

Science Policy

Intent at The Willows

Creating a sense of 'Awe and Wonder' has provided the basis for the Science Curriculum at The Willows. High-quality science education drives our curriculum, ensuring that all of our children have the opportunity to find out about the world around them and explore their place within it. It is our intent to inspire the next generation of scientist and equip all our pupils with the skills and knowledge they need to succeed in an increasingly scientific and technological world.

Staff collectively created a set of Science principles (2022) by which all of our teaching and learning stems from;



The Willows Primary School Science Principles

For a child to be able to develop their scientific skills and knowledge, they need to be given the freedom to explore ideas, questions and concepts. They must have the chance to pose their own questions for investigations and to feel empowered in making mistakes and changing ideas.

Science at the Willows is everyone...

Staying Safe

Enjoying

EXPLAINING IDEAS

INVESTIGATING

Working Scientifically

ASKING QUESTIONS

WONDERING

Involved and engaged

Inflated by teachers, brought to life with the children (poster created by Y5 pupil)

Science at The Willows will:

- be taught on a weekly basis;
- have lessons that are at least 1.5 hours in length;
- develop our working scientifically knowledge;
- use practical equipment where appropriate;
- encourage exploration;
- encourage question asking;
- get everyone involved;
- involve and encourage investigations;
- encourage asking; why? how?

According to Sherrington (2020), the experience of 'doing' is more likely to build schema and make it stick as children are able to make links to what they have seen or done. Using the enquiry-based approach to learning in science, children will be supported in making connections

between what they know and have learned, and what they are being introduced to. Planned, purposeful practicals and visual or physical prompts, give children the opportunity to activate that prior knowledge.

A sense of rigor and clear structure means that the National Curriculum is set as the minimum expectation for The Willows, with additional non-statutory guidance used to further develop children's understanding and capabilities. Underpinning each and every lesson across our entire curriculum is the processes and methods of 'Working Scientifically' where the children are encouraged to develop their knowledge of Working Scientifically/Disciplinary knowledge. Science, as a core subject, is often independent of themes or topics, except where these themes and opportunities can enhance and embed the learning; this is in order to ensure that children develop a secure understanding of each key unit of knowledge.

To ensure a purposeful and challenging curriculum is embedded successfully, all teaching staff take part in regular professional development during staff meetings with the science lead or via external means. Staff planning Science lessons also have a termly opportunity to map out their next unit with coaching support from the subject leader. This gives others the chance to hear and share the latest research and developments relevant to this subject. All staff have the opportunity to take part in their own CPD with relevant science courses signposted.

Implementation at The Willows

Curriculum

Staff are well informed and well equipped to plan a challenging and enriching Willows' curriculum. Our curriculum teaches the entire EYFS Framework through Development Matters 2021 and the National Curriculum 2014, and is based on current evidence-led practice for pedagogy and learning. Subject knowledge and workload is well supported through research and evidence-led practice and resources sign posted by the subject leaders.

Rooted firmly in the National Curriculum, PLAN resources (see below) are used to ensure a familiarity with the curriculum as a whole; particularly the learning that has taken place prior to or after the given year group. Our Science curriculum is created collaboratively with teachers and aims to be creative with purpose, inspiring and rich with knowledge.

Disciplinary Knowledge

Disciplinary knowledge refers to the theories and concepts making up Science, the method of posing questions and carrying out investigations. Although there is no fixed way in which scientists work, all investigations tend to have aspects of common processes such as observation, classification, hypothesising, data collection, interpretation of data and evaluation. Children will be immersed in the different ways in which a Scientist works: what disciplinary knowledge they possess and the way in which they collect or find their data;

answering questions in different ways; comparative and fair testing, identifying and classifying, pattern seeking, observation over time, and research which are often referred to as 'Enquiry Types'. The Working Scientifically elements of the curriculum are not taught as a separate strand but they permeate throughout all science teaching.



To ensure that this is embedded within our curriculum, we have embraced a TAPS (Teacher Assessment in Primary Science) approach from the Primary Science Teaching Trust. This approach ensures that disciplinary knowledge is weaved through everything that we do and is focused upon through their given 'focused assessments'. A TAPS focused assessment is completed once per unit, mid-way through the unit to give opportunities for recap or the addressing of misconceptions is found. Teachers assess formatively throughout lessons to improve outcomes for children. Year 6 staff will draw on formative assessments to report summatively.

