Our Science Curriculum

Newcomen Primary School

"Be brave, be curíous, be determíned, overcome the odds. It can be done."

S. Haulus

Professor Stephen Hawking



scientia potentia est

Intent

Newcomen Primary School is committed to safeguarding and promoting the welfare of children and expects all staff, volunteers and visitors to share this commitment. All children are provided with equal opportunities and equal access to the curriculum. At Newcomen Primary, we are committed to ensuring equality of opportunity for all pupils, staff, parents and carers irrespective of race, gender, disability, belief, sexual orientation, age or socio – economic background. This document is a statement of our Intent for, and the Implementation and Impact of the teaching and learning of Science skills and knowledge at Newcomen Primary School.

At Newcomen Primary School, we provide all of our children, our most precious asset, with an ambitious and appropriate Science



education. Our Science curriculum is knowledge and skills rich and provides the foundations for understanding the world through the specific disciplines of Biology, Chemistry and Physics. Through our bespoke curriculum, which is written with the needs and context of our children at its heart, we recognise the importance of Science in every aspect of children's lives. Furthermore, we aim to inspire children to be inquisitive, life-long learners of Science whilst on their journey through primary education and beyond. Through establishing a body of key knowledge, skills and vocabulary, pupils are encouraged to recognise the power of rational explanation and develop a sense of excitement and curiosity in the world around them. Once knowledge is deep and embedded; children are provided with opportunities to work scientifically. In line with our wholeschool values, we teach all children to foster curiosity for nature, encourage respect for living organisms and the physical environment and provide opportunities for critical evaluation of evidence.

Our Aims:

- To provide a logically planned and progressive curriculum which embeds key scientific knowledge, skills and vocabulary
- To follow the key aims of the National Curriculum and customise learning opportunities to meet the needs of our children linked to their locality and demographics
- To embed the development of basic skills throughout our Science curriculum to ensure we address the impact of social disadvantage on our children's literacy and maths skills
- To expose children to a range of scientists appropriate to their age and the impact those scientists had on our understanding of the world
- To work scientifically once knowledge is deep and embedded

- To appreciate and respect the natural world around them including natural phenomena
- To promote a passion for life-long learning of Science
- To promote continuity, coherence and challenge across school
- To ensure the highest expectations for and from all
- To be aware that our children are the future of our planet and understand the implications that this has for the impact they can have on the world including climate change
- To equip children with the scientific knowledge required to understand the uses and implications of Science today and for the future
- To be confident and passionate when delivering scientific knowledge and empower children to demonstrate their scientific knowledge, vocabulary and skills through the disciplines of Biology, Chemistry and Physics
- To empower children to be inquisitive and ask well-formulated scientific questions
- To empower children to be brave when formulating a hypothesis and understand how this links with a scientific conclusion
- To be respectful of the natural world
- To be equipped to make sense of phenomena, seek explanations and think critically.

Through studying our progressive Science curriculum, pupils become more expert as they move through school. They accumulate, connect and make sense of the rich substantive and disciplinary knowledge.

- 1. **Substantive knowledge** this is the subject knowledge and explicit vocabulary used to learn about the content. Common misconceptions are explicitly revealed as non-examples and positioned against known and accurate content.
- 2. **Disciplinary knowledge** this is knowing how to collect, use, interpret, understand and evaluate the evidence from scientific processes. This is taught discretely. Pupils construct understanding by applying substantive knowledge to questioning and planning, observing, performing a range of tests, accurately measuring, comparing through identifying and classifying, using observations and gathering data to help answer questions, explaining and reporting, predicting, concluding, improving, and seeking patterns.
- 3. **Scientific analysis** is mapped throughout our Science curriculum developed through:
 - identifying and classifying
 - pattern seeking
 - research
 - observing over time
 - fair and comparative testing
- 4. **Substantive concepts** include concrete examples, such as 'plant' or more abstract ideas, such as 'biodiversity'. Concepts are taught through explicit vocabulary instruction as well as through the direct content and context of the study.





environment and comment on living things including plants and animals. Emphasis is placed on being curious; children are encouraged to ask questions about why things happen and how things



Early Years

Understanding of the World is one of the specific areas of the Early Years Foundation Stage Curriculum. Children are encouraged and guided to use investigation and exploration to develop their understanding of the natural world. Our ambitious Early Years curriculum is designed to enable children to make sense of the physical world around them and their community.

