



Primary science education beyond 2021 – what next?

A commentary and guiding principles.

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Authors and acknowledgements

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We would like to thank all staff from the schools who have spared time to take part in the research since 2016, CFE Research, all the stakeholders who have worked with us on our campaign, and all those in Wellcome who enabled the primary science campaign to be so successful, including developing Explorify.

Primary science education beyond 2021 – what next?

Introduction

During 2020-2021 schools experienced considerable challenges to teaching due to the COVID-19 pandemic which affected all aspects of teaching and learning. Understanding science became especially important and for children this begins in the first stages of education.

This document considers the data that have emerged from our 2021 research together with data from our previous state of the nation reviews, stakeholders' research, and outcomes from a workshop with a wide range of stakeholders in July 2021 to consider what is needed to continue to develop good primary science education and suggest principles for the future.

Background to Wellcome's campaign

Wellcome's work in primary science education was based upon the premise that high quality primary science teaching ensures that young people will be better prepared for their futures:

- equipped for decision making as responsible citizens
- able to make informed decisions for their health and the health of others
- aware of the value of science in their lives
- able to pursue a science related career, whatever their background.

Initial research led Wellcome to develop a theory of change (Figure 1) for a primary science campaign. The importance of good science leadership in schools and improved confidence for teachers were pivotal to improve primary science teaching, characterised by more and better teaching of science. To achieve this, Wellcome needed to work with other organisations across the sector to create a more unified approach to advocacy and encourage teachers and school leaders to prioritise science more, allocate enough time for quality teaching, and value subject leadership and continuing professional development.

Further research with teachers identified that success depended upon a bespoke approach that would support teachers with tools to meet their needs. Teachers identified that supporting thinking and developing curiosity in science would be valuable to them and Wellcome invested further research to develop [Explorify](#)¹.

Explorify provides a range of curriculum-linked activities to stimulate scientific enquiry and develop thinking skills for pupils. It also provides background subject knowledge for teachers and pedagogical support as well as support to lead science. Teachers report that Explorify supports oracy, helps children apply their understanding in unfamiliar contexts, helps develop scientific vocabulary and is useful for formative assessment².

Baseline data, gathered in 2017³, indicated that science was a low priority in primary schools: around 42% of pupils in the UK had adequate teaching time for science; schools were not well resourced for

¹ www.explorify.uk created and developed by Wellcome, managed by STEM Learning since 21.09.21

² <https://cms.wellcome.org/sites/default/files/2021-09/the-impact-of-covid-19-on-primary-science-education.pdf>

³ The 'State of the Nation' report in 2017

teaching science and science leaders had little time to lead science or access to professional development.

