HIGHFIELD FARM PRIMARY SCHOOL

Science Policy

Date of Policy approval _____
Date of Policy review _____

"Science is a way of life. Science is a perspective. Science is the process that takes us from confusion to understanding in a manner that's precise, predictive and reliable - a transformation, for those lucky enough to experience it, that is empowering and emotional."

— Brian Greene

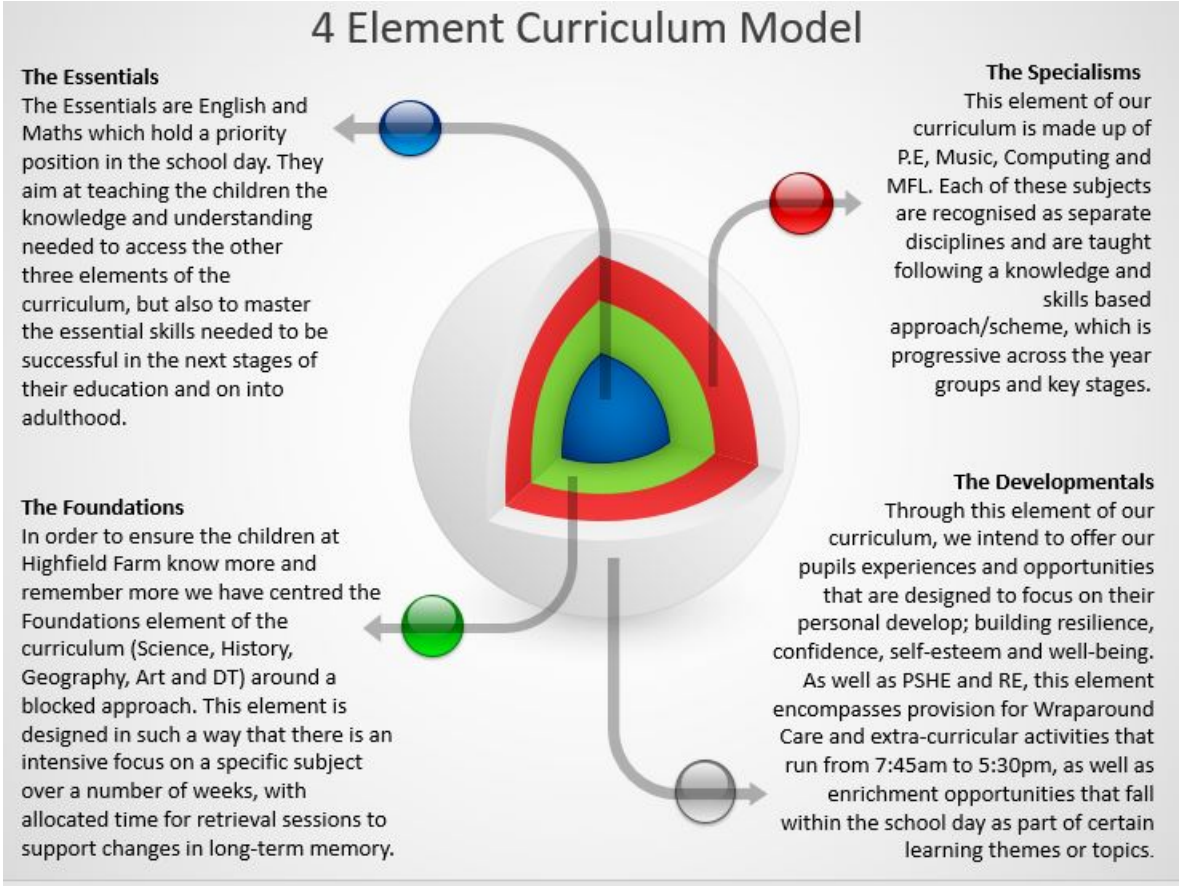
Science is important at Highfield Farm. The teaching of science builds on the natural curiosity children are born with and it is our intent to foster this curiosity within the pupils by developing their understanding of the importance of scientific discoveries throughout history, for example: Galileo's development of the first telescope; Newton's discovery of gravity; Darwin's theory of evolution, and many more! The teaching of science provides pupil's both substantive knowledge, where they learn the products of science (such as models, laws and theories), and disciplinary knowledge, where the children understand the practices of science and how theories can be supported with evidence. The importance of science is shown at Highfield Farm, by being placed as a key element within the *Foundations* aspect of our curriculum.