Substantive knowledge

In Science, this refers to the knowledge of the subject as written out in National Curriculum unit objectives. This encompasses key concepts that serve as the foundation of the subject, such as digestion, evolution, the notion of force, and the essential scientific vocabulary. Possessing a firm grasp of substantive knowledge links prior knowledge to new learning, fostering the development of conceptual understanding. It is recognised that there is a vast amount of substantive knowledge within the Science curriculum and it requires meticulous sequencing over time and opportunities for revisiting to build upon.

Substantive knowledge should embed disciplinary knowledge within the most appropriate substantive content and be based on children's existing concepts in science. We aim to arouse curiosity about natural phenomena which stimulates the posing of questions about such phenomena.

Inclusion

Our Science lessons are carefully designed to be fully inclusive of all children, regardless of their ability or background. The approach in Science lessons at The Willows begins by acknowledging and building upon the children's existing knowledge and understanding of the subject matter in addition to their own personal experiences. The interactive and exploratory nature of these lessons ensures that all students can engage with the activities and articulate their comprehension. Where necessary, pupils with Special Educational Needs and Disabilities (SEND) or with English as an Additional Language (EAL) may be introduced to relevant vocabulary beforehand to enable their active participation in lessons, but again sometimes it may be necessary for children to be immersed in the experience, to truly understand the language e.g. the word 'shadow' can be quite abstract until it is seen and explored. Encouraging pupils to communicate their

knowledge and understanding through verbal explanations and drawings may alleviate the pressure of producing extended pieces of writing.

Retrieval

Revisiting is inherently built into the architecture of our Science curriculum. Teachers should seek to revisit key vocabulary and knowledge as frequently as possible. By providing the opportunity for students to retrieve knowledge, it enhances their understanding of new concepts. Pupils benefit from having time to discuss ideas, answer questions, and practice applying their knowledge. Throughout their learning journey, children will use a range of retrieval strategies to ensure retention and ensure a depth and breadth of knowledge is built. As such, lessons will usually begin with a recall of previous learning, whether this be from the last lesson, last topic or when the topic was last studied in a previous year group. There are various methods of retrieval used such as Explorify or physical props, but they will be chosen carefully to ensure activation of the appropriate prior knowledge.

PLAN assessment documents lay out what should have been done prior to teaching and what the children will move onto next; this provides the perfect stepping stones to ensure learning is built upon. New content is connected to prior learning and children's own or local experiences, easing the load on their working memory. To ensure progression of knowledge, skills and vocabulary, staff use PLAN documents to help plan and map out each unit. These documents provide an overview for each unit across the year groups, explicitly listing the vocabulary to be introduced in each year. The plans also indicate connections to other areas of the Science curriculum (red) where this knowledge will also contribute to the unit.

E.G. Vocab PLAN document for forces

Forces


Year-group(s)	Vocabulary/Statement(s)
Birth to 3	<ul style="list-style-type: none"> Repeat actions that have an effect.
Nursery	object, float, sink, water, up, down, top, bottom, push, pull, magnet, spring, squash, bend, twist, stretch, turn, spin, smooth, rough, fast, slow
Reception	float, sink, up, down, top, bottom, surface, move, roll, drop, fly, turn, spin, fall, fast, slow, faster, slower, fastest, slowest, further, furthest, wind, air, water, blow, bounce
Year 1	
Year 2	flexible, rigid, shape, push/pushing, pull/pulling, twist/twisting, squash/squashing, bend/bending, stretch/stretching (Y2 - Uses of everyday materials)
Year 3	force, push, pull, twist, contact force, non-contact force, magnetic force, magnet, strength, bar magnet, ring magnet, button magnet, horseshoe magnet, attract, repel, magnetic material, metal, iron, steel, poles, north pole, south pole
Year 4	
Year 5	force, gravity, Earth, air resistance, water resistance, friction, mechanisms, simple machines, levers, pulleys, gears
Year 6	
Key Stage 3	<ul style="list-style-type: none"> Magnetic fields by plotting with compass, representation by field lines Earth's magnetism, compass and navigation Forces as pushes or pulls, arising from the interaction between two objects Using force arrows in diagrams, adding forces in one dimension, balanced and unbalanced forces Moment as the turning effect of a force Forces: associated with deforming objects; stretching and squashing – springs; with rubbing and friction between surfaces, with pushing things out of the way; resistance to motion of air and water Forces measured in Newtons, measurements of stretch or compression as force is changed

