Intention and substance: further findings on primary school science from phase 3 of Ofsted's curriculum research

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Introduction

This article is the first in a series of snapshots giving deeper insight into the wealth of data collected from our research programme.

Our phase 3 curriculum research found differences in curriculum quality between subjects, particularly in primary schools.[1] Inspectors found that science and most of the foundation subjects often had weaknesses in the curriculum design that were not present in English and mathematics. Because science is a core subject within the national curriculum, this is a particular worry. For that reason, we would like to provide some further detail on the science findings from the phase 3 research. These findings build on similar concerns that we identified in 2016.[2]

What's intended in the curriculum vs what actually happens in the classroom

In our study, we looked at the science offer in 14 primary schools from the phase 3 sample. The indicator criteria created for the study suggests that many of these schools had some weaknesses in developing pupils' scientific knowledge and conceptual understanding. Figure 1 provides a breakdown by some of the more important curriculum quality indicators. It shows that inspectors found the provision for English and mathematics to be much stronger than for science.

[1] 'An investigation into how to assess the quality of education through curriculum intent, implementation and impact', Ofsted, December 2018; www.gov.uk/government/publications/curriculum-research-assessing-intent-implementation-and-impact.

[2] HMCI's commentary: science and foreign languages in primary school, Ofsted, May 2016; www.gov.uk/government/speeches/hmcis-monthly-commentary-may-2016.

Figure 1: Curriculum quality indicators for science subjects reviewed in the 14 schools sampled compared with the indicators for English and mathematics

Implementation indicator	Subject	Band 1	Band 2	Band 3	Band 4	Band 5	Total
Subject leadership (3a)	Science	2	2	7	3	-	14
	English or maths	1	-	2	7	4	14
Subject knowledge (4a)	Science	3	5	5	1	-	14
	English or maths	-	-	4	8	2	14
Equitable delivery (5c)	Science	-	7	5	-	2	14
	English or maths	1	1	5	4	3	14
Depth and breadth (6a)	Science	2	4	6	1	1	14
	English or maths	1	2	4	6	1	14
Planning the progression model (6b)	Science	2	8	2	1	1	14
	English or maths	1	2	3	7	1	14
Assessment (7a)	Science	3	4	5	2	-	14
	English or maths	-	2	5	6	1	14

A score in band 1 reflects that this aspect is absent in curriculum design; a score in band 5 suggests that this aspect of curriculum is embedded in practice and may include examples of curriculums of very high quality.
The indicator references relate to aspects of curriculum quality that we tested in the phase 3 research. See the full report for more details: www.gov.uk/government/publications/curriculum-research-assessing-intent-implementation-and-impact.

However, most of these primary schools also had relatively strong curriculum aims (figure 2). This suggests that, although leaders were advocating a broad and balanced curriculum with science in its proper place, implementing the science curriculum at subject level was being prevented by other factors.

Figure 2: Curriculum quality indicators for the curriculum intent of senior leaders in the 14 schools sampled

Intent indicator	Band 1	Band 2	Band 3	Band 4	Band 5	Total
Rationale (1a)	-	1	4	5	4	14
Concepts (1c)	-	-	7	4	3	14
Ambition (2a)	2	1	4	7	-	14

A score in band 1 reflects that this aspect is absent in curriculum design; a score in band 5 suggests that this aspect of curriculum is embedded in practice and may include examples of curriculums of very high quality.
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Schools that focused on English and mathematics

Interestingly, we noted differences across the schools in how leaders had approached the science curriculum. A few headteachers had decided to focus on English and mathematics over other subject content. This was because of:

- a desire to raise low standards in reading, writing and mathematics
- pupils' poor test outcomes in reading, writing and mathematics
- a new headteacher in post who had concerns about the previous curriculum offer and their decision to reinvigorate the English and mathematics curriculum as a priority.

Science provision was weakest in these schools as a result. Leaders suggested that they were committed to ensuring that pupils could master the basics and focused on improving test outcomes before unlocking the wider curriculum. The design of this particular study did not allow us to verify these broader statements, although we will routinely check this in schools that we inspect from September 2019 under the new inspection framework.

Unsurprisingly, inspectors conducting this research saw very little science content. Where this was apparent pupils were often being given low-level worksheets to complete, even in some higher year groups. Little consideration was given to understanding scientific concepts and skills nor how they could be sequenced to aid pupils' understanding. We understand the incentives that have led some schools to deprioritise science. However, there is clearly enough room within the timetable to ensure that young people can master the essentials of English and mathematics at the same time as building their knowledge in science.

Lack of coherence

Most of the remaining schools had stronger subject leadership. Leaders responsible for designing the science curriculum had often thought about the objectives of the curriculum for their pupils and had carried out some form of curriculum planning to work towards meeting these aims. In many instances, inspectors' initial review of the curriculum documentation suggested that there was a lot of science going on.

However, despite the documentation, inspectors' focus on curriculum implementation managed to identify that much of this planning was piecemeal. It showed surface-level compliance with the national curriculum, which in practice meant carrying out one-off activities or lessons covering the statements in the programmes of study. Although a greater amount of science content was being taught in these schools, science leaders often struggled to build a meaningful science curriculum. They had a limited understanding of what progression and sequencing of knowledge and skills looked like in topics across the subject.

In a few other schools, leaders were focused more on activity-led learning, chiefly to meet the national curriculum aims of 'working scientifically'. The belief here was that

this would make learning more engaging and motivating for pupils. However, teachers' subject knowledge and their depth of planning were not strong enough to sequence the knowledge and skills that pupils needed to learn before carrying out practical experiments. Too frequently, the activities carried out were not deepening pupils' understanding of the scientific concept, because teachers had not covered the baseline substantive knowledge required sufficiently beforehand.

The misconception here is that 'working scientifically' becomes the mechanism for teaching knowledge and concepts. However, approaching the teaching of science in this way leads to a recurring problem that pupils are engaged in these lessons, but it is the experiment that is memorable and not the underlying knowledge intended to be learned. For instance, when inspectors questioned pupils during the research visits, pupils could easily recall the task carried out, but struggled to explain how the processes they were investigating actually worked.

We also found a link between weaker implementation of science and superficial oversight by headteachers and governors. Typically, headteachers did not give themselves or other senior leaders enough time to monitor how subject leaders and staff deliver the curriculum, beyond English and mathematics. They relied too much on planning documentation despite knowing that science leaders did not always have enough expertise in the subject and that staff confidence in and understanding of the science curriculum was low. Additionally, while a wealth of high-quality resources exists to support primary science leaders, too much professional development time provided by leaders in these schools focused on English and mathematics and middle-leadership training. In fact, a few headteachers were shocked to find during the research fieldwork just how limited their science curriculum really was.

The one school providing a successful science curriculum in the sample was providing coverage over whole science units in depth and with progression over and across years. Appropriate sequencing of content to build pupils understanding of scientific concepts was particularly evident in this school. Leaders were also using assessment effectively to recognise that areas of working scientifically were weaker. This had led to the subject leader delivering further training and support to other staff to make sure that practical science activities helped to improve pupils' knowledge and conceptual understanding.

Conclusion

Science has clearly been downgraded in some primary schools since the scrapping of the key stage 2 test. This is likely to have a serious impact on the depth and breadth of science understanding and knowledge that pupils take with them into secondary school, which may in turn stifle pupils' later curiosity and interest in the sciences.

School leaders need to ensure that teachers have deep subject knowledge and to consider what curriculum design really involves in science. We will carry out further investigations on the primary science curriculum later this year.

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