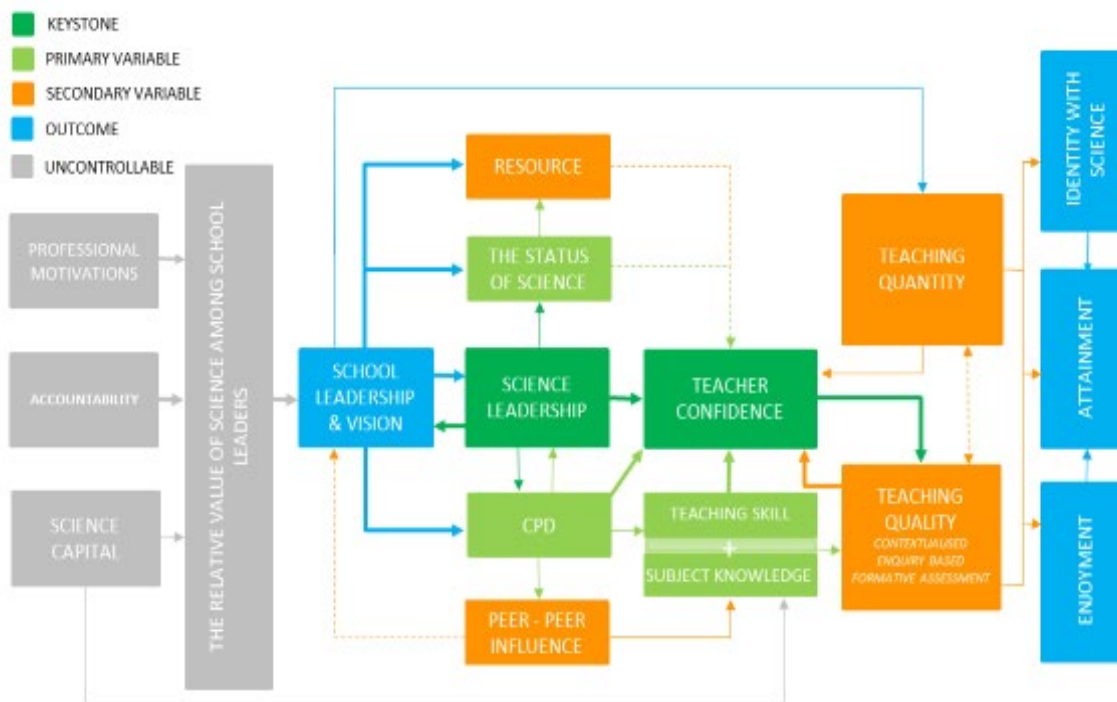


Figure 1 Theory of change

Impact of the campaign, 2018-2020

Although instigated by Wellcome, the campaign’s positive impact has arisen because of improved collaboration across the sector, including better agreement of the purpose of primary science education and a [definition](#)⁴ of the requirements of teachers and subject leaders to provide quality primary science education. Our policy and advocacy work developed from the annual data gathering (State of the Nation) reports, cited by Ofsted⁵ in its 2021 review of science education.

Data from the 2020 evaluation of the campaign⁶ indicated that when schools increase science teaching time and provide release time for science leaders to lead science well and attend continuing professional development, the quality of science teaching is improved.

Impact of COVID 19 on primary science education

Our evaluation model was altered in 2021 to reflect the changed status in education due to the COVID-19 pandemic. We sought instead to provide an informative [report](#)⁷ on how schools adapted to delivering science and to understand how pupils had been affected.

There is no doubt that school staff have worked incredibly hard to teach and support pupils and families in very tough circumstances but, the negative impact on teachers and learners is significant:

⁴ <https://cms.wellcome.org/sites/default/files/defining-primary-science-expertise.pdf>
⁵ <https://www.gov.uk/government/publications/research-review-series-science/research-review-series-science>
⁶ <https://wellcome.org/reports/primary-science-teaching-improving>
⁷ <https://cms.wellcome.org/sites/default/files/2021-09/the-impact-of-covid-19-on-primary-science-education.pdf>

- increased workloads for teachers
- planning sequences altered to make home learning more accessible
- less opportunity to develop skills for learning science
- fewer opportunities for collaborative work and problem solving
- gaps in knowledge and conceptual development
- unclear information on progress
- some of the science curriculum could not be taught
- development plans altered, abandoned or paused
- disadvantaged pupils more likely to be adversely affected.

But there have also been some positives. During the first lockdown in 2020, many teachers accessed professional development online, particularly to improve subject knowledge. With science so regularly at the forefront of news and central to decision making, the importance of science in our daily lives has become much more apparent, which helps to correct the myth that science is only for the few instead of being for all. Some schools reported better engagement with parents and carers, and new IT skills were developed as a necessity.

Developing primary science

Teaching and learning science in primary school

After such a period of upheaval, getting science education back on track might seem impossibly daunting. It's tempting to try to catch up on missed learning, but the skills of science need to be practised and built on. Children learn from making sense of the world around them, applying their learning bit by bit into new and less familiar contexts. They need opportunities to explore and discover how science works so it's important to take the time to re-establish an understanding of what a high-quality primary science education looks like and plan to move forwards, focussed on what will make a positive difference to pupils' outcomes.

Science leadership

Good primary science education is underpinned by good science leadership. Until 2020, we saw more science leaders being given meaningful time to lead their subject and this impacted positively on their colleagues and pupils⁸. It's vital that science leaders are given regular time to lead and manage science, with the expectation that they will be able to support their colleagues to develop good practice. As stated by Ofsted⁹, this requires a commitment from school leaders and governors (in England) and local authorities to fund regular release time and ongoing professional development for science leaders, and to recognise the value that science leaders bring to pupils' education.

Science leadership is often seen as a stepping-stone to other middle leadership roles because it has little specific recognition. The consequence is a regular turn-over of personnel and lack of stability in schools for science that results in limited progress and improvement. In England science is a core subject and leadership of science should be valued as much as the leadership of English and maths.

