

Developing *great science* subject leadership



Great ideas for primary
science leaders from schools
that value science.

“

Where science has a good profile within the school as a result of dedicated leadership, and where staff are expected to teach exciting, investigative science with access to high-quality expertise, children are likely to enjoy learning the subject.”¹

Primary Science: Developing good practice in leading primary science

Why should we care about science?

The short answer is because science is a core subject in the national curriculum (in England). But science is much more than just a compulsory subject: science inspires children, encouraging them to be inquisitive about the world, nurtures their innate curiosity and enables them to develop a range of skills that are useful across their learning. By the end of primary education children start to make up their minds about whether science is for them. We think science is for everyone, not just those who want to continue into science-based careers; having an understanding of science allows people to make informed decisions about new technologies, their health and other important matters. We should all champion primary science and make sure that every child has a positive experience of science throughout their primary school education.

Good leadership of science is essential at primary school. This leaflet provides support for you as a primary science leader (PSL), based on good practice in schools that value science.

Background

In 2013 the Wellcome Trust conducted an online survey to find out how PSLs are deployed in schools. The responses and follow-up case studies, written up in a report available on our website,² released a wealth of information and advice that can help support you as a science leader, whether you are new-in-post or at a school that is looking to improve its science teaching.

We know that taking on responsibility for leading science may be your first taste of leadership, and that like many primary teachers you may not have a strong science background. However, this need not be a barrier to leading exciting primary science – there is support to help you develop expertise in both teaching and leadership. This leaflet will help you get started by leading you to reflect on science in your school and begin planning its improvement.

Key questions

- What is your shared vision for primary science?
- How should you develop and use your science expertise?
- How do you evaluate the science curriculum?

Improving primary science

How is science led in primary schools?

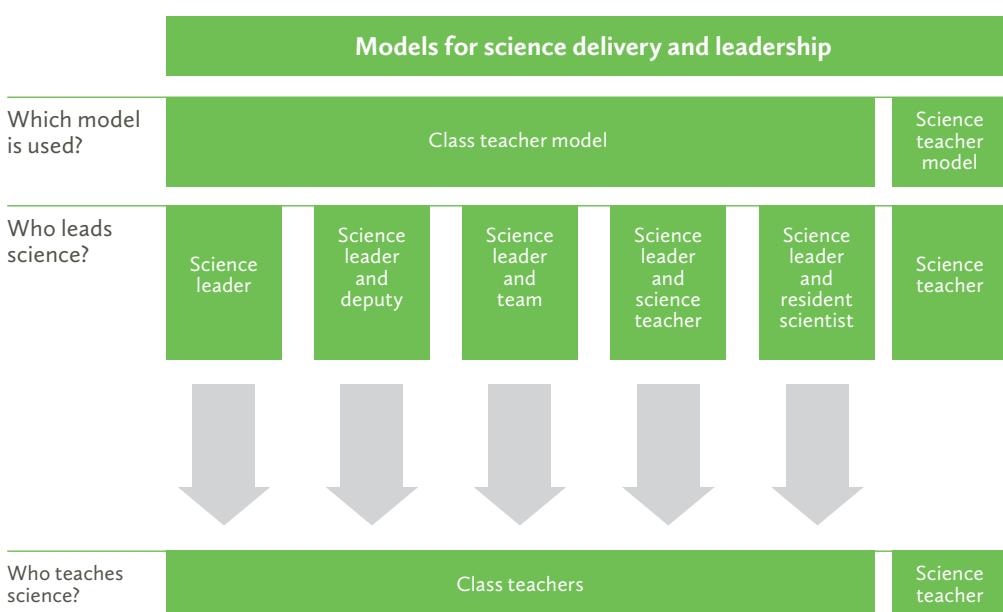
Very few schools employ a specialist science teacher who leads and teaches all the science in the school.

In most schools science is taught by class teachers, one of whom takes on the role of science leader. But there are variations of this model, which reflect different schools' contexts and priorities for strategic improvement in science.

Schools that give science a high profile use rigorous self-evaluation to choose which leadership model is most appropriate for them. Our report explores the advantages of the different models in detail³.



The model chosen (for science teaching and leadership) makes the best use of the skills of each member of staff.”⁴



What expertise does a good science leader need?

Inspiring science teaching arises from science leaders that place scientific enquiry at the heart of their school's science curriculum and understand how children learn science. But many teachers have not studied science beyond the statutory requirements⁵ and worry about their weak subject knowledge and low confidence in dealing with pupils' questions about tricky bits of science. It is essential that all schools have (or have access to) a PSL who has an appropriate level of science expertise, as described in the box opposite⁶. You may not have the expertise to start with, but you can build it by accessing high-quality science CPD and gaining recognition for your development.



