



# Pathfinder

A Teaching School Alliance

# Ofsted Research Review - Science



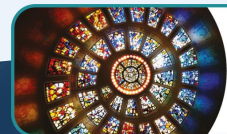
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# What does it mean for me and my school?



- What is it?
- What is it not?
- What should I do?
- What shouldn't I do?

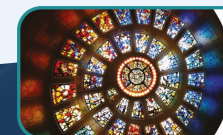


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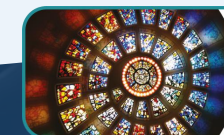
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## **1. Curriculum progression: what it means to get better at science**

# Based on the above, high-quality science education may have the following features



- The curriculum is planned to build increasingly sophisticated knowledge of the products (substantive knowledge) and practices (disciplinary knowledge) of science.
- Disciplinary knowledge (identified in the 'working scientifically' sections of the national curriculum) comprises knowledge of concepts as well as procedures.
- When pupils develop their disciplinary knowledge, they learn about the diverse ways that science generates and grows knowledge through scientific enquiry. This is not reduced to a single scientific method or taken to mean just data collection.
- The curriculum outlines how disciplinary knowledge advances over time and teaches pupils about the similarities and differences between each science.
- Pupils are not expected to acquire disciplinary knowledge simply as a by-product of taking part in practical activities. Disciplinary knowledge is taught.
- Scientific processes such as observation, classification or identifying variables are always taught in relation to specific substantive knowledge. They are not seen as generalisable skills.





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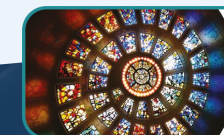
## 2. Organising knowledge within the subject curriculum



# Based on the above, high-quality science education may have the following features



- In the early years, pupils are introduced to a wide-ranging vocabulary that categorises and describes the natural world. These words are not too technical but provide the 'seeds' for developing scientific concepts that will be built on in later years.
- Attainment targets, specification points and the EYFS educational programmes are broken down into their component knowledge.
- Substantive knowledge is sequenced so that pupils build their knowledge of important concepts such as photosynthesis, magnetism and substance throughout their time at school.
- Knowledge is sequenced to make the deep structure of the scientific disciplines explicit. This allows teachers and pupils to see how knowledge is connected.
- Disciplinary knowledge is sequenced to take account of:
  - its hierarchical structure
  - the best substantive contexts in which to teach it.
- Once disciplinary knowledge is introduced, it is used and developed in a range of different substantive contexts.
- Planning for progression takes account of what is taught in other subjects. For example, the science curriculum should be coherent with what is taught in mathematics. Where there are differences, these are made explicit to pupils and teachers.





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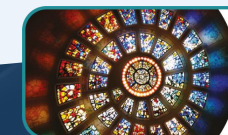
## 3. Other curricular considerations



# Based on the above, high-quality science education may have the following features



- Sufficient curriculum time is allocated for pupils to embed what they have learned in long-term memory through extensive practice before moving on to new content.
- The component knowledge pupils need in order to read, write, represent and talk science is identified and sequenced.
- Curriculum plans consider how component knowledge introduced at one point in time influences future learning. This ensures that knowledge builds incrementally from pupils' prior knowledge and so pupils' misconceptions are less likely.
- The curriculum anticipates where pupils are likely to hold misconceptions. These are explicitly addressed, and pupils learn how the misconception is different to the scientific idea.
- Pupils know when and why models and rules can be used in science, which includes knowing what they can and cannot be used for.





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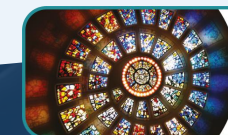
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## 4. Curriculum materials

# Based on the above, high-quality science education may have the following features



- Online resources match what the curriculum is intending pupils to learn and are not a source of errors/misconceptions.
- If science kits are used, they help achieve the curriculum intent and the activities themselves do not become the curricular goal.
- High-quality textbooks are used as an important resource for learning and teaching science.





