive tasks. In many cases, the result was a lack of a clear focus – at both school and system-wide level – as to what was the most important factor affecting standards in science in Wales: curriculum or quality of teaching and assessment? In some schools the reduction in range of content alongside a new focus on 'learner-centred' teaching led to an unfortunate reduction in both the quantity and quality of pupils' scientific work.

Science was now commonly encountered integrated into thematic planning. In the hands of skilful teachers, thematic integration enhanced the quality of scientific experiences and learning. However, poorer quality thematic planning, frequently characterised by weak subject linkage and poorly developed enquiry skill development, often resulted in insufficient opportunities to ensure progression in both science enquiry skills and content range. Reservations about the quality of pupils' skill development in the post-2008 curriculum were reinforced through a critical report from Estyn, the schools' inspectorate in Wales (Estyn, 2011), citing fault lines between subject delivery and generic skill development.

More recent reports

In June 2013 Estyn published a thematic review into the standard of science in Welsh schools in key stages 2 and 3 (Estyn, 2013). Although the report found that the majority of teaching and learning observed was good or better, it identified some key concerns, namely:

- **the lack of challenge for more able pupils and a decline in the proportion of pupils achieving the higher level attainment (level 5 and above);**
- **shortcomings in the assessment of science in nearly all primary schools, including doubts over the reliability and validity of teacher assessment judgements, compounded by a lack of external verification and unclear assessment criteria;**
- **curriculum planning lacking structure and challenge in a minority of schools, including insufficient opportunities for pupils to use and apply their scientific knowledge;**
- **insufficient teaching time in primary schools that allocate one hour per week to science;**
- **only half of primary schools having a clear vision for the subject in their school;**
- **insufficient support for science from local authorities and/or regional consortia.**

It is now a significant challenge for schools in Wales to respond to the recommendations of this report. Recent reforms to the education system have removed nearly all subject-based support and now place a heavy reliance on school-to-school support networks. Since 2011, Welsh education policy has been fixed upon a rapid response to the PISA agenda, including improving standards in literacy and numeracy together with corresponding statutory testing of these. Proposals for a new skills-based curriculum in 2015 are focused around literacy, numeracy and wider skills.

Quite how Welsh schools respond to the challenges laid down in this Estyn report may be determined more by the nature and shift in educational policy in Cardiff Bay than by the need to improve and nourish this most essential aspect of the curriculum.

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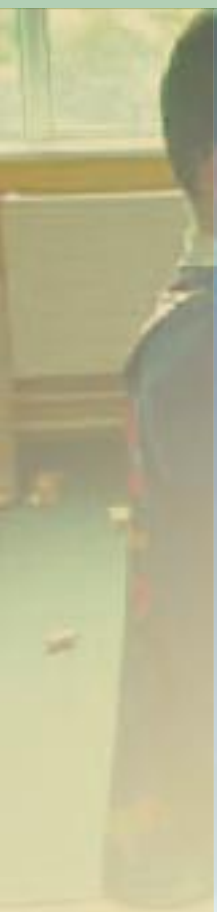
Richard Watkins is a System Leader (Adviser) in the North Wales Regional School Effectiveness Service. Email: richardwatkins@gwe.org.uk



leading change

What does OFSTED say?

Tara Lievesley discusses the challenges and development points offered by the 2014 triennial report from Ofsted

Key words:
CPD
Nature of science

In 2011, Ofsted produced its triennial report, *Successful science* (Ofsted, 2011), celebrating the successes of science in English schools over the previous three years and informing us of what things needed to be addressed, such as:

- lack of specialist expertise among teachers, both in subject knowledge, particularly physical processes, and in skills, which has the knock-on effect of limiting the progress of more-able pupils;
- lack of continuing professional development (CPD) for teachers, particularly for subject leaders;
- practical lessons that develop skills;
- pupils not being aware of the next steps they need to make in order to progress, particularly in skills where assessment is not well developed.

The Primary Science Quality Mark (PSQM, www.psqm.org.uk) was highlighted as helping to address many of these challenges. Ofsted noted the impact the PSQM was having on raising the profile of science in schools and providing a clear framework to bring about change and improvements. It was also helping with the increased focus on enquiry in those schools taking part in the scheme.

Now, three years on, have the challenges changed? Have we cracked these issues and has Ofsted noticed other areas we need to work on? The latest report, *Maintaining curiosity* (Ofsted, 2014), raises some similar and some new concerns, such as:

- ensuring that enough time is provided to teach the science curriculum and that the curriculum is covered in full;
- ensuring that the provision of science increases;
- providing pupils with opportunities to plan and carry out their own ideas;
- making relevant links to real life, particularly bringing clear links to literacy or numeracy as pupils make more progress in both subjects when this happens;
- providing CPD for subject leaders and teachers;
- making more rigorous assessment judgements;
- providing enough challenge for more-able pupils;
- bringing assessment into line between schools, as there is disparity between schools and the time and focus on it.

In fact, the report's title says a lot about science: *Maintaining curiosity*. We need to work hard to make science increasingly more enquiry based and to allow time for our pupils to be curious, to explore and to try things as they go through their lives. Once children are given these opportunities, it is often 'maintaining energy' that is required, as one colleague put it!

Status of science

Science is a core subject in England. Full stop. It has been since the National Curriculum was set out in 1988 and is still a core subject in the new curriculum about to become statutory in September 2014. But senior leadership teams (SLTs) in schools are not ensuring it is covered fully or with enquiry at the heart of planning and teaching. Is this the 'fault' of the new wave of cross-curricular or thematic planning (often called creative, but you don't need to be cross-curricular to be creative!)? SLTs need to encourage teachers to allow time for children to be curious. This often looks like 'not doing much' but thinking time is so important if you are going to make sense of the world around you – consider your own actions when faced with a new mobile phone: do you use it competently straight away, or do you 'play' and explore first?

However, it was noted in the report that meaningful links, particularly to literacy, enhance the learning and progress in both subjects, perhaps helping to dispel the myth that some pupils and teachers have about science being about writing up reports. Indeed, the writing should be focused, particularly on the analysis and evaluation, not just an instruction-writing exercise.

Science has lost out in terms of provision, particularly since the demise of the standard tests in 2009. While it is good to be able to focus on skills rather than jumping through the testing hoop, this has allowed literacy and numeracy to become even stronger, with science sometimes relegated to a poor slot somewhere in the thematic curriculum and, when it doesn't fit a theme, being sidelined even further. Obviously this is a worst-case scenario and is not the case everywhere.

Ofsted is also concerned about an over-reliance on published texts, where the planning for enquiry has disappeared as the 'activity' is taken from the scheme of work – planning has become perfunctory. This leads to pupils not being able to be more independent, thinking and doing for themselves.

A further point made in the report relates to the use of 'fair testing' and how some experiments and activities should be about elicitation of knowledge through exploration, rather than formulaic practicals. More time needs to be given to pupils to practise their enquiry skills, particularly in evaluation and analysis, in order to learn from mistakes.

Continuing professional development

CPD is still an issue and what is concerning is that it is the subject leaders who are not receiving training in order to improve leadership of their subject. This may be linked to SLTs not giving science the focus it deserves, but also to local authorities cutting back on staff, be it consultants or advisers, or their leading teacher programmes. Does this mean that this will continue to be an issue in future reports?

There is the added complication that in many schools the role of subject leader for science is not constant, hampering development of the leader and their impact. So what can we do for ourselves? The simplest thing is to make links with other subject leaders. Email colleagues and have an informal 'tea party' type meeting – it doesn't even have to be in school if the local café is more convenient. PSQM continues to develop science leaders, with its hubs and hub leaders, and there are independent consultants out there who can help. The Science Learning Centres are still in operation, although they have undergone cutbacks as well. Then there is the PSTT (Primary Science Teaching Trust, www.pstt.org.uk), which runs a series of clusters designed to bring like-minded teachers together to support each other with the help of professionals, working on a project that the trust funds.

What about assessment?