E.G. Knowledge objectives PLAN document for plants

Plants

Birth to three	<ul style="list-style-type: none"> Explore natural materials, indoors and outside.
Nursery	<ul style="list-style-type: none"> Use all their senses in hands-on exploration of natural materials. Explore collections of materials with similar and/or different properties. Plant seeds and care for growing plants. Understand the key features of the life cycle of a plant and an animal. Begin to understand the need to respect and care for the natural environment and all living things.
Reception	<ul style="list-style-type: none"> Draw information from a simple map. (Reception – Living things and their habitats) Explore the natural world around them. (Reception – Living things and their habitats) Describe what they see, hear and feel whilst outside. (Reception – Living things and their habitats) Recognise some environments that are different to the one in which they live. (Reception – Living things and their habitats) Understand the effect of changing seasons on the natural world around them. (Reception – Seasonal changes)
Year 1	<ul style="list-style-type: none"> Identify and name a variety of common wild and garden plants, including deciduous and evergreen trees. Identify and describe the basic structure of a variety of common flowering plants, including trees.
Year 2	<ul style="list-style-type: none"> Observe and describe how seeds and bulbs grow into mature plants. Find out and describe how plants need water, light and a suitable temperature to grow and stay healthy. Identify and name a variety of plants and animals in their habitats, including microhabitats. (Y2 - Living things and their habitats)
Year 3	<ul style="list-style-type: none"> Identify and describe the functions of different parts of flowering plants: roots, stem/trunk, leaves and flowers. Explore the requirements of plants for life and growth (air, light, water, nutrients from soil, and room to grow) and how they vary from plant to plant. Investigate the way in which water is transported within plants. Explore the part that flowers play in the life cycle of flowering plants, including pollination, seed formation and seed dispersal.
Year 4	<ul style="list-style-type: none"> Recognise that living things can be grouped in a variety of ways. (Y4 - Living things and their habitats) Explore and use classification keys to help group, identify and name a variety of living things in their local and wider environment. (Y4 - Living things and their habitats) Recognise that environments can change and that this can sometimes pose dangers to living things. (Y4 - Living things and their habitats)
Year 5	<ul style="list-style-type: none"> Describe the life process of reproduction in some plants and animals. (Y5 - Living things and their habitats)
Year 6	<ul style="list-style-type: none"> Describe how living things are classified into broad groups according to common observable characteristics and based on similarities and differences, including micro-organisms, plants and animals. (Y6 - Living things and their habitats) Give reasons for classifying plants and animals based on specific characteristics. (Y6 - Living things and their habitats)
Key Stage 3	<ul style="list-style-type: none"> Reproduction in plants, including flower structure, wind and insect pollination, fertilisation, seed and fruit formation and dispersal, including quantitative investigation of some dispersal mechanisms.

E.G. PLAN overview for Y2 Animals inc humans (each unit available for each year group) These plans also include the possible misconceptions that children might have so that they can be tackled through the unit.

	Year	2	Topic	Animals, including humans
	<ul style="list-style-type: none"> Notice that animals, including humans, have offspring which grow into adults. Find out about and describe the basic needs of animals, including humans, for survival (water, food and air). Describe the importance for humans of exercise, eating the right amounts of different types of food, and hygiene. 			