⁸ <https://cms.wellcome.org/sites/default/files/2020-10/evaluation-of-the-primary-science-campaign-2020.pdf>

⁹ <https://www.gov.uk/government/publications/research-review-series-science/research-review-series-science>

Curriculum and progression

Each UK nation has a curriculum that specifies the science that must be taught, including the skills for science and how science works but each school is free to decide how to teach science. During the pandemic, it became clear that schools had to make tough choices on what to teach and how, and inevitably knowledge rather than skills was emphasised. Future teaching must make sure that practical discovery and skills for science are not neglected but embedded throughout the science curriculum and that the context of science is relevant to pupils too. This will help children understand how science fits in with our lives and our futures.

Understanding children's progress in science has been made difficult by the mix of home and school-based learning and children from disadvantaged backgrounds have been more negatively affected than others. Getting the curriculum context and its delivery right is vital to help address gaps in learning and to build conceptual understanding. Bianchi, Whittaker and Poole's report¹⁰ explores more deeply why getting the curriculum right and understanding how children learn science is essential for good primary science teaching.

Resources and management

When Wellcome started its campaign in 2016, teachers reported that resourcing for science was a significant barrier to good science teaching. Delving deeper it appeared that the issues stemmed from how resources were managed centrally in schools, with problems over resources for teaching electricity being most frequently cited as not fit for purpose, together with a lack of understanding of how to use some equipment effectively.

But some science topics are not taught in all year groups, and every class should have access to measuring equipment for maths as well as science, so perhaps some resourcing issues could be overcome by reorganising how resources are managed, to avoid time wastage and problems with resources being broken or depleted. Long term plans help identify what might be needed so resources can be checked in advance. Each school must, however, budget appropriately for consumable materials. Resourcing must not be a barrier to good teaching and learning in future.

Timetabling for science

In 2017 Wellcome found that over half of UK schools taught science for under two hours per week. Although it is the quality of teaching that is important enough time must be given to enable children to explore and develop their conceptual understanding to make progress, and to allow the breadth of the curriculum to be taught fully. By 2020, data showed that more schools were teaching for longer, particularly schools using Explorify, but since March 2020 the amount of time allocated to teaching science has lessened. It's essential the schools allocate enough time to teach science, based upon a sound curriculum and understanding of appropriate pedagogy¹¹.

Continuing professional development

During the first lockdown of 2020, many teachers sought online professional development (CPD) for science looking to improve their subject knowledge, pedagogical content knowledge or explore support for science subject leadership. Accessing CPD online when it suited them was a real benefit to teachers who appreciated new models of delivery becoming more accessible to them, removing some of the barriers

¹⁰ https://docs.google.com/forms/d/e/1FAIpQLSea8o2twKyJGaUkpLhVpRgQuMi-rZ_KqPRXUu09fag6agFvA/viewform

¹¹ <https://www.gov.uk/government/publications/research-review-series-science/research-review-series-science#conclusion>

such as time out of school and travel previously being reported as stopping teachers accessing CPD. It demonstrated the appetite for professional development.

Uptake of CPD waned during 2021. As pupils returned to school, teachers workloads remained high or increased further as they managed multiple teaching delivery methods and worked with the constraints resulting from the pandemic. Digital fatigue also set in as teachers were spending so much time online. We see that teachers want to access professional development but the best way to achieve that is still not agreed. A diet of digital CPD is not ideal for science either; face to face CPD to develop confidence with equipment and techniques is essential.

Sector support for teachers and school leaders

In the past eighteen months providers in the primary science education sector also had to find new ways to support teachers and make their offers accessible. Reviewing how a range of stakeholders had achieved this, and how quickly showed the immense desire to make sure support for schools, teachers and pupils remained constantly available.

Digital support

Resources were already available digitally for teachers, but quick adaptations were made to enable teachers, parents and pupils to access content to support learning at home, backed by social media using common hashtags that increased visibility for teachers, parents and carers.

Providers of CPD developed blended approaches to facilitate collaboration and support individual development. Some teachers reported that accessing CPD in this way was less daunting than attending face to face sessions where they have been previously anxious about exposing what they do not know in an unfamiliar group. Confidence from such sessions inspired teachers to seek more support and continue. Further blended approaches and clear pathways developed for specific needs will be helpful to enable teachers to select the most appropriate route for continuing their professional journey, from early career teachers to those more experienced and science leaders at different stages of their journey and accounting for the specific needs of teachers who started their careers in the most recent school year.