This is the six-million-dollar question, particular for the new curriculum. The report states that, while attainment has risen marginally, there is an issue with the 'levelling' of pupils, with some published materials meaning that the 'levels' awarded are too high, particularly when compared to secondary school expectations.

Assessment is such an issue because, if enquiry is not built into the heart of it, then progression is hard for pupils and teachers alike. Ensuring pupils know what they need to do next in order to achieve is paramount; otherwise attainment will be low. However, not only do the tools need to be provided for teachers to make judgements and provide feedback to pupils, but there needs to be CPD for teachers to help them apply these rigorously and consistently, so avoiding the disparity between schools.

It seems that England is not alone in having this problem. Judging from the ASE conference talks, workshops and events focusing on enquiry rather than knowledge, and on ways to assess these skills and help pupils make progress, these are also key issues in many other countries.

Comparison to the Estyn report

It may feel from reading the Ofsted report that England has a long way to go to get science 'right', but when compared to one of our sister countries, Wales, it makes for interesting reading. Wales has already changed its curriculum, but some of the same points for development are made in the recent Welsh inspection report (Estyn, 2013) as in the Ofsted one, such as the amount of teaching time. For Wales this links to thematic planning – is this the same for England? We will need to ensure that, with our new curriculum, we make any cross-curricular planning rigorous for all subjects involved, but particularly for science.

With the increased focus on literacy and numeracy, both reports also note that science has lost status. Both England and Wales have a hard task ahead in tackling science in the face of trying to raise attainment in these other two subject areas that dominate the curriculum. No government, it seems, wants to be bottom of the international PISA 'results tables'!

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Tara Lievesley is a primary science education consultant and Editor of *PrimaryScience*. Email: tara@makingitpractical.com

leading change

Teachers attending a PSTT cluster meeting

PSTT... HAVE YOU HEARD?

Key words: CPD

Kathy Schofield explains how the Primary Science Teaching Trust came into being and how it continues to enhance science for primary teachers and children

The Primary Science Teaching Trust (formerly the AstraZeneca Science Teaching Trust) provides financial assistance to help improve the learning and teaching of science in the UK. The Trust was established in April 1997 as an independent charity operating with a substantial trust fund donated by AstraZeneca PLC. Its name was changed in 2013 to the Primary Science Teaching Trust (PSTT). The Trust provides financial assistance, via projects and other means, to improve the teaching and learning of science in primary schools. Since its inception the Trust has funded over 100 projects and invested over £5,000,000 in UK science education. It is now one of the major voices in the area of primary science teaching and, despite the focus being on UK teaching, it has developed an international reputation and it is still developing and growing in order to continue with its original aim.

The Trust has also sponsored the annual Primary Science Teacher of the Year Awards since 2002, which recognise excellence in primary science teaching.

Back to college

When the current director, Dudley Shallcross, Professor of Atmospheric Chemistry at Bristol University, took up his post in 2010, the Trust took on a new direction and strategy. He began by establishing the Primary Science Teacher College, which drew together past winners of the Primary Science Teacher of the Year Award into a virtual college. All new winners of the award automatically become fellows of the College; teachers who have held the status of Advanced Skills Teacher (AST) can now

also become members.

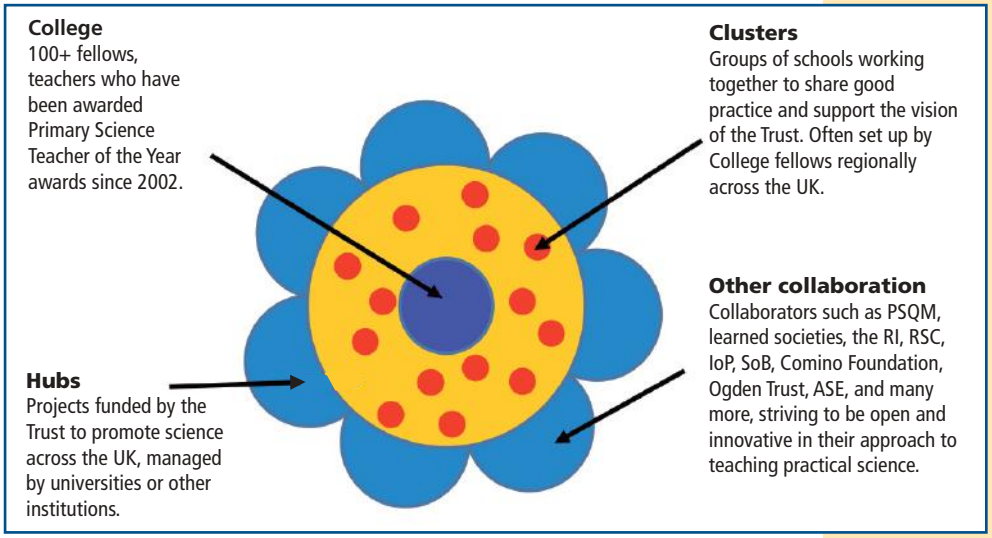
The College has its own annual conference, web area and, most importantly, its own funding from the Trust, so that these excellent teachers can develop new projects, undertake professional development and disseminate best practice from their own teaching. Some fellows are involved in larger projects with other institutions or partners that are also funded by the Trust.

What the Trust does now

In 2013 the Trust was rebranded and the new Primary Science Teaching Trust (PSTT) was launched at the ASE summer conference. Since that date the work of the Trust has changed direction. Instead of funding large projects, often submitted by large institutions with a research focus, the main focus now is mainly through the primary sector using the model of clusters and hubs (Figure 1, Boxes 1 and 2). The importance of the College has been further reinforced by partnerships with learned societies and other trusts. The College fellows are endorsed by these societies and are becoming increasingly involved in supporting these partners to develop their connections with primary science teaching and learning. The Trust has a clear vision for the future based on a strategic plan:

To see excellent teaching of primary science in every classroom in every

Figure 1 How the PSTT now focuses its energy and funding



Box 1 What it means to be a PSTT hub

PSTT are supporting the development of seven hubs spanning the UK. Hubs are usually found in higher education institutions and benefit from a three-year relationship with the Trust. Each hub is quite distinct, but all share the core purpose of supporting the Trust in achieving its mission of '*every teacher in every school offering high-quality primary science teaching and learning to their pupils*'. Here are a couple of examples of PSTT Hubs in the making.

The Bath Spa Hub

The Centre for Research in Early Scientific Learning (CRESL) at Bath Spa University consists of a team of researchers who work with schools to develop primary science. Its extensive links with schools across south-west England, through teacher-training partnerships, provide opportunities for research and professional development that can then be disseminated more widely.

The focus for this hub is the Teacher Assessment in Primary Science (TAPS) project. TAPS aims to synthesise an approach to teacher assessment that supports both formative and summative assessment of skills and knowledge. It will meet the requirements of the revised National Curriculum in England and exemplify 'best practice' across the UK and internationally.

The approach will be developed and tested with a cluster of 12 schools over a three-year period. In addition, the project will draw upon the expertise of the Primary Science Teacher College and Primary Science Quality Mark (PSQM) schools. Through the creative application of e-portfolio technology, TAPS aims to design with teachers and children an approach that meets the key criteria of validity, reliability and manageability.

The University of Manchester's Science Education Research & Innovation Hub

Based within the Faculty of Engineering and Physical Sciences and directed by Dr Lynne Bianchi, the PSTT is based within a larger hub which aims to enrich the opportunities for collaborative activity between primary and secondary schools, university researchers and a range of educational partners. PSTT activity dovetails into work with other partners such as the Comino Foundation, The Ideas Foundation, The Expansive Education Network and Huthwaite International. The purpose of the hub is to:

- develop effective teachers and communities of practice working on enhancing science and engineering education in primary and secondary schools;
- explore models of continued professional development of teachers;
- contribute to the understanding of effective pedagogies for teaching, learning and assessment of primary science and engineering through academic publications and dissemination routes;
- help motivate young people about further study and careers in STEM subjects;
- capitalise on and promote the expertise and partnerships offered within and beyond the University of Manchester, as a means of profiling its work and achievements.