With regards to CPD, it's the science leader's responsibility to stay up to date and to identify appropriate courses.”⁷

Defining the expertise of a PSL

Subject knowledge

A PSL should have a deep understanding of the scientific concepts within the Key Stage 1 and 2 national curricula, supported by a working understanding of the scientific concepts within the Key Stage 3 national curriculum. A PSL should be confident in the use of scientific vocabulary and know how to research science topics and guide their pupils to do the same.

Pedagogical knowledge

A PSL should have knowledge of an appropriate range of teaching methods suitable for the content concerned. Their knowledge should cover enquiry-based pedagogies, practical activities, out-of-classroom learning, group work and problem solving, digital technologies, and formative assessment practices. It should also include an understanding of the key features that result in the successful implementation of these pedagogies and how to evaluate their impact on pupils.

Subject leadership

A PSL should have a whole-school vision for science and be able to lead its development by instigating appropriate initiatives, including providing CPD to colleagues, monitoring progress and contributing to the strategic development of learning in school.

What does a good science leader do?

A good science leader ensures that all pupils can develop their understanding of the big ideas of science, and learn the skills needed to work like a scientist, because their teachers are confident practitioners who deliver an enquiry-rich curriculum with access to appropriate resources.

They plan improvement that:

- builds their school's science curriculum
- raises standards for pupils
- leads colleagues to teach science better.

Most science leaders manage resources, support science curriculum development, monitor teaching quality and pupil achievement, and lead staff meetings to share ideas and skills. But less than a third are involved directly in strategic planning and development within their schools, despite this being essential to raising the profile of science and the achievement of pupils. Science leaders are able to develop a whole-school vision for science when school leadership teams value science as a core subject that builds skills across the curriculum and include it fully in strategic planning.

Questions on science leadership

- What is the whole-school vision for science?
- How do you monitor it?
- How does it link strategically with the school improvement plan?
- How is science expertise used in your school to teach and to lead science?
- What provision do you need to develop your expertise and keep your skills up to date?

How does good science leadership improve science teaching?

Building the science curriculum

Many new science leaders tell us that their first task is to organise their current resources. It's a good place to start – you need to know what you have – but there's more to it than that. Children need to develop independent learning skills and the ability to design their own investigations and take measurements with increasing accuracy. They should be able to select the resources and equipment they need to do this. Teachers also need to have confidence in using the resources themselves and know how to do so safely.

Science doesn't just take place in the classroom either. Children need to explore different environments – this is vital for all strands of science, not just biology. Access to a suitable range of environments is

essential. Some schools make use of partnerships or schemes to help them develop outdoor learning environments or enrich their curriculum⁸. Free loans of equipment, such as microscopes, and visits from local scientists provide a rich experience for children too.

Questions for reflecting on resources and environments for teaching science

- How do science resources in your school compare with recommended benchmarks?⁹
- Do you have what is needed to teach the statutory curriculum and enable pupils to work scientifically?
- What message about science is given by the state of the resources?
- Are they age-appropriate?
- Are some resources not used because teachers aren't sure how to use them?
- Do resources and environments enrich and enhance learning?
- Do you prepare an annual budget for science that accounts for consumable items and the replacement and enrichment of resources?

Our published case studies¹⁰ highlight the strategic ways that science leaders have developed their curricula beyond the statutory minimum, making science exciting and inspiring for pupils, teachers and parents¹¹. These schools have a vision for science that is shared by the whole school community.

Questions for reflecting on the science curriculum

- How does your science curriculum ensure pupils develop conceptual understanding and science skills?
- Is the curriculum flexible enough to encourage children to ask lots of questions and investigate?
- Does it match skill development in maths and English?
- How is assessment incorporated into planning?
- Does it make science seem relevant to the children attending your school?
- What does your science curriculum say about your vision for science?



“Children love the hands-on nature of the subject and the opportunities to really get involved in big, practical experiments using scientific equipment.”¹²

Raising standards for pupils

Monitoring teaching, pupil achievement and progress in science is essential, but the outcomes of this monitoring should be used strategically to secure even better science.

- data analysis
- learning walks
- moderating assessment
- observing lessons
- planning
- pupil focus groups
- team meetings
- work scrutiny
- other ideas

Sometimes science leaders deliver specialist lessons in a trade-off with a teacher leading another subject area so that pupils have challenging science lessons. While this ensures better quality teaching for some lessons, it does not allow pupils to develop their learning across other subjects or enable teachers to develop their skills in subjects that they are less confident to teach; team teaching is preferable as it shares teachers' expertise and develops skills that will raise pupils' achievement. Where opportunities for team teaching are included in strategic planning, teachers are enabled to teach science well and pupils benefit.

Questions on pupils' experiences

- Does science teaching reflect your whole-school vision for science?
- How do pupils develop science skills through working scientifically?
- Are pupils enthusiastic about learning science? How does attainment in science compare with other core subjects for all pupils?
- What strategic actions would improve learning?