We must be aware of expectations potentially arising that CPD takes place out of school in teachers' own time. Time for CPD needs to be balanced. The value of high quality CPD to schools and teachers, and the ultimate benefit to pupils, needs to be clearly communicated so that CPD is central to school development, with teachers taking ownership and translating the learning from CPD into high quality teaching as explored in Wellcome's CPD challenge¹².

Diversity and inclusion

The workforce of organisations that support teaching and learning is not diverse nor representative of the primary schools of the UK. We know the importance of science capital¹³ in ensuring that pupils connect with science, but we need to reflect more widely if we are to make sure that all pupils and teachers connect with science, seeing themselves reflected in schools and those who champion primary science. Sometimes the language of science is confusing for those who do not have a science background and this can add to the impression that science is for others.

¹² <https://www.shu.ac.uk/sheffield-institute-education-research/projects/wellcome-cpd-challenge>

¹³ <https://www.ucl.ac.uk/ioe/departments-and-centres/departments/education-practice-and-society/stem-participation-social-justice-research/science-capital-teaching-approach>

Data suggest that different groups of science leaders are emerging – those who actively seek and access support for their roles and those who do not. It's not clear if this trend is a direct consequence of the generally low status afforded to science leaders or if a lack of diversity is also having an impact, or a mixture of factors. If science leaders do not see themselves represented or valued, might it appear that science is not for them? We urgently need to collect data to help understand and address the cause(s).

Addressing diversity in the supporting organisations will take time and is for individual organisations to consider. However, the resources that are provided must support diversity and as far as possible for the type of resource, be inclusive for teachers and their pupils. One aspect noted by some stakeholders in reviewing their provision is that few digital resources are developed specifically for pupils with SEND in mainstream education, meaning that either the teacher must differentiate them in some way or provide another experience. Instead of supporting teachers sometimes, as a sector, we are adding to their workload. Co-development of resources and strategies may lead to more useful products.

Being prepared for future demands

Being able to adapt quickly and support schools, teachers, parents and pupils with home learning reflects the desire of the sector to support good primary science education. Stakeholders agreed they had learned through collaborative processes but acknowledge the divide between different schools and communities in terms of how they can access and then integrate support. This is a wider national funding issue for Governments to address.

Regular communication between stakeholders, with each specifying what support is being offered by whom and for whom, creates clear pathways for teachers and others in education. Future success will depend on ongoing collaboration and united approaches to advocacy, with clear recommendations for schools and the science education sector to implement, based on representative data so that teachers can have complete trust in the guidance provided.

Principles for future primary science

Good progress in science requires effective science teaching¹⁴.

- Schools must include primary science in their whole school development plans.
- All teachers must be supported to develop good subject knowledge and pedagogical content knowledge for science, aligning with their national teachers' standards.
- Enough time must be allocated to teach science regularly in a well-designed curriculum, allowing pupils to explore science, develop conceptual understanding and apply their learning.
- Science must be appropriately resourced - inadequate resources must not be a barrier to effective teaching and learning.

Good primary science education is dependent upon good science leadership¹⁵.

- Science leadership must be valued and recognised as a vital role in primary schools, at least equivalent to leadership of English and maths, and appropriately resourced.

¹⁴ https://www.scienceacrossthecity.co.uk/wp-content/uploads/2021/03/3634_Childrens_Learning_in_Primary_Science_Report_2020_v8.pdf

¹⁵ <https://cms.wellcome.org/sites/default/files/defining-primary-science-expertise.pdf>

- Science leaders must have enough dedicated management time to achieve their schools' goals for primary science, including working with and supporting colleagues, and for collaborative working with other science leaders e.g., for moderation of assessment.
- Science leaders must be able to access specific CPD for science leadership and must be given time to do so.

Science is vital for everyone's future, so it must be accessible

- Communication about science and why it matters must be simple and unambiguous, building trust in science.
- Greater diversity is needed so teachers and pupils see themselves reflected in science.
- Data should be gathered to help the sector understand ongoing needs of educators, thus ensuring that provision meets needs, locally and nationally.
- Collaboration has been a strength for the primary science education sector. This is essential for the future, so that schools are supported well and hear a unified voice for primary science.

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