This hub's work champions innovative curriculum development undertaken with teachers and related research in primary science, with associated links into engineering education at primary level. Its main mission is to engage children, their schools and their local communities in real and relevant science experiences from an early age. A variety of innovative projects, such as Scientific Weaving and Smart Scientists, provide opportunities for teachers to partner with leading university researchers, encouraging us all to really push the boundaries of primary science teaching and learning.

School partnerships are at the heart of the work of this hub, often being realised through short-, medium- and long-term research and innovation curriculum development projects that enhance the opportunities for teachers' professional development. Associated academic research adds rigour to the activity being undertaken.

Box 2 Collaboration

PSTT has joined forces with the learned societies to assist teachers to cover all aspects of science in context as this example illustrates.

Sarah Eames, a year 4 teacher (ages 8–9) at Sandfield Close Primary School, Leicester, has an Endorsed Teacher Fellowship from the Institute of Physics (IoP). Sarah is also a Rolls-Royce Science Prize finalist and is following the National Curriculum aim to equip children with the scientific knowledge required to understand the uses and implications of science, today and in the future. In other words, *real science, real scientists, real jobs*. The children Sarah teaches are working scientifically using a range of enquiry-based methods across the school, across the content areas of the curriculum, and with a range of others (parents, university colleagues). As a result of this work her school was acknowledged by Ofsted for its standards in engaging pupils in science.

Sarah is one of the many College fellows who are using drama effectively in science, engaging parents and grandparents of EAL (English as an Additional Language) children in the teaching of science, using outdoor learning or thinking skills to engage children.

A PSTT College fellow at work

primary school in the UK, where every teacher is confident in their ability to teach primary science.

Putting the Trust's vision into action

The National Curriculum for Science in England aims to ensure that all pupils develop scientific knowledge and conceptual understanding through the specific disciplines of biology, chemistry and physics. In support of this, and the increased focus on different enquiry types, the PSTT College is working to promote the teaching of the principles and big ideas of science education. This involves encouraging development in understanding of the nature, processes and methods of science through different types of science enquiries, so children will become more able to answer scientific questions about the world around them.

The Trust is proud of what it is achieving and it has much to share, as well as still having much to learn. This learning will not come from teaching materials or resources and for this reason the Trust is actively engaging with its colleagues in the science education and STEM arena.

As a Trust, we are passionate about encouraging primary teachers to ask: *How can we push the boundaries of primary science?* We feel that the new curriculum offers a real opportunity to consolidate what is good practice and to try to refine those areas that really enable children to think, feel and work scientifically. We realise that there are many teachers who are quietly, below the radar, enhancing the quality of primary science, sometimes fighting an uphill battle with the diminished priority given to science in recent times. We want to work with these teachers, supporting them and helping them to develop further themselves and to support others.

This isn't just for the new English National Curriculum: our aims are UK wide and we are working alongside our fellows and teachers in Northern Ireland to raise the profile of science in *The World Around Us* area of their curriculum. There are currently 13 fellows in Northern Ireland who are gathering momentum to spread the word about the importance of practical science for the future of the next generation of teachers in Northern Ireland. We also have connections with Wales and Scotland who have the own curriculum issues but are always willing to share and collaborate with PSTT.

We look forward to supporting primary science across the UK and we believe it will be a time for reflection and development as we watch how events unfold in Northern Ireland and how the new curriculum in England is interpreted.

We invite you all to wonder about this with us and extend an open invitation to teachers and other interested parties to get in touch and collaborate in order that we interpret this new primary science curriculum sensibly, wisely and, most importantly, creatively.

To explore our resources or find out more about PSTT please visit our website and feel free to get in touch if you have any queries you would like addressing. We are about sharing good practice and collaborating with as many people as possible to have a positive impact on children's learning in primary science.

Website
Primary Science Teaching Trust: **www.PSTT.org.uk**

Kathy Schofield is Director of the Primary Science Teacher College. Email: kathy.schofield@pstt.org.uk

leading change

ASSESSMENT IN ENGLAND: SOME FAQS (AND ANSWERS!)

from Sarah Earle

Are levels really going?

Yes, the curriculum will be based on a 'mastery' approach where we will identify whether the children have achieved the curriculum statements for that key stage. By removing the level descriptors the aim is for there to be a much stronger relationship between the science that children are taught and the science that is assessed.

What should I do first?

Focus on Assessment for Learning; that is where you will make an impact on pupils' learning. Find out where the children are, plan how to take them on a bit and then find out whether they have understood it. Help them to reflect back to their initial ideas and to say what they have learnt. Ask children to say '*I used to think xxxx … and now I think yyyy …* ([or] *and I still think xxxx …. makes sense*) *because …*'. You can share the learning objective, agree what it would look like to be successful and ask the children to judge where they are.

How will I know whether they have achieved the year group's objectives?

Plan lessons in which the children can show you, lessons that clearly lead to the meeting of a learning intention linked to the programme of study (PoS) objectives. Elicit their ideas with questions, discussion, concept cartoons, annotated pictures, floor-books, deciding whether statements are true or false, sorting, a quiz, problem solving, exploration, enquiry and so on.There is no set way of doing this, but success criteria will be helpful. Make a judgement, ideally with the child, about whether they have achieved the objective. You can discuss informally with colleagues to moderate. In time, groups of schools or projects such as TAPS at Bath Spa (see PSTT article in this issue and updates on the PSTT website) might develop electronic portfolios with examples of children's work so that teachers can build up a picture of what mastery of a curriculum statement looks like. This will help to develop consistency in teachers' judgements.

Do I have to record a judgement each lesson then?

You do not have to do this for every lesson; select the lessons that are key to the year group objectives. There may be many lessons that lead up to this. You could work on the assumption that most will have achieved the objectives; just make a note of who hasn't and who has gone further.

How do I track progression when the units have all changed?

In time, as the new curriculum beds in, we will find new ways to do this. As before, you must judge how children have performed against the learning intentions. Across terms and year groups don't forget to look for progression in the Working Scientifically PoS. It is in the development of children's skills in asking questions, planning, collecting and analysing data, drawing conclusions and evaluating that you will be able to track progression. To track mastery of the conceptual knowledge, use a broad range of evidence, for instance, do they know what a term means, can they explain it and apply it in an unfamiliar context?

How do I set targets and track progression across the years?

Each teacher could keep a record of those children who have exceeded expectations, met the expectations and who are making progress towards the expectations. If they exceeded expectations in Working Scientifically in year 2, then you could set a target for them to exceed expectations in year 4 and so on.

Do I need to revise for the sample tests?

No, the sample will be a small number of children (a group of five rather than a whole class) from a small number of schools. The biannual sampling will provide anonymous information about children's achievement against the PoS for science across the country: individual child or school results will not be available. (See www.education.gov.uk/a00227496/sciencesampling).

Do I need to buy tests?

A test will only give you a small amount of information; it will not tell you everything the child knows or can do. Tests are not useful for telling us about Working Scientifically, which is the progressive thread in the PoS and at the heart of science. Teacher assessment is based upon the full range of experiences you have with the children and is more valid.

Should I start APP?

No, it does not match the new Working Scientifically. Those schools that have found APP useful in the past may select elements that support them to plan for progression, but, if you are able to, start from the new curriculum descriptors. Discuss what these will look like with your staff. This kind of moderation discussion is excellent science CPD.

Do I have to change everything straight away?

No, the process of moving to a mastery curriculum will take time. Consider small, manageable steps that will support your teachers in developing children's learning in science.

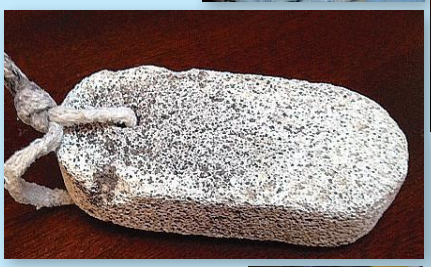
Sarah Earle is a senior lecturer in Primary PGCE Science at Bath Spa University.