Prior learning	Future learning
<ul style="list-style-type: none"> Identify and name a variety of common animals that are carnivores, herbivores and omnivores. (Y1 - Animals, including humans) Identify, name, draw and label the basic parts of the human body and say which part of the body is associated with each sense. (Y1 - Animals, including humans) 	<ul style="list-style-type: none"> Identify that animals, including humans, need the right types and amount of nutrition, and that they cannot make their own food; they get nutrition from what they eat. (Y3 - Animals, including humans) Describe the differences in the life cycles of a mammal, an amphibian, an insect and a bird. (Y5 - Living things and their habitats) Describe the life process of reproduction in some plants and animals. (Y5 - Living things and their habitats) Recognise the impact of diet, exercise, drugs and lifestyle on the way their bodies function. (Y6 - Animals, including humans)

WHAT PUPILS NEED TO KNOW OR DO TO BE SECURE	
Show understanding of a concept using scientific vocabulary correctly	
Key learning	Possible evidence
<p>Animals, including humans, have offspring which grow into adults. In humans and some animals, these offspring will be young, such as babies or kittens, that grow into adults. In other animals, such as chickens or insects, there may be eggs laid that hatch to young or other stages which then grow to adults. The young of some animals do not look like their parents e.g. tadpoles.</p> <p>All animals, including humans, have the basic needs of feeding, drinking and breathing that must be satisfied in order to survive. To grow into healthy adults, they also need the right amounts and types of food and exercise.</p> <p>Good hygiene is also important in preventing infections and illnesses.</p>	<ul style="list-style-type: none"> Can describe how animals, including humans, have offspring which grow into adults, using the appropriate names for the stages Can state the basic needs of animals, including humans, for survival Can state the importance for humans of exercise, eating the right amounts of different types of food, and hygiene Can name foods in each section of the Eatwell Guide

Key vocabulary	
offspring, reproduction, growth, baby, toddler, child, teenager, adult, old person, names of animals and their babies (e.g. chick/hen, kitten/cat, caterpillar/butterfly), survive, survival, water, food, air, exercise, heartbeat, breathing, hygiene, germs, disease, food types (e.g. meat, fish, vegetables, bread, rice, pasta, dairy)	
Common misconceptions	
Some children may think:	
<ul style="list-style-type: none"> • an animal's habitat is like its 'home' • all animals that live in the sea are fish • respiration is breathing • breathing is respiration. 	
Apply knowledge in familiar related contexts, including a range of enquiries	
Activities	Possible evidence
<ul style="list-style-type: none"> • Ask people questions and use secondary sources to find out about the life cycles of some animals. • Observe animals growing over a period of time e.g. chicks, caterpillars, a baby. • Ask questions of a parent about how they look after their baby. • Ask pet owners questions about how they look after their pet. • Explore the effect of exercise on their bodies. • Classify food in a range of ways, including using the Eatwell Guide. • Investigate washing hands, using glitter gel. 	<ul style="list-style-type: none"> • Can describe, including using diagrams, the life cycle of some animals, including humans, and their growth to adults e.g. by creating a life cycle book for a younger child • Can measure/observe how animals, including humans, grow. • Show what they know about looking after a baby/animal by creating a parenting/pet owners' guide • Explain how development and health might be affected by differing conditions and needs being met/not met

EYFS

Science at Foundation Stage is covered indirectly through activities that encourage children to explore, problem solve, predict, think, make decisions and talk about the world around them. During the initial year, pupils will be encouraged to explore creatures, people, plants and objects in their natural environments, introducing those initial scientific words at a very basic level. They will observe and manipulate objects to identify similarities and differences and begin to classify into simple groups. The children will be encouraged to ask questions about how and why things work as well as being asked questions, such as, what they think might happen and with support, plan, investigate, record and evaluate findings. The EYFS Science gives them the foundation for all the Science yet to come in their Primary school life.

Understanding the World is one of the seven areas of learning and development in the Early Years curriculum. The educational programme is as follows:

Understanding the world involves guiding children to make sense of their physical world and their community. The frequency and range of children's personal experiences increases their knowledge and sense of the world around them – from visiting parks, libraries and museums to meeting important members of society such as police officers, nurses and firefighters. In addition, listening to a broad selection of stories, non-fiction, rhymes and poems will foster their understanding of our culturally, socially, technologically and ecologically diverse world. As well as building important knowledge, this extends their familiarity with words that support understanding across domains. Enriching and widening children's vocabulary will support later reading comprehension. (Statutory Framework 2024)

Children are provided with an array of learning opportunities which link to the scientific expectations outlined in the 'Development Matters' document. Reception teachers and practitioners will also utilise the early learning goals which summarise the knowledge, skills and understanding that all young children should have gained by the end of the EYFS. The Early Learning Goal which links specifically to Science in this educational programme is 'The Natural World'.