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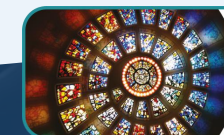
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## 5. Practical work

# Based on the above, high-quality science education may have the following features



- The curriculum is sequenced so that pupils have the necessary disciplinary and substantive knowledge to carry out practical work successfully and learn from it.
- The purpose of practical work is clear in relation to curriculum content so that practical activities can be set up and managed to develop pupils' disciplinary and/or substantive knowledge.
- Practical activities form part of a wider instructional sequence that gives pupils time to connect theory to observation.
- Pupils are not expected to learn disciplinary knowledge only through taking part in practical work – disciplinary knowledge should be taught using the most effective methods.
- Pupils encounter the full range of objects and phenomena they are studying through both laboratory and fieldwork. These encounters should take pupils beyond their everyday experiences to develop a sense of wonder and curiosity about the material world.





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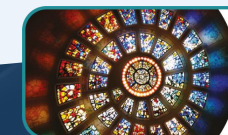
## 6. Pedagogy: teaching the curriculum



# Based on the above, high-quality science education may have the following features



- Activities are carefully chosen so that they match specific curriculum intent.
- Teachers use systematic teaching approaches, where learning is scaffolded using carefully sequenced explanations, models, analogies and other representations to help pupils to acquire, organise and remember scientific knowledge.
- Teaching takes account of the limited working-memory capacity of their pupils when planning lessons.
- Pupils are not expected to arrive at scientific explanations by themselves without sufficient prior knowledge.
- Systematic approaches, alongside carefully selected texts, are used to teach the most important vocabulary in science.
- Pupils have regular opportunities in the early years and primary classrooms to learn vocabulary through story and non-fiction books, rhymes, songs and oral rehearsal.





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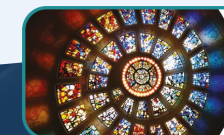
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## 7. Assessment

# Based on the above, high-quality science education may have the following features



- Teachers and pupils are clear on the purpose of assessment. There is clarity about what is being assessed.
- Assessment is not overly burdensome on teachers' time in relation to marking, recording or feedback.
- Feedback is focused on the science content and not on generic features. Teachers have sufficient subject knowledge to be able to do this.
- Pupils regularly retrieve knowledge from memory to help them remember and organise their knowledge. This is coupled with feedback. Teachers think carefully about what pupils are being asked to retrieve and whether this prioritises the most important content.
- Overuse of external assessment items, such as GCSE or A-level questions, is avoided because this narrows the curriculum and leads to superficial progress that does not prepare pupils for further study.
- Systems are in place to support teachers to make accurate decisions when assessing pupils' work. This includes supporting primary teachers with statutory teacher assessment of science at key stages 1 and 2.





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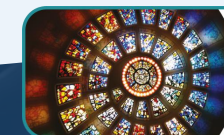
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## 8. Systems at subject and school level

# Based on the above, high-quality science education may have the following features

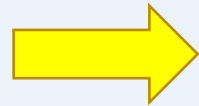


- Teachers, teaching assistants and technicians have access to high-quality subject-specific CPD to develop subject knowledge and pedagogical content knowledge. This is aligned to the curriculum.
- In primary schools, there is at least one teacher who specialises in teaching science and science leaders have dedicated leadership time.
- Science teachers engage with subject associations, and take responsibility, with support from the school, for developing their own subject knowledge throughout their career.
- Early-stage teachers in particular have timetables that allow them to develop expertise in one science and that do not give them too many key stages to teach.
- Timetables allocate appropriate teaching time to science, reflecting its status as a core subject in the national curriculum. There are particular concerns that pupils in some primary schools are not receiving sufficient curriculum time to learn science.
- Pupils have access to sufficient practical resources to take part in demanding practical work, either independently or in appropriately sized groups that enable first-hand experiences.





# Other key docs to read:



THE 10 KEY ISSUES  
WITH CHILDREN'S  
LEARNING IN  
PRIMARY SCIENCE  
IN ENGLAND