WOBBLY Corner

In response to a recent request, the 'Wobbly Corner' is making a comeback. If you have any 'wobbles', where you think you know about a concept but could do with clarification, then why not request a response from us? We will do our best to provide a simple but accurate answer – and we won't reveal who asked for the wobble to be explained!








A large range of common items are colloids; these photographs show just a few of them

TYPES OF MIXTURES

The 'wobbly' conversation that has provoked the return of the 'Wobbly Corner', focused on mixtures, whether there are special names for things like smoke and whether you could you have mixtures of liquids in solids as well as solids in liquids.

When considering very small particles (bigger than atoms and molecules) of one state of matter (solid, liquid or gas) evenly dispersed, or mixed but not dissolved, in another state (or the same state) of matter, we are in actual fact talking about **colloids**. These are different from **suspensions**, where the particles are much bigger and therefore will eventually separate out, such as oil and water or sand and water, and **solutions**, where the particles are smaller (the size of atoms and molecules) and have dissolved into the solvent, such as sugar and water. A solution will be transparent, whereas a colloid will scatter light, and appear translucent or opaque (called the Tyndall effect). There are many types of colloids, with different names depending on the states of matter involved – see table.

While 'colloids' are not taught as a concept in primary science, it is interesting how many different types of 'mixtures' there are. We should not restrict our learning and understanding of science to the things that we have to teach. It is the enrichment we can provide by our own outside learning and interests that will engage and enthuse the children. As many common household things are colloids this is an interesting piece of information that may fascinate your class!

Types of colloids

Continuous phase (the main appearance)	Dispersed phase (the particles inside)		
	Solid	**Liquid**	**Gas**
Solid	Solid in a solid = **solid sol**. There aren't many household examples unless you have things like cranberry or ruby glass.	Liquid in a solid = **gel**. Examples: jelly, gelatin, cheese.	Gas in a solid = **solid foam**. Examples: Aero, Crunchie middles, Wotsits, pumice, expanded polystyrene.
Liquid	Solid in a liquid = **sol**. Examples: blood, paint (e.g. powder paint).	Liquid in a liquid = **emulsion**. Examples: Paint (obvious as we even call some paint 'emulsion'– but depends on type as some are sols), hand cream, milk, cream, mayonnaise, salad dressing.	Gas in a liquid = **foam**. Examples: shaving foam, squirty cream.
Gas	Solid in a gas = **solid aerosol**. Example: smoke.	Liquid in a gas = **aerosol**. Examples: fog and mist, hairsprays (in fact any 'aerosols' you buy).	None, because gases are molecule or atom sized, so by mixing these, you have a solution, not a colloid.

NEW TO TEACHING

'VEGEGATING' CHILDREN

Figure 1 The authors on their teaching placement

Key words:
ITE students
Types of activity

*Student teachers, **Katherine Bagshaw, Hannah Barham, Rebecca Betts, Amie Felton and Joshua Knatt**, share their ideas on how to bridge the gap between statutory and non-statutory guidelines for food and nutrition with 8- to 10-year-olds*

In recent years, the health of our children has become a focal point of concern for both parents and education practitioners. We have moved away from the dichotomy of 'healthy' and 'unhealthy' diets and towards thinking about food and nutrition in terms of a 'healthier' diet. There is a new generation of terminology, as we refer to 'balanced' (gaining adequate nutrition from the main five food groups and understanding moderation) and 'unbalanced' (an inadequate level of nutrition or an imbalance in the consumption of the main five food groups) diets in food education.

Alongside the statutory requirements of the English National Curriculum (DfEE, 1999), the Department of Health has suggested guidelines for trainee primary school teachers to assist them in teaching about food and nutrition, covering classifying food groups, healthy and balanced diets to give us energy, and food manufacturing (DoH and MAFF, 1998).

Bridging the gap

While these guidelines cover many of the areas the children in our teaching placement school wanted to learn about, they did not include all of the questions they had raised during our elicitation session, for example the sugar content of drinks (Box 1).

Box 1 What the children wanted to know

Questions we identified from the first session's elicitation:

- Why do we need water?
- Why do we need vitamins and minerals?
- How is bad food good for you?
- What's in junk food?
- What makes fruit and vegetables healthy?
- How many cans of coke would it take to make someone unhealthy?
- What types of drinks are good for you?
- How do you know if someone is healthy?

Therefore we wanted to plan a series of lessons to bridge the gap between w*hat we are required* to teach and what the children *wanted* to learn. We felt that the most effective way of doing this was to use carousel activities in class as well as homework tasks. This would allow us to utilise our limited teaching time effectively, which in turn would permit us to answer more of the children's questions.

Confident teaching

Confidence in your subject knowledge is an important factor affecting the quality of teaching and learning, and in the area of food and nutrition there is scientific uncertainty and controversy. Nestle (2007) recognises that this may be because nutrition science is 'reductive': it attributes the health effects to the consumption of one nutrient or food. However, it is the overall dietary pattern that really matters. Children asking questions such as '*What are the differences between different vitamins?*' can test a teacher's own understanding to the limit. We know the importance of children asking questions, but are commonly worried about the gaps in our own subject knowledge and being able to answer the children's questions correctly (Harlen and Qualter, 2009). Therefore we had to do our own homework in order to feel more confident and be more effective teachers.

The activities

Throughout our time in the school, we used a variety of teaching approaches to incorporate the various learning styles in the classroom, such as the (possibly controversial) use of first names for all, hoping to create a more relaxed environment for sharing ideas. We also chose not to share explicit knowledge-based learning objectives, wanting our teaching to be fuelled by the children's own learning rather than them feeling it was dictated by the teacher, thus limiting unintended learning and prohibiting discussions. We acted as facilitators, taking a step back and allowing the discussions to follow the course the children set, opening opportunities for the children to lead their own learning and take responsibility, thus promoting intrinsic motivation.

Box 2 shows the carousel activities we ran in order to bridge the gap between the children's questions and what we needed to teach. We found that the children were fully engaged with their learning, which reduced behavioural issues. However, as with many lessons, time constraints meant that we were unable to go into as much detail as we would have liked. In future, we would plan for more time so that the learning becomes deeper, with particular focus on the plenary, as we understand its importance in regrouping the children, clarifying their learning and identifying next steps for us to plan for further sessions.

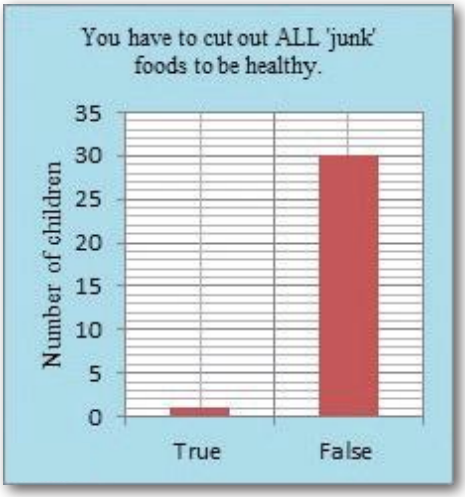
Box 2 Carousel activities on food groups

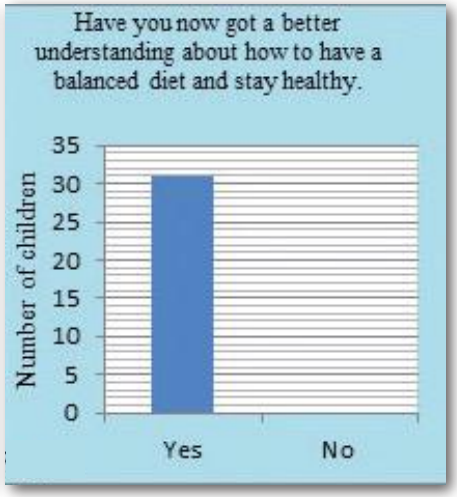
- **Fruit and vegetables:** Matching games, matching the fruit or vegetable to the vitamin or mineral, followed by a discussion, initially teacher led, on where different vitamins and minerals come from.
- **Dairy:** With a range of different pictures of dairy products, children discussed which ones are good for us and why we need them in our diets.
- **Carbohydrates:** A teacher-led discussion around what carbohydrates do in the body followed by children discussing which carbohydrates are good and what might happen if we eat too many of them.
- **Fats and sugars:** Children looked at a bag of fat and a bag of sugar. Discussions took place about how much fat and sugar was in certain foods and how many bags or fractions of bags certain foods contain. Children discussed the importance of only having small amounts of sugars and fat in their diets.
- **Protein:** Children engaged in a sorting activity of lots of different pictures of different foods into either protein or non-protein. The teacher with this group then moved certain foods to the correct column and discussions ensued on the misconception that all protein is meat.
- **Consolidation activity:** Sandwich making – The children were given the brief that they had to make a sandwich that was healthy from a range of different available sandwich fillings and explain their choices.