Intent

At Highfield Farm, through our science curriculum, we aim to build and develop scientific vocabulary; increase our pupil's knowledge and understanding of science (and the specific disciplines of chemistry, physics, biology and working scientifically); the importance of scientific discoveries throughout history and different scientific enquiries that are used to support many, many theories! We seek to create an everlasting love of science within all of our pupils through fostering positive attitudes, encouraging open-mindedness and developing confidence within the subject. We understand the importance of developing aspirations in science within our children for the betterment of society and, through high-quality teaching and learning, our children will develop a love for the curious nature of science and strive to become scientists in the future.

In science, children need to develop their knowledge in a structured and organised way, to limit working memory overload which in turn will lead to long-term retention of knowledge. To further aid in this, our curriculum at Highfield Farm is sequenced to reveal the slight

interplay within both substantive and disciplinary knowledge – this not only develops their knowledge and understanding of science concepts, but also the evidence for it. As the children progress through their journey of science, we aim for children to develop upon their existing skills and knowledge which can then be spread across other areas in the curriculum. Our curriculum aims to broaden the children's understanding of scientific processes which will in turn help them to understand the natural world around them for life.



We see all children at Highfield Farm as 'scientists in training' and each as an individual with their own thoughts and ideas about the world around them. To this end, we strive to encourage all children to develop critical thinking skills alongside the practical skills they require to test their hypothesis. Furthermore, one of our principle aims is to foster collaborative skills through investigative experiments.

Implementation

Based upon the National Curriculum and the individual needs and starting points of our children, we have developed a science curriculum progression map through the use of composites and components, which sets out the individual objects taught in each year group and the knowledge the children are expected to learn and retain by the end of KS2. At both Key Stages, the 'sticky knowledge' takes full account of the National Curriculum's main characteristics of:

- **Physics**
- **Chemistry**
- **Biology**
- **Working scientifically**

These are further intertwined with the following distinctions:

- **Substantive knowledge (the products of science such as concepts, laws and theories)**
- **Disciplinary knowledge (how scientific knowledge is generated and grows)**

And working scientifically through:

- **Knowledge of methods that scientists use to answer questions**
- **Knowledge of scientific apparatus and techniques (including measurement)**
- **Knowledge of data analysis**
- **Knowledge of how science uses evidence to develop explanations**

Organisation

Due to the make-up of cohorts at Highfield Farm, a cycled approach to coverage was developed to ensure that all children have access to the entire science curriculum throughout their primary education. In foundation stage, the children will learn science through the area of 'Understanding the World'. In year 1 and 2, a two-year cycle of the KS1 curriculum is in place, as is the same in years 3-4 & 5-6. Planning for the units set out in the National Curriculum are taken from our long- and medium-term documents, which all staff have access to from the shared drive.

Sequencing

The units identified and planned for in our science curriculum have been structured within the school's long-term plan with meticulous consideration. Not only has this been considered to ensure coverage, but it is also planned in a way that offers the children a good foundation for securing substantive knowledge and conceptual understanding. As the children progress through both individual academic years and the entire primary curriculum, we expect the children's understanding of vocabulary and abstract ideas to develop in such a way that it becomes stored within their long-term memory and thus the science units are placed on our curriculum to add a further developmental undercurrent to teaching. We understanding that repeated exposure to taught knowledge and skills are key for children's long-term success in science. All staff delivering science are to plan an introductory session before the commencement of each new unit, recapping previously taught knowledge. This is to aid in the retention and for the children to form links in their learning both from that year's units and knowledge taught in previous years in order to ensure long-term retention of skills and knowledge.