Many teachers worry about assessment in science. If a teacher is not secure about science concepts, can their assessment be accurate? A child might use a key word that suggests understanding but unless probed further, mastery cannot be confirmed. When assessment is inaccurate children may develop misunderstanding or be put off science, thinking that it is too hard. Assessment needs to be planned carefully and must be integral to teaching; science leaders need dedicated management time to work with colleagues, both in school and in local networks, to develop robust practice.

Leading colleagues to teach science better

Science leaders recognise that a whole-school vision for science encourages consistency throughout the school, through shared ownership and strategic planning. But they also say that anxiety over weak subject knowledge and low confidence in teaching in a scientific way are barriers to science being as good as it can be; access to high-quality science continuing professional development (CPD) is the factor most likely to help them improve science in their schools.

“

Ensuring that each class teacher has the best subject knowledge possible is the priority for the science leader.”¹³

New science leaders want to access CPD that will equip them with good subject knowledge and pedagogical skills that they can share with their colleagues. They need time out of the classroom to coach other staff to teach science and mentor them to increase confidence. One school told us that after completing high-impact Science Learning Centre courses¹⁴, their science leader would be timetabled for one school year to teach science alongside all other teachers, to raise

science to an ‘outstanding’ level in the school. This school valued subject-specific CPD and expected that it would have a significant impact.

A range of CPD is available; you need to audit your needs against the expected impact to select the most appropriate provision.

Questions on leading others' in teaching science

- Which areas of subject knowledge do colleagues need most support with?
- How confident are teachers with assessment of science?
- What methods of support have the greatest impact on pupils' science? How do you know?
- How does support for colleagues link with all other aspects of your leadership role?

Science leaders frequently network with one another to do learning walks or to moderate assessments. Including colleagues from secondary schools helps everyone to understand how children progress in science and can prevent the overuse of some practical investigations. Online networks are great for sharing ideas and solving queries.

Improving primary science

Looking for more?

Free resources

National STEM Centre (nationalstemcentre.org.uk)

Primary Science Teaching Trust (pstt.org.uk)

Wellcome Trust (wellcome.ac.uk)

Professional development

Science Learning Centres provide professional development courses that have bursaries to cover most of the costs (www.sciencelearningcentres.org.uk)

School support

Association for Science Education (www.ase.org.uk)

Primary Science Quality Mark (www.psqm.org.uk)

1. Wellcome Trust. The Deployment of Science and Maths Leaders in Primary Schools. London: Wellcome Trust; 2013, 3.
wellcome.ac.uk/stellent/groups/corporatesite/@msh_peda/documents/web_document/wtpo56231.pdf

2. Wellcome Trust. The Deployment of Science and Maths Leaders in Primary Schools. London: Wellcome Trust; 2013.
wellcome.ac.uk/stellent/groups/corporatesite/@msh_peda/documents/web_document/wtpo56231.pdf

3. Wellcome Trust. The Deployment of Science and Maths Leaders in Primary Schools. London: Wellcome Trust; 2013.
wellcome.ac.uk/stellent/groups/corporatesite/@msh_peda/documents/web_document/wtpo56231.pdf

4. Wellcome Trust. The Deployment of Science and Maths Leaders in Primary Schools. London: Wellcome Trust; 2013, 29.
wellcome.ac.uk/stellent/groups/corporatesite/@msh_peda/documents/web_document/wtpo56231.pdf

5. The minimum science qualification required for primary teaching in England is a GCSE in science, or its equivalent.

6. This definition has been endorsed by the Education Committee of the Royal Society. wellcome.ac.uk/Education-resources/Education-and-learning/Our-work/Teacher-training/WTS052326.htm

7. Wellcome Trust. The Deployment of Science and Maths Leaders in Primary Schools. London: Wellcome Trust; 2013, 14.
wellcome.ac.uk/stellent/groups/corporatesite/@msh_peda/documents/web_document/wtpo56231.pdf

8. Join the Primary Resources community group at nationalstemcentre.org

9. SCORE (Science Community Representing Education) has produced a set of resourcing benchmarks for teachers and school practitioners to use when planning science budgets and equipping classrooms. score-education.org/publications/publications-resourcing-benchmarks

10. Wellcome Trust. The Deployment of Science and Maths Leaders in Primary Schools. London: Wellcome Trust; 2013.
wellcome.ac.uk/stellent/groups/corporatesite/@msh_peda/documents/web_document/wtpo56231.pdf

11. nationalstemcentre.org/primaryscience

12. Wellcome Trust. The Deployment of Science and Maths Leaders in Primary Schools. London: Wellcome Trust; 2013, 26.
wellcome.ac.uk/stellent/groups/corporatesite/@msh_peda/documents/web_document/wtpo56231.pdf

13. Ibid.

14. www.sciencelearningcentres.org.uk

Published in December 2015

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Wellcome Trust
Gibbs Building
215 Euston Road
London NW1 2BE, UK
T +44 (0)20 7611 8888
F +44 (0)20 7611 8545
E contact@wellcome.ac.uk
www.wellcome.ac.uk

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London NW1 2BE, UK). PE-57513/12-2014/MC