Misconceptions and learning

Some issues arose from the language we introduced. Many children were unfamiliar with the terms 'balanced' and 'unbalanced', simply labelling food as 'good' or 'bad'. This could be a by-product of prior learning, previous misconceptions or conflicting messages received from the media. As trainee teachers, we found it imperative

Figure 2 The 'washing line' balanced food continuum





Figures 3 Our end-of-session questioning indicated that we had successfully challenged some of the children's misconceptions about diet

to be sensitive when referring to food groups and individual diets; we always referred to ourselves as the subject to illustrate points of view.

During the first session, when we had asked children to place various foods on a 'washing line' from the most healthy to the least healthy (Figure 2), we found that the use of 'healthy' and 'unhealthy' led to conflicts in the children's ideas, hence our adoption of the terms 'balanced' and 'unbalanced'. We then went on to discuss how too many unhealthy foods led to a poor diet. This in turn led to some of the children believing that too many healthy foods were also bad for you, without grasping the concept of a 'balanced diet'. This occurred because of the freedom of discussion we allowed the children to engage in, our use of inexplicit language and the fact that we did not reiterate the need for a 'balanced diet'. Subsequently, we planned a starter activity in the next session to clarify the importance of a balanced diet and to make sure that the children fully understood the concept of moderation before moving on to progress their knowledge.

Throughout the sessions it became clear that the children had one very central and common misconception in terms of food and nutrition education: '*All fats are bad for you*' (Allen, 2010). Many children justified their ideas with '*It said so on the TV*'. Further conversation showed that this misconception had been generated as a result of the labels on food packaging, with advertisements emphasising '*no added fat*' and the negative impact that fat has on the body. Allen (2010) suggests that this is a '*public health view*'. We therefore devoted time to discussing the role 'fat' plays in diets, our bodies and resultant health and created a good unintended learning opportunity.

A second misconception we encountered was the idea that '*eating only healthy food is the healthiest way to live*'. This was identified during the washing line activity. Our second session was used to develop the children's understanding of the importance of all food groups and the importance of a balanced diet through the use of the carousel activities described above. As shown in Figure 3, this was successful in challenging these misconceptions.

The impact of our teaching

The time taken to bridge the gap between what children want to know and what needs to be taught has undeniable benefits for both children and teachers. There is increased engagement from the children when they use their own ideas, creating ownership and opportunities for us as teachers to gain insight into the children's misconceptions. By being flexible in our approach, and adapting our planning to respond to the children's wants and questions, we achieved our intended learning, but there was the bonus of unintended learning, which enriched and challenged both our and the children's understanding. So there were benefits all round when we were 'vegecating' our class!

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Katherine Bagshaw, Hannah Barham, Rebecca Betts, Amie Felton and **Joshua Knatt** are BA(Hons) Primary Education students specialising in science at the University of Winchester. Email: josh.knatt@hotmail.co.uk

SUBJECT ASSOCIATIONS ROUND-UP

The Association for Science Education (ASE) works closely with other subject associations to provide support for primary teachers faced with an increasingly cross-curricular approach. We are therefore pleased, in this special issue of *Primary Science*, to give some space in the following few pages to several of our fellow subject associations so that they can tell you a little about what they offer. They show just how closely the subjects are enmeshed and give a flavour of the wide range of support available.

Full subject association information and links are available via the ASE website, **www.ase.org.uk**

A list of many of the associations and other useful organisations that provide specialist support, with links to their websites, can be found at:

www.geography.org.uk/eyprimary/subjectassociations

Further information about subject associations is available from the Council for Subject Associations (CfSA), **www.subjectassociation.org.uk**, while the Association for the Study of Primary Education (ASPE), **www.aspe-uk.eu**, provides support for all areas of primary education.

Association for the Study of Primary Education

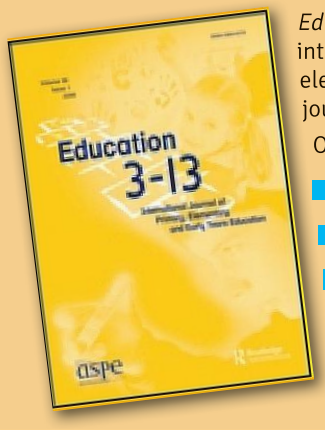
aspe

ASPE was founded in the belief that one of the best ways to advance primary education is through professional collaboration and action.

It is open to all involved in primary education. We are here to encourage a considered and well-researched perspective that will enable all children in primary education to get a better deal.

ASPE does not have allegiances to particular subjects but is influential in articulating the core purposes of primary education. We stand for providing a good and well-balanced range of experiences for every child, especially when they are in school.

ASPE has responded in a professional and critical manner to consultation about the new primary curriculum and the proposed controversial arrangements for assessment.



Education 3-13 - International Journal of Primary, Elementary and Early Years Education is the major international publication of ASPE. Every member receives a copy of this journal six times a year as well as electronic access to all articles written by both academic and school-based researchers throughout the journal's 20-year history.

Our annual membership rates are:

- £10 for student/NQT membership
- £40 for individual membership
- £75 for schools membership

For further details about ASPE's work please contact:

Mary Woodcock, Membership Secretary, at **mary@swallowbarn.fsnet.co.uk**

Paul Latham, National Chair, at **Jpaullatham@aol.com**

The English Association

www.le.ac.uk/engassoc

Worried about the new National Curriculum? The fast pace of changes to literacy in the primary classroom? Then *English 4–11* is the magazine for you.

English 4-11 is primary teachers' favourite literacy magazine, with up-to-the-minute accounts of classroom practice, a wealth of book reviews and recommendations, author interviews and literacy news. Supporting all aspects of the new English curriculum, recent issues have featured:

- teaching grammar creatively
- issues of inclusion
- promoting reading for pleasure
- promoting productive talk
- reading the classics
- developing writing
- using film to support literacy
- cross-curricular projects
- the *English 4–11* Picture Book Awards

Our website also has a load of extras – interviews with children's authors, top 5 reads, online-only articles, supplementary material and even more reviews:

https://www2.le.ac.uk/offices/english-association/primary

English 4–11 is published by The English Association and the United Kingdom Literacy Association.

Email us today for a free sample copy (while stocks last!) quoting '4–11 Offer' in the subject line – **engassoc@le.ac.uk**

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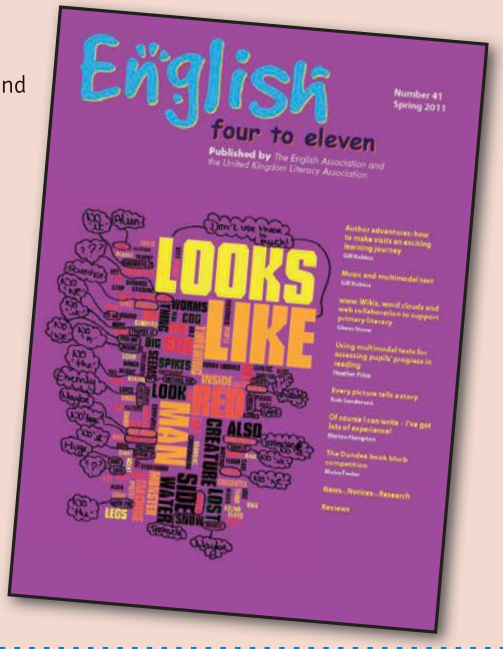


SUBJECT ASSOCIATIONS ROUND-UP

Association of Teachers of Mathematics

professional support for all teachers of mathematics
www.atm.org.uk

Do you want to enhance understanding and enjoyment of mathematics?