Planning

Long and short-term planning is supported by an online resource, Developing Experts, which provides a sequenced curriculum designed to support the delivery and retrieval of skills and knowledge throughout the school. It is the teacher's responsibility to consider the children's working short-term memories when planning lesson sequences and this should be done effectively and, in a manner, which considers long-term retention of knowledge and success.

Wherever possible, we aim as a school to provide real, first hand experiences to the children, from visits to external science centres, visitors and experimentation. This is to ensure the children have a basis of understanding of each new unit that will be covered and as a tool to engage the children in all units that will be delivered.

Each individual lesson has content that is carefully differentiated both between, and within, year groups so that we can ensure learning is age-appropriate and high expectations of the learning outcomes can be maintained. Individual and/or sequences of lessons must consider the following principles of instruction as laid out by Barak Rosenshine (see appendix 1) so that clarity and simplicity to the teaching and learning process within science is clear. It is not expected that all principles are evident in each lesson, but a range designed for across the unit sequence. The purpose of incorporating these principles into our science curriculum, is so that new understanding and material is not only understood fully but transferred from the pupil's working short-term memory into their long-term, allowing for schemata to develop and new, continuous learning to occur naturally.

Science Skills

The National Curriculum working scientifically statements are what we assess against at Highfield Farm Primary School. However, as these statements are quite complex and built with specific terminology and non-child friendly terminology, we have adapted these into ten skills areas within KS2 and seven skills for KS1 taken from the Primary Science Education Consultancy program. These skills will be included within the lesson WALT where applicable so that the children are aware of the skill they will be using and developing within a given session. The science skills we focus on at Highfield Farm are based upon the five types of science enquiry set out in the National Curriculum:

- ***Comparative and fair testing***
- ***Observing over time***
- ***Pattern seeking***
- ***Classifying***
- ***Research using secondary sources***

In order to ensure our children become competent and comfortable with the skills they are developing within a lesson, we include a symbol to highlight the skill being taught – see below:

	Science skill		Science skill
	Asking scientific questions		Presenting results
	Planning an enquiry		Interpreting results
	Observing closely		Drawing conclusions (KS2 only)
	Taking measurements		Making predictions (KS2 only)
	Gathering and recording results		Evaluating an enquiry (KS2 only)

Vocabulary

Vocabulary in science at Highfield Farm is taught both discretely and directly. Teachers must plan for key questioning and provide opportunities for discussion throughout all units taught in order for children to acquire new terminology and, in turn, use it effectively in both writing and verbalisation. Key scientific terms (such as capillaries, cardiovascular, vertebrates, oesophagus, substance, coniferous, mammals, etc.) are revisited following Rosenshine's principles of instruction regularly, to ensure learning is memorable, relevant and retrievable. This is complimented by our vocabulary policy. The teaching of vocabulary has been specifically designed to also take account of introducing children to specific terminology that will support future learning across the entire curriculum.

Throughout the entire National Curriculum for science, the importance of spoken language in pupils' development cannot be understated. At Highfield Farm, we provide a quality and variety of subject specific vocabulary to develop children's confidence and accuracy when using science specific language and their ability to articulate science concepts clear and concisely.

Reading in Science

At Highfield Farm, we fully understand and embrace the importance of reading. In science, we see it as integral for children achieving their full potential and readiness for secondary science education. As the children become more secure in the phonics understanding and become increasingly competent in their ability to read, they will become exposed to a wider selection of literature to support the teaching of science. In doing so, it is our aim that the children become more exposed to the scientific terminology and disciplinary vocabulary they require in order to be successful, as doing so will enable an academic understanding that will better prepare them for their secondary education. Teachers should aim for a reading opportunity in ever lesson. High quality non-fiction science texts will be updated annually with the support of the English subject leads.