In the Early Years, children are encouraged to be scientists by using their senses to investigate materials, notice and discuss similarities and differences in patterns and observe and describe what they can see. During outdoor learning, in our popular wildlife garden and charming orchard, children observe the natural



work.

In Early Years, reading plays a crucial role in the teaching and learning of the natural world. Staff model and encourage children to articulate how their experiences are similar to, or different from, what has been read. Furthermore, children are given high-quality experiences for outdoor exploration which helps to broaden their understanding of the world.



Science – Early Years Foundation Stage

	ELG The Natural World	How this is achieved in EYF3
gnimpal to park pitipaqs bhoW ant gnibnotriabnU	Children at the expected level of development wit: • Explore the natural world around them, making observations and drawing pictures of animals and plants; • Know some similarities and aliferences between the natural world around them and differences and what has been read in class; • Understand some important processes and changes in the natural world around them, including the seasons and changes in the natural world around them.	 Look at the stages of growing up. Talk about how we change as we grow. Make observations about ourselves and others - hair colour, eyes etc. Name simple body parts. Identifying our senses and what we use them for. Keeping healthy/self-hygiene Oral Hygiene. Inserving the changes in seasons overtime. Exploration. Interactions with outdoors - hands on experience with world exploration. Minibadsti. Minibadsti.

Cultural Capital

Children develop an understanding about scientists appropriate to their age and based upon the areas of science that they study. Furthermore, they understand the impact that these men and women have had upon our understanding of the world today and links are made with ongoing scientific developments. The scientists that children study are from a range of cultures, races and backgrounds.

At Newcomen Primary School, we are proud of our shared heritage. Following the discovery of iron ore in the Cleveland Hills in 1850, Teesside has become renowned across the world for its steel and iron industry. In addition, the Tees Valley is one of the most significant integrated industrial economies in the world and produces 30% of the UK's chemical output. At Newcomen, we believe that we must inform and inspire our children with first-hand experiences of STEM (Science, Technology, Engineering and Mathematics) through an enriched Science curriculum including workshops with local industry experts. Visits, both with in the local area and further afield, also enhance the cultural capital offer.





Implementation

Our curriculum is underpinned by evidence, research and cognitive science. Our exciting and informative modules are deliberately sequenced for robust progression. There is an emphasis on oracy and vocabulary acquisition, retention and use to break down learning barriers and accelerate progress. A rich diet of language and vocabulary is deliberately planned for and specific skills are discreetly taught and practised so that they become transferrable. The sequenced modules activate prior learning, build on skills and deepen knowledge *and* understanding. Learning, vocabulary and content is cumulative; content is learned, retrieved and built upon. Alongside our experiential approach to learning, we firmly believe that this is the strongest approach for a curriculum to meet the needs of our children.

Modular Approach – Knowledge

At Newcomen Primary, Science is taught across each year group in modules that enable pupils to study in depth key scientific understanding, skills and vocabulary. Each module aims to activate and build upon prior learning, including the Early Years Foundation Stage, to ensure better cognition, retention and confidence. Each module is carefully sequenced to enable pupils to purposefully layer learning from previous sessions to facilitate the acquisition and retention of key scientific knowledge. This enables our children to retain key knowledge and information. Once knowledge is embedded, and children can articulate their learning with confidence and accuracy, children have a range of opportunities to apply their knowledge and work scientifically which they love to do.



Cumulative Quizzing (Supporting Cognitive Load)

Cumulative quizzing forms a vital part of our curriculum offer. At the beginning of each module, pupils undertake a short quiz to establish prior knowledge and understanding of the module content. This immediately informs teacher's planning to ensure that knowledge is built upon. Furthermore, planning is fluid to accommodate this vital Assessment for Learning opportunity. Throughout each module, pupils continually revisit previous content to reinforce key knowledge and vocabulary. Practice makes permanent! Carefully constructed to build on previous learning, our Science curriculum incorporates all principles of instruction consistent with Rosenshine's Principles of Learning to ensure success. It presents new learning in small, manageable steps alongside practise and scaffolding new skills, and regular reviews. This allows teachers to understand how secure our children's scientific knowledge is and address any misconceptions immediately. At the end of the module, pupils take another quiz to check their understanding and knowledge. This approach allows pupils to utilise effective cognitive load and ensure retention. All

quizzing is recorded in each child's Knowledge Assessment Book and our children relish the opportunity to demonstrate and celebrate their learning.

