Science Curriculum Rationale

At St Thomas of Canterbury School, children will explore the world around them that was created by God. Through the specific disciplines of physics, chemistry and biology, they will learn about how the physical and natural world works, what its components are and how the world got to be the way it is. Science education is essential to provide children with a broad understanding of the status and nature of scientific knowledge, how it is created and how dependable it is.

INTENT

Alignment to National Curriculum

St Thomas of Canterbury follows the National Curriculum programme of study as this ensures cohesion and progression.
Rising Stars, Ark+, PLAN Knowledge Matrices produced by the ASE and the key vocabulary list produced by STEM supplement the National Curriculum ensuring teachers recognise the powerful knowledge and core vocabulary all children must master.

End Points

By the time pupils move on to secondary school, they will be able to answer their own science questions independently, by carrying out one of the five types of enquiry. The end points for working scientifically, set out in the National Curriculum for Y2 (where the focus is observation and exploration) and Y4 (scaffolded enquiry), are the stepping stones towards this goal.

Sequencing

The National Curriculum for science follows the Bruner model of a spiral curriculum and so has been carefully sequenced to provide progression through the domains of biology, chemistry and physics. Through an enquiry-based approach, pupils develop their understanding of how the 'small' ideas and details they have previously mastered develop into 'bigger' ideas. This is all part of their journey towards an understanding of the 'big ideas' in science, mastered by the end of KS4, as outlined by Harlen et al (2015).

Addressing Social Disadvantage

Demographically, the people learning STEM subjects beyond 16 in the UK fall into the same gender, ethnic and social groups as they did 20 years ago, and yet there is a STEM skill gap in the country. St Thomas of Canterbury uses the 'science capital' approach to try to address this inequality. We recognise that children come to us with different amounts of science capital (knowledge, attitudes, skills and experiences) and use enquiry-based learning alongside regular opportunities for retrieval practice to close this gap. Additional science capital is gained by all through activities such as trips and science visitors.

Local Context

Sheffield is one of the greenest cities in the world. St Thomas of Canterbury is set within walking distance of Graves Park and local woods. We have a wildlife pond and woods on site. These resources are utilised to support the teaching of science in the real world and so enhance children's science capital.

IMPLEMENTATION

Pedagogical Approaches

We have an enquiry-based approach to learning in science as this has proven to be effective in enabling children to make strong connections between the 'smaller' ideas and details mastered in previous year groups and the 'bigger' ideas they are currently studying (Harlen et al 2015). Retrieval practice, as described by Rosenshine and rooted in cognitive science, is used at appropriate intervals to ensure children remember the key knowledge acquired through enquiry. This knowledge will form the 'smaller' idea in the next stage of their development.

Teachers' Expert Knowledge

The demonstration of good subject and curriculum knowledge is a requirement in the DfE teaching standards. To this end, it is expected that teachers whose curriculum knowledge is not sufficiently developed will take steps to address this gap (e.g. through reading or participating in online training such as Reach Out CPD). It is essential that teachers have the required level of expert knowledge so that explanations are clear and accurate, and children's misconceptions are anticipated and addressed as they arise.

Promoting Discussion and Understanding

An enquiry-based approach to science naturally leads to conversation. Children share observations and findings and help one another to make connections in their learning and so develop a deeper understanding. Discussion (both pupil to pupil and pupil to teacher) has an important role in the development of scientific ideas. Effective questioning by the teacher is key to allow pupils to practise new knowledge and to help them make links between new material and prior learning (Rosenshine). Essentially, through these opportunities for science talk, key vocabulary, and so core knowledge, is truly mastered.

Knowing More and Remembering More

Knowledge organisers set out the powerful knowledge, core vocabulary and big ideas that all children are expected to master. A first lesson for each unit of work is used to review the 'smaller' ideas mastered in previous units, ready for their development in the new one. Opportunities for retrieval practice are included in science lessons to ensure knowledge is transferred into long-term memory. Retrieval activities may require children to remember learning from the previous lesson, previous topic or even previous year to ensure the retrieval strength of powerful knowledge is high.

Teacher Assessment

We are part of the EFA project. Formative assessment is essential in the implementation of the science curriculum to ensure that all children are developing the declarative and procedural knowledge needed to ensure the further development of cognitive schemas of understanding which will move them on their journey from novice to expert. Effective questioning, as outlined in Rosenshine's principles, plays a fundamental role in checking for understanding and ensuring misconceptions are quickly addressed.

IMPACT

Approach to Assessment

The five strategies of formative assessment (Wiliam 2011) are used in science to support and promote deep learning. These provide the foundations for any summative assessments required e.g. at the end of KS1 and 2. Focussed assessment tasks, such as those shared on the PSTT website, and specific recall activities like quizzes, are used to enable teachers and children to monitor the depth of understanding of core procedural and declarative knowledge and the strength of its retrieval.

Performance Data

Data is published for science at the end of KS1 and KS2. The school tracks progress towards these to ensure children are on target for national expectation. Historically, children achieving national expectation at St Thomas of Canterbury at both Ks1 and 2 is around 80 - 90%.

Pupils' Work

Pupils' work, in written and photographic forms, is used to secure and demonstrate children's learning. It informs teacher assessment, both formative and summative, and is used by subject leaders as part of the monitoring process. Greater independence in written work is evident in the higher year groups as enquiry becomes less scaffolded.

Talking to Pupils

The subject leader talks to pupils about their learning as part of the monitoring process. Children's books and knowledge organisers are used to guide discussion and provide the subject leader with the information required to measure how much of the powerful knowledge and core vocabulary has been remembered and understood.

Links / References

The National Curriculum for Science
Rosenshine's Principles for Instruction
Dylan Wiliam – Embedded Formative Assessment
The Teaching of Science in Primary School – Wynne Harlan and Anne Qualter