EYFS

We understand the necessity of teaching science in our EYFS unit at Highfield Farm. Following the EYFS framework, we ensure that we provide the children in EYFS a range of experiences which increases their understanding of themselves, the world and their place within it. We aim to achieve this by offering opportunities for the children to explore the natural world, learning about the seasons, and changing states of matter. By the end of their EYFS learning, we expect the children to be confident in their understanding and with their arsenal of vocabulary they will develop, which in turn will aid their transition into KS1 science.

Assessment

Assessment for learning is continuous throughout all delivery of science, through the entire planning, teaching and learning cycle.

At the end of each unit, children in both KS1 and KS2 are tasked with answering specific questions (in written form) that evidence their acquisition of key knowledge set out in our curriculum. This is to identify what each child knows about the unit covered at its completion to ensure progression in following units as they progress through their journey in primary science.

Children are further assessed in the following ways:

- Being observed while working (individually, in pairs, in small groups and in class discussions)
- Key questioning during and out of lessons
- Studying of the work the children have produced and the investigations they have designed

Outcomes of the work produced by the children, key questioning and their responses all evidence their progress within each unit.

Impact

The impact of our science curriculum is measured in a variety of different ways: key questioning and responses during lesson, marking of the children's work, listening to child-led discussions, interviewing the pupils about their education and book-looks and using images and videos of the children's investigations.

By the end of Key Stage 2, and when the children have completed the science curriculum at Highfield Farm, our children will:

- Have a wider understanding and an ability to use a range of scientific vocabulary and terminology,
- Have a secure understanding of the different branches of science (physics, chemistry, biology and working scientifically),

- Have a breadth of knowledge on how and why things work the way they do;
- Have an understanding of what area of science they enjoy most and why;
- Have increased critical thinking skills so that they are able to scrutinise current accepted theories
- Have a range of problem-solving skills which lead to intrigue and increased questioning of accepted theories;
- Be confident in their own skills as scientists and have a sense of readiness for their secondary science education.

Appendix

THE PRINCIPLES OF INSTRUCTION

Taken from THE INTERNATIONAL ACADEMY OF EDUCATION
By BARAK ROSENSHINE
Based on strategies to optimise how we acquire and use new information

01 DAILY REVIEW

Daily review is an important component of instruction. It helps strengthen the connections of the material learned. Automatic recall frees working memory for problem solving and creativity.

02 NEW MATERIALS IN SMALL STEPS

Our working memory is small, only handling a few bits of information at once. Avoid its overload – present new material in small steps and proceed only when first steps are mastered.

03 ASK QUESTIONS

The most successul teachers spend more than half the class time lecturing, demonstrating and asking questions. Questions allow the teacher to determine how well the material is learned.

04 PROVIDE MODELS

Students need cognitive support to help them learn how to solve problems. Modelling, worked examples and teacher thinking out loud help clarify the specific steps involved.

05 GUIDE STUDENT PRACTICE

Students need additional time to rephrase, elaborate and summarise new material in order to store it in their long-term memory. More successful teachers built in more time for this.

06 CHECK STUDENT UNDERSTANDING

Less successful teachers merely ask "Are there any questions?" No questions are taken to mean no problems. False. By contrast, more successful teachers check on all students.

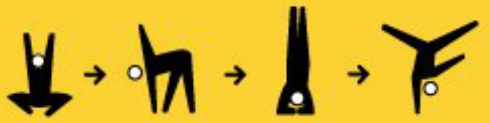
07 OBTAIN HIGH SUCCESS RATE

A success rate of around 80% has been found to be optimal, showing students are learning and also being challenged. Better teachers taught in small steps followed by practice.

08 SCAFFOLDS FOR DIFFICULT TASKS

Scaffolds are temporary supports to assist learning. They can include modelling, teacher thinking aloud, cue cards and checklists. Scaffolds are part of cognitive apprenticeship.

09 INDEPENDENT PRACTICE



Independent practice produces 'overlearning' – a necessary process for new material to be recalled automatically. This ensures no overloading of students' working memory.

10 WEEKLY & MONTHLY REVIEW

The effort involved in recalling recently-learned material embeds it in long-term memory. And the more this happens, the easier it is to connect new material to such prior knowledge.

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