Planning

All modules have a sequenced overview outlining recommended number of sessions, key concepts, knowledge and vocabulary to be taught. Planning is always adapted in order to meet the needs of our children. Furthermore, it incorporates cooperative learning techniques, key vocabulary and core concepts to enable all teaching staff to effectively plan and support the needs of all pupils in the classroom which ensures all children are able to flourish; children love to articulate their knowledge. Knowledge is power!

Knowledge Organisers and Knowledge Notes

Our well-designed Knowledge Organisers play a fundamental role in helping all of our children know and remember more. The Knowledge Organiser contains key vocabulary, information and concepts which all pupils are expected to understand and retain.

Knowledge Notes are the elaboration and detail to help pupils acquire the content of each module; they limit cognitive load and support vocabulary and concept acquisition through a well-structured sequence that is cumulative. Each Knowledge Note begins with questions that link back to the cumulative quizzing, focussing on key content to be learnt and understood. At the end of each lesson, children are able to answer the questions using knowledge and vocabulary taught. Knowledge Organisers and Knowledge Notes are dual coded to provide pupils with visual calls to aid understanding and recall.

Knowledge Organisers and Knowledge Notes are referenced throughout each module and copies of the Knowledge Organiser are sent home to families to support with home learning. Furthermore, pupils can access key learning platforms at home that are used in school.

Science and English

Reading

At Newcomen Primary School, we firmly believe that it is imperative for pupils to have access to high quality texts to support their learning and develop their skills in accessing information from a range of sources. Shared reading is implemented to help our pupils acquire knowledge and deepen their understanding of the subject.

Vocabulary

Vocabulary forms a key part of every aspect of our curriculum. Subject specific Tier 2 and Tier 3 words are incorporated in each module and pupils document and commit these to memory to expand their scientific vocabulary repertoire. All children have their own Vocabulary Knowledge book for Science. This documents the key vocabulary the children are expected to learn.





Oracy

When discussing their findings or presenting information, pupils are encouraged to speak using full sentences and incorporate the key subject vocabulary. This skill is consistently modelled by staff ensuring pupils are supported to develop their oracy skills in Science. As a Newcomen citizen, we want all of our pupils to be articulate and well-informed members of society.

Writing

Pupils are encouraged to write across all areas of the curriculum and teachers model how to write purposefully in each subject using key structures and vocabulary. Where appropriate, pupils are encouraged to apply their knowledge of the Writing Checklist in Science. Pupils are encouraged to use their vocabulary knowledge book, knowledge organisers and knowledge notes to support their writing.

SEND/Inclusion

Newcomen Primary School is committed to ensuring that all pupils achieve their full potential. Barriers to learning are quickly identified and our school is committed to closing any gaps in achievement.

Each child is unique and within every school there will always be a number of children who, for a variety of reasons, are classified as having Special Educational Needs or Disabilities (SEND). Our school identifies children with a suspected Special Educational Need early so that interventions are swift and immediate.

All children receive quality-first teaching and activities are differentiated appropriately. Every teacher at Newcomen is a teacher of every child in our school, including those with SEND. When pupils are identified as needing additional support, proven intervention programmes, booster classes and 1-1 support are provided. Small, focused groups are also provided for children who may require additional support within lessons. The needs of children with English as an additional language will be met through targeted support in the classroom and additional 1-1 focused support.

More Able Learners

More able learners are identified as part of our assessment procedures. We provide for their needs through a framework of quality-first teaching which focuses on ensuring the children are challenged appropriately. In addition, we focus on developing their learning behaviours, including a greater depth of reflection, problem solving and enquiry, making connections, higher order thinking skills and independent learning.

Staff Development

All staff members keep up to date with Science subject knowledge and use a range of quality and consistent resources to deliver an ambitious and relevant curriculum. Training needs, based on local and national initiatives and priorities in the local area, are identified. All teachers and support staff attend all training. Continuing professional development is delivered by the Science Leader (National Professional Qualification in Senior Leadership/National Professional Qualification in Leading Teachers) and Science Team to ensure whole-school consistency.