ATM can help through its high-quality publications, its stimulating journal and vibrant community of teachers. Visit the ATM website **www.atm.org.uk** to find out more.

The new National Curriculum for mathematics includes **conceptual understanding, mathematical reasoning** and **problem solving** in its aims. These have always been important as they resonate closely with **Using and Applying Mathematics**. Ofsted champions teaching of mathematics that emphasises Using and Applying Mathematics both within the teaching of mathematics and across the curriculum. **Working scientifically** in the new programmes of study for science reiterates the need for children to apply their mathematical knowledge to their understanding of science.

ATM has recently produced **Primary CPD Support Packs** which are freely available for members to download and which target new mathematics content in the key stage 2 programme of study, such as algebra.

Membership of the Association of Teachers of Mathematics is available to individual teachers or via school/institutional membership. According to one primary head teacher, *'ATM membership is the best CPD you will buy this year'*.

Let ATM help you make mathematics exciting and engaging in your school!

Geographical Association

Science and Geography: connecting enquiry

Enquiring about the world

Geography and science have a lot in common. Both start with enquiry and both investigate and collect data, analyse it and draw conclusions. Both investigate the real world and work out-of-doors and both make informed predictions about possible futures.

Together, they offer a connected set of enquiry questions that support a deep understanding of the world: science asks '*Why, how and what?*', while geography asks '*Why, how and where?*' So, when planning your science curriculum you may be just one or two steps away from some linked, high-quality geographical thinking.

Living things

The study of 'Living things' in key stage 1 science links well with geographical fieldwork in the school grounds. Locating and mapping different types of plants and animals develops scientific and geographical knowledge and vocabulary and helps pupils understand that, even at the micro scale, places vary. Science studies at key stage 2 include recognising that habitats change and can pose dangers to living things in doing so: a topic that geography can ably support through its knowledge of how human activity and environments interact at different scales.

Materials

The study of 'Materials' in key stage 1 science can be linked to geographical enquiry about the use of locally sourced materials for building homes in places around the world as well as in our own locality. This supports pupils' understanding about the application of science: what makes this a good building material? What are its properties? Is it available nearby and how is it suited to the local elements? In key stage 2, the scientific study of rocks underpins a range of geographical enquiries as geology influences the very nature of landscapes and human activity: soils, agriculture, water supplies, fuels, trade and transport – all are connected.

Weather

The science curriculum at key stage 1 requires pupils to '*observe and describe weather associated with the seasons and how day length varies*' whereas in geography pupils must '*identify seasonal and daily weather patterns in the United Kingdom*'. At key stage 2 science examines aspects of weather (evaporation, condensation and temperature) in more detail while geography widens the scale by mapping and explaining the distribution of climatic regions of the world, linking this to patterns of vegetation, settlement, agriculture and biodiversity.

Powerful alliance

It is this combination of precise analytical thinking and synergistic application that makes science and geography such a powerful alliance. How will you develop both of these aspects in your curriculum?

Links

Join the Geographical Association: **www.geography.org.uk/login_join.asp**

Download a free sample of *Primary Geography*: **www.geography.org.uk/journals/freesample/**

Free images with accompanying activities: **www.geography.org.uk/resources/adifferentview/imagesandactivities/#top**

Habitats in the School Environment KS1: **www.geography.org.uk/projects/younggeographers/resources/littlecommon**

Why Recycle? KS2: **www.geography.org.uk/projects/younggeographers/resources/leighton/**

Paula Owens is Curriculum Development Leader (Primary) at the Geographical Association. Email powens@geography.org.uk

KS1 children investigating local flora. Photo © Angharad Forbes.

The Historical Association

www.history.org.uk

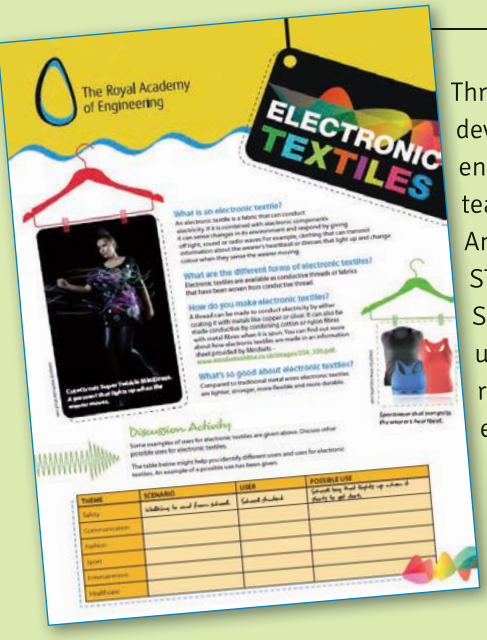
The Historical Association is working hard to ensure that our members' needs are supported with the changes to the new curriculum. The Historical Association has responded to the history teaching challenge with a wide range of initiatives to support the subject cross over and the changes in the new primary curriculum. There is history in every curriculum subject, including science. In key stage 1, pupils are asked to study significant individuals. These people may have made significant contributions to science and technology, or be some of the named individuals from the science curriculum. In key stage 2, students are required to undertake a chronological unit that develops their chronological understanding beyond 1066. There is nothing to stop this tracing a theme like science or technology over time, or picking a specific turning point such as the Industrial Revolution. We are also developing partnerships with other subject associations to work together to support our members, including a conference for English and history subject specialists to re-examine their teaching of the First World War. We can offer help and advice with the curriculum cross over through our articles, resources, podcasts, lesson plans, schemes of work and topic and curriculum guides. Already in development are units of work linked to English and maths and future plans include units of work with links to science.

Whether it's planning and delivery, pedagogy or subject knowledge, we can provide support for your school.

SUBJECT ASSOCIATIONS ROUND-UP

Royal Academy of Engineering

STEM resources from the Royal Academy of Engineering



Through its various education programmes the Royal Academy of Engineering has developed over 20 resources to support learning and teaching in science, technology, engineering and mathematics (STEM). These resources are primarily for school teachers and provide ideas for enriching class-based learning or STEM club activities. An important aim of each resource is to enable teachers to engage their students with STEM through hands-on activity and by focusing on stimulating engineering contexts. Some of the activities detailed in the resources take less than an hour and can be used to create lessons or enrichment that will wow students. For example, two of the resources teach students the STEM behind paints that disappear when heated or how electronic textiles are being used to create wearable technology. Other resources can be used over a number of lessons or club sessions and give students the opportunity to investigate real-world issues that are tackled by engineers, such as responding to natural disasters or designing equipment to help disabled people take part in sport. The Academy regularly develops new resources and is currently developing mathematics-focused resources that investigate deployable structures.

View the Academy's resources at:
www.raeng.org.uk/education/eenp/engineering_resources/default.htm

D&T Association on close links between Science and D&T

Linking D&T with science can improve the quality of children's learning in both subjects. The new primary National Curriculum provides many opportunities for making connections that enhance children's learning. There are also opportunities to make valuable links outside the programmes of study. For example, although 'forces and motion' is no longer a science requirement in the new programme of study for KS1, schools have often linked it successfully with work on simple mechanisms, which continues to be one of the requirements for D&T.