Activities are carefully planned, and where possible, link to the book of the week. There will be opportunities for both adult directed and independent activities to allow children to practise their skills and consolidate their learning. Children will be encouraged to explore, problem solve, predict, think, make decisions and talk about the world around them. These activities will take place both indoors and outdoors in our woodland area. Children will explore a variety of materials and the way they change, develop an understanding of the natural environment by looking at seasons, life cycles and growing things, and consider forces.

During these processes, children will be supported in asking questions about how and why things work. They will also be asked questions about what they think might happen and with support, plan, investigate, record and evaluate their findings. The aim is to build children's learning over time and prepare them for their transition into Key Stage 1.

Formative assessment is an integral part of this learning and development process, and through their interactions with the children the Early Years team will ensure that children have the opportunity to build on their prior learning. At the end of the Reception Year children will be assessed against the Early Learning Goal and this assessment will be used to inform the Foundation Stage Profile which will be shared with parents and Year 1 staff.

Impact

How do we monitor the impact and effectiveness of our intent and implementation?

Our monitoring cycle is planned across the year. When science is a focus of school development, there is additional time and resources budgeted so that a deep audit, review and evaluation of impact can be carried out, and actions completed. When science is not a main focus, leaders will complete monitoring as outlined within their action plans. Leaders and staff work collaboratively to monitor and evaluate the impact of the science curriculum using a variety of strategies. To ensure the impact of Science is monitored, evaluated and improved, Subject Leaders triangulate its impact using: book looks, review of planning, lesson walk-throughs, pupil conferencing, learning conversations with staff and data evaluation.

How do we assess the impact of what we teach via pupil outcomes?

Formative assessment is embedded throughout all Science units and lessons using a variety of strategies. TAPS (Teacher Assessment in Primary Science) is used during each science unit, teachers will assess the children's retention of the knowledge they have gained and how their working scientifically skills have developed. By using assessment throughout teaching and learning, teachers will have a holistic view of the child and their understanding in order to be able to make summative judgements when needed.

Staff are able to pinpoint the purpose of their assessment strategy and use this assessment to better the teaching and learning for children; as well as move them onto next steps.

How do we impact our children and their view of themselves as Scientists now and in the future?

Science capital is a concept that encompasses all the science-related resources, experiences, and ideas that a child possesses. By connecting daily observations at home and in the community to scientific principles, we make science relevant and significant to individuals. This connection bridges existing knowledge with new learning, fostering a sense of belonging and sparking aspirations to pursue a career in science.

As an analogy, we can think of science capital like a bag, or holdall, that you carry throughout life, containing all your science-related knowledge (what you know), attitudes (what you think), experiences (what you do) and contacts (who you know). By intertwining the study of science with children's identities, experiences, and community values, we establish positive associations between young learners and the field of science.

At The Willows, we firmly believe that nurturing a child's science capital is essential. Not only does it elevate their ambitions for future careers, but it also equips them with valuable skills to contribute meaningfully to society as adults. By fostering a deep understanding and appreciation for science from an early age, we empower our youth to become confident, inquisitive thinkers who are well-prepared to engage with and shape the world around them.

We believe that building up the Science capital of a child is imperative. Not only to raise their aspirations for life as a working adult, but to give them the skills to employ in their wider adult community.

Enrichment

We will provide children with a range of hands on, purposeful learning opportunities to bring the topics to life, such as: local experiences, museum visits, science presentations/festivals and forest schools. Classes will use real life experiences/props where possible to ensure that vocabulary is understood and learned. Children will experience various animals, visitors, scientists and investigations.

In addition to work within the classroom, we aim to provide Science after school clubs and gardening clubs. We also host a set of Science ambassadors with representatives from each year group who help to steer our actions, monitor the implementation and drive the enjoyment of Science across school. Our pupils enjoy an annual Science Fayre with their family members, and additional activities are planned for different year groups such as our Space Camp for Year 5 pupils.