Our staff have been trained in evidence informed reading pedagogy which emphasises the importance

of teaching reading across all subjects and how to teach vocabulary – including etymology (the study of the origin of words) and morphology (the study of the forms of words). Teachers are encouraged to develop their subject knowledge by accessing resources and research and disseminating good practice in school and online.

As a National Support School, Newcomen Primary School supports the Self-Improving School System and actively works with, and supports, other schools with staff development work and whole school improvement.

Resources and Accommodation

The subject of Science is extremely well-resourced at Newcomen Primary School. The Science Team regularly audit and replenish equipment. Furthermore, staff have a written document outlining the resources we have and where in school they are located. Having clearly labelled, accessible resources supports staff in the delivery of inspiring and practical Science lessons across the school.



In addition to classroom resources, Newcomen Primary School has extensive grounds which enable countless opportunities for learning outside the classroom; our Science curriculum is enriched by our thriving bug hotel which the Early Years and Key Stage One in particular children love to visit, a vibrant wildlife garden attracting a range of native birds and insects and a delightful fruit orchard. Year 4 take great pride in developing and maintaining our sensory garden. This provides a secluded spot to observe living creatures in their natural habitat, enjoy the scents of a variety of herbs and become immersed in Mother Nature. Our hibernacula are suitably placed and attract hedgehogs and hoglets aplenty! As there is a firm emphasis on knowledge at Newcomen Primary School, it is vital that children understand a range of scientists and their impact on our view of the world. Without great minds such as Charles Macintosh and David Attenborough, our knowledge and understanding of the

world may be completely different! We inspire children from Year 2 upwards by focusing on scientist linked to their learning and appropriate to them. Studying inspirational scientists really ignites a passion for Science in our children and highlights the fact the endless opportunities that scientific knowledge, skills and vocabulary opens up for them. In addition to well-known scientists, Newcomen Primary School also has links with current scientists such as Professor Carole Haswell (Professor of Astrophysics and Head of Astronomy at the Open University). Professor Haswell works alongside the Science Team to plan and deliver enrichment opportunities for our children such as our Women in Science webinar for Year 4 and a cross-curricular space and art workshop for Year 5.



Year 2	Year 3	Year 4	Year 5	Year 6
Charles Macintosh	Mary Anning	Thomas Edison	David Attenborough	Charles Darwin
Chemist	Paleontologist	Inventor	Naturalist	Naturalist, Geologist and Biologist

An age-appropriate selection of high-quality texts are available in our popular school library situated in Learning Area 3. This selection is updated regularly and is carefully selected to inspire our learners and compliment their learning. In addition our school library, we use digital texts from 'Curriculum Visions' to ensure a wide range of inspirational resources can be accessed at home. This enables our children to enthusiastically share what they have been studying with their parents and carers.



Monitoring and Evaluation

The Head Teacher, members of the SMT and the Science Team monitor Science. Shared collaborative book studies are undertaken and the Science Team monitor teaching and learning by observing lessons across the whole school. These ensure whole-school consistency.

Home School Partnership

Newcomen Primary School is a family school with a strong sense of identify and tradition. Our school is embedded deeply within the community and parents and carers are very supportive; their opinions are welcomed and acted upon reflecting an honest and genuine home school partnership. At the beginning of each academic year, all parents and carers receive a laminated Year Group Curriculum Overview detailing information about the curriculum. This explains the curriculum in detail. The 'Science Curriculum Map' is also available on our website for our parents and carers to refer to. Furthermore, parents and carers are provided with booklet produced by the Science Team which provides up-to-date information about Newcomen's approach to teaching, learning and assessment in Science.



Science at school and at home is regularly celebrated on the @NewcomenPS Twitter feed. It is with such joy that snapshots of learning are shared with our families and celebrated for our children. On a termly basis, scientific vocabulary is the theme of our Head Teacher's Celebration Assembly and children relish the opportunity to confidently demonstrate their knowledge in front of their peers. British Science Week is celebrated on an annual basis and focuses on inspirational scientists from a range of cultures, races and backgrounds.



Impact

Assessments are undertaken in line with our school assessment policy. Teachers use effective

assessment for learning to ensure planning is based on prior attainment and that pupils know what needs to be done to achieve the next steps. Group and individual targets are discussed and set accordingly.

Cumulative Quizzing

At the start of each module, pupils undertake a short quiz in Years 3-6 or a verbal assessment (Years 1-2), to establish prior knowledge