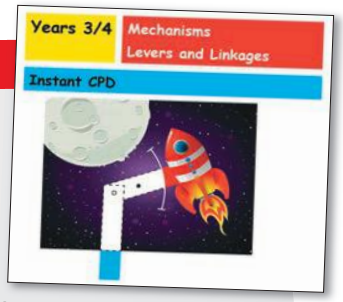
There are three models for linking the subjects:

- **Appliance of science model** – this is where science knowledge and understanding is used when children design and make products. For example, understanding of electricity is used when designing and making battery-powered nightlights. Children use learning in science to inform their design decisions, whilst deepening their science understanding through rigorous application in D&T.
- **Springboard model** – children carry out a D&T project that provides an impetus for further science investigation. For example, following a project to design and make bread, children might go on to extend their science understanding of yeast and other micro-organisms.
- **Context model** – D&T can provide a context for science: for example, where children create a safety jacket for teddy, this provides a meaningful context to develop their understanding of the properties of materials. Science can provide a context for D&T: for example, activities on forces and motion might create the starting point for children to design and make moving pictures. Science and D&T can be linked through cross-curricular themes, such as 'our wildlife area' where children create bird hides and investigate living things in their habitats.

As well as making strong links between D&T and Science, the new D&T curriculum provides opportunities to make links to many other subjects including maths, art and design, and computing.

To update their understanding of the subject, primary schools can take advantage of the support, guidance and CPD sessions that the D&T Association is providing.

We are working closely with primary education experts, including teachers and consultants, to develop and deliver full day CPD sessions, twilight CPD sessions and guidance to help implement the new curriculum. Our major new resource for KS1 and 2, Projects on a Page, is a new, innovative national scheme of work, consisting of 15 inspirational and practical project planners. It is designed to support primary schools in successful implementation of the new National Curriculum.



*Membership offer!

To be entered into the draw for an iPad Mini;

1. Become a primary D&T member
   - Individual £40 (yearly)
   - School £80 (yearly)
2. Purchase *Projects on a Page – new primary scheme of work – £85. Discounted to £60 (member rate).

Draw will take place on 15 December 2014.
The winner will receive their iPad Mini in time for Christmas.

*By becoming a primary member you will take advantage of discounted member rates for all resources including Projects on a Page and CPD sessions.

SUPPORT EXCELLENT **RE** IN YOUR SCHOOL

Religious Education (RE) is an important and well respected academic subject, which can make an impact on young people's thinking and lives beyond the classroom.

At its best, it is intellectually challenging and personally enriching. It helps young people develop beliefs and values, fosters civilised debate and reasoned argument, and helps pupils to understand the place of religion and belief in the modern world.

All schools are required to teach RE at all key stages and every child and young person who goes to school is entitled to an experience of high-quality RE. However, Ofsted's report on RE states that the subject's potential is still not being realised fully. Many local authorities are struggling to fulfil their responsibility to promote high-quality RE; and other changes to education policy have led to a decline in RE provision in some schools despite the subject's statutory status.

The Ofsted report suggests that in primary schools where the teaching of RE was less than good, RE is usually taught by teachers with a poor understanding of the subject and had limited access to effective training. However, the National Association of Teachers of Religious Education (NATRE) helps teachers to understand the subject and plan and teach the subject engagingly and effectively. RE, like science, can be taught using enquiry strategies, enabling children to answer questions about religion and belief that are relevant to them.

Addressing the challenges of delivering excellent RE, the RE Council of England and Wales has published a review of the subject in England and developed a national curriculum framework for RE to parallel the new national curriculum. The framework also makes connections with other subjects of the curriculum. To download the report, visit www.religiouseducationcouncil.org.uk.

Supporting the excellent provision for RE nationally, NATRE offers a vital service addressing the real concerns of primary and secondary RE teachers in all schools and institutions and at all stages of their career. In partnership with RE Today Services, research has been carried out to improve support of the RE needs of teachers and other professionals.

Many teachers of RE in primary schools are non-specialists who can feel isolated being the sole person in charge of RE and pressured to deliver the subject well, on top of all the other subjects they teach. Feedback from the research also shows that many headteachers and subject leaders do not feel they have access to expert advice on RE. NATRE is addressing these RE needs through a newly developed membership scheme to support teachers, regardless of their age, qualification and experience of teaching in the classroom.

Starting from £75 up to £250 a year for the most comprehensive support package, a NATRE membership equips both specialist and non-specialist teachers of RE with all the essential resources, knowledge and confidence to deliver excellent RE. These packages provide headteachers or subject leaders access to expert advice from RE Today advisers alongside their highly acclaimed publications and websites; in addition there will be free or discounted rates on RE Today professional development courses, dependent on the membership package of choice.

Support high-quality RE provision in your school. Sign up to the new NATRE membership today!

NATRE
National Association of Teachers of Religious Education

'Primary school teachers play a vital role in helping children to look beyond the messages that are presented in the media so that children can appreciate that science and religion are both important to individuals and society...'

Dr Berry Billingsley,
Associate Professor of Science Education
LASAR (Learning about Science and Religion)
University of Reading

To find out more visit www.natre.org.uk or call 0121 472 4242

Snap Science: Teaching framework year 3

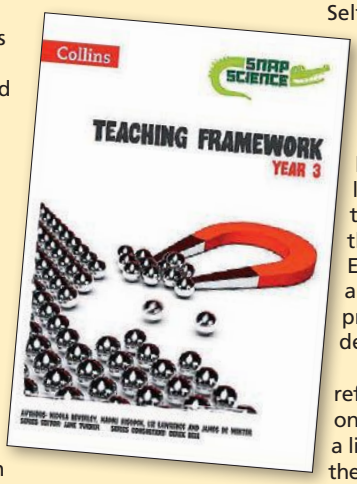
Nicola Beverley, Naomi Hiscock, Liz Lawrence and James De Winter (series editor: Jane Turner)
London: Collins Educational, 2014
321 pp. £100.00
ISBN 978 0 00 755143 9

Complete and detailed sequences of lessons to support your children to 'Work scientifically'

Changes in the English National Curriculum provide many opportunities and challenges. There is the opportunity to widen primary science beyond the fair test and beyond the classroom (use naming plants as the excuse to get outside!). The challenge of any change is always finding the time to consider what you will keep and what you will adapt. It is here that publishers are keen to support us with a wide array of publications designed to support implementation of the new curriculum. This is one such publication.

The new Collins Snap Science programme describes itself as a 'dynamic toolkit'. This means that there are a number of parts, many of which can be adapted online to suit your class. There is a paper book called a *Teaching framework* for each year group, containing sequenced lesson plans. There is also a subscription-based online resource kit on the Collins Connect platform, which contains the lesson plans in editable 'drag-and-drop' format, so that the activities can be selected and used in your preferred order. There is online supporting material for the lessons in the form of images, videos, animations and slideshows. Online assessment and tracking are also mentioned but at the time of writing this was still under construction, so this review can only make comment on the *Teaching framework* book.

The publisher states that the scheme is written by a team of curriculum experts, and the list of names does bode well, including advanced skills teachers (ASTs), consultants and 'big names' in primary science, all of whom started in the classroom. It is not surprising then that there are great principles stated at the start of this year 3 book: progression leading to big ideas in science; developing understanding through working scientifically; active involvement of children in their own learning; and the prominence of assessment for learning (AfL) strategies. These high aims are embedded in the lessons; for example, each has a clear enquiry focus and, in support of AfL, learning intentions are exemplified by 'I can' success criteria to support the teacher and children.



Each module begins with some background science for the teacher and common misconceptions to look out for. The lesson plans are clear, with all the usual sections for resources of vocabulary and so on. I particularly like the way every lesson is based around a question and starts with 'Explore activities', designed to catch attention, place the science in context, stimulate children's questions and provide an opportunity for the teacher to find out what the children already know about the topic. The main 'Enquire challenge' is described in three levels of differentiated challenge and provides opportunities for practical exploration, data collection and analysis. For example, exploring leaves leads onto comparing, sorting and classifying leaves. When comparing rocks, challenge 1 gives clear instructions to test absorbency, challenge 2 asks children to time how long it takes for water to be absorbed, and challenge 3 gives children the opportunity to design and carry out their own investigation into the permeability of rocks.

Self- and peer-assessment is highlighted in many of the plenary sections, reinforcing the principle of supporting the children to be active in their own learning. The sequences of lessons include 'core' lessons that are needed to cover all the objectives from the new English programme of study, and 'enrichment' lessons that provide extra breadth and depth.

The lessons do contain many references to the supporting online materials, so it may be a little frustrating to only have the book, although the lesson plans are complete if you are willing to spend a little time finding images and so on. The Snap Science toolkit represents a significant financial commitment; thus it is likely the decision over whether to purchase it will need to be made at a whole-school level.

While many of the activities are not new ideas (which is quite comforting too!), the clear, complete and principled way this resource is presented brings enquiry, context and children's questions to the fore so that we can be confident we are supporting children to be active in their learning.

Sarah Earle

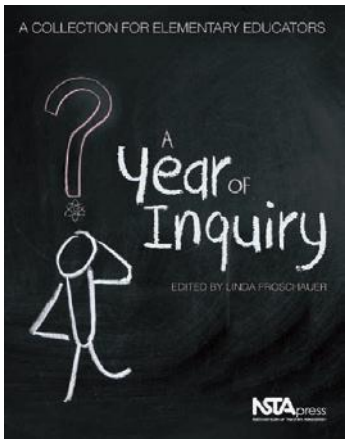
Senior Lecturer, Bath Spa University

A year of inquiry: a collection for elementary educators

Ed. Linda Froschauer
Arlington, VA: National Science Teachers Association, 2013
211 pp. £21.95
ISBN 978 1 936959 34 1

Support in moving to an inquiry-led approach

If you have been clamouring for help to understand and then apply inquiry within your classroom, this book is the time-saving resource you need. It provides guidance on ways to move your students toward doing science and away from lectures, memorisation, and cookbook labs. And it does so in one convenient place, through a collection of 36 easy-to-read articles from Science and Children, *NSTA's elementary-level journal.* (publisher's blurb)



This book is organised into nine different sections, each subdivided into four chapters. Although American in context, many of these sections resonate easily with the teaching of primary science in the UK: 'What does a scientist do?', 'Process skills', 'Science notebooks', 'Investigable questions', 'Data collection and representation', 'Selecting an inquiry experience', 'Switching from cookbook labs to full inquiry', 'Research results' and 'Inquiry'.

Taking 'Switching from cookbook labs to full inquiry' as an example, it is worth considering how this book can be used to support the teaching of primary science in our curriculum. The first of the chapters considers why 'Inquiry is essential' and helps the reader to identify the essential features of it. This theory-based chapter is concise, readable and usefully summarised into a table which shows '*the spectrum from teacher-led to pupil-led working in a lesson underpinned by inquiry*'. The next two chapters ('Five strategies to support all teachers' and 'Fire up the inquiry') support teachers in moving from what we would consider to be a 'fair test' to a true enquiry-led approach, something that I believe should be encouraged in every classroom; any resource that supports teacher confidence in doing so should be commended. The final chapter offers a practical lesson outlining how the previous chapters can be translated into practice; this format is repeated throughout the sections.

The challenge with any book of this nature is encouraging primary science teachers to read the first three chapters in each

section – and not skip to the 'what do I do?' chapter. If used completely, with teachers finding the time to develop their reading around *why* as well as *what* they are doing, then I feel that this book has a great deal of merit. The American language and references aside, this resource also has the potential to support science teaching in the light of the forthcoming changes to the curriculum in England, and it sits comfortably alongside existing material such as the Millgate House publication *It's not fair*.

I am in favour of the accessibility of the content of this resource and feel it has a great balance between theory and practice; it has the potential to act as a resource that can be dipped in and out of rather than requiring a week of dedicated reading – always a positive when supporting the classroom teacher!

Leigh Hoath

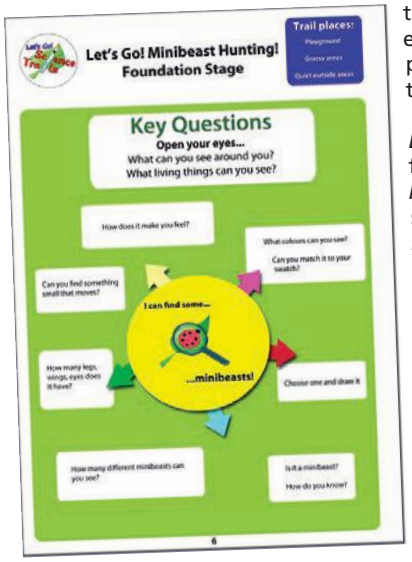
Head of Science Education, Bradford College, West Yorkshire

Let's go! Science trails

Teachers in the London Borough of Haringey
80 pp. £10.00
Primary Science Teaching Trust
(www.pstt.org.uk), 2012

Practical ideas for making the most of outdoor areas, from foundation stage to key stage 2

This full-colour booklet provides



a collection of 25 science trails developed in the London Borough of Haringey as part of a project to encourage outdoor learning funded by the Primary Science Teaching Trust. Each trail is set in context and summarised with a set of objectives, ideas for differentiation, use of technology, health and safety Implications and basic resource list. There are also ideas for both 'Out on the trail' and 'Back in the classroom'. The layout of the pages makes them easy to follow and the trails are brought to life with examples of learning outcomes, photographs of children out on the trails and some worksheets.

Examples of trails include: *Let's go! A listening walk!* for foundation stage; *Let's go! Homes and materials!* for key stage 1; and *Let's go! Rock hunting!* for key stage 2.

The objectives are referenced to the current programme of study of the English National Curriculum so may not be relevant for the year groups listed in the booklet but they can be cross-referenced to the new 2014 curriculum. The majority of the trails cover biology topics with some examples from the other areas of science. The booklet gives examples of how to make the most of using technology including iPods, digital cameras and QR codes to enhance observation and recording outside the classroom.

The trails are set in the context of the project schools but the tried-and-tested practical ideas in the booklet provide a good bank of starting points for individual teachers who would like to take science learning outdoors and the layout of the pages provides a useful thinking frame for developing new trails for different contexts. The booklet would also work well as a CPD resource to provide a stimulus for generating ideas for whole-school development of science trails in the local environment.

Joelle Halliday

Think Primary Ltd, Independent Consultant and Coach

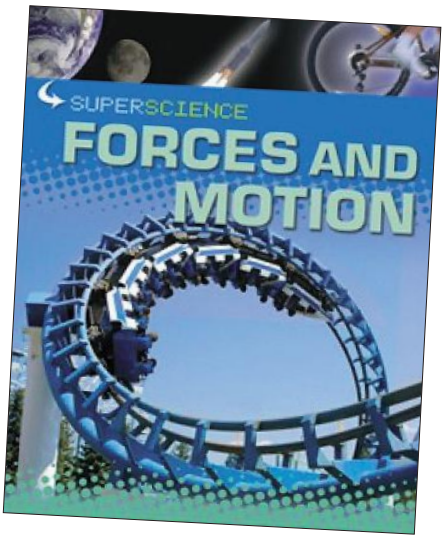
Superscience: Forces and motion

Rob Colson
London: Franklin Watts, 2013
32 pp. £8.99
ISBN 978 1 4451 2292 2

Useful resource for KS2 children and teachers

This is a small resource book for both children and teachers to use in the classroom. Each section contains topics or questions, which are clearly explained, including visuals and other additional boxes to help children visualise some of the abstract concepts. For teachers and other adults there is a section at the front of the book giving potential assessment opportunities and lesson ideas.

In the section 'Why do things move?' the solar system is introduced clearly with an informative diagram. However, many primary-age children would struggle with some of the scientific language, such as 'black hole', that remains unexplained. There is a glossary, supporting children's independent learning, but some key vocabulary is missing including this term. Key scientific language such as this does need explaining or it could



cause confusion.

The booklet also contains 'project boxes', giving practical experiments to help children visualise some of the abstract concepts that are being explained. However, again the language used, for example in the momentum marble experiment, is not child friendly and would need adapting for use in the classroom.

Overall, this is an excellent resource, in terms of its layout, with a glossary, index and the content as a whole. The use of project boxes is really practical and workable in a primary classroom with some adaptation. However, the language needs to be made more appropriate for the level it is aimed at and fuller use made of the glossary.

Samantha Dorrington

Trainee primary teacher, Manchester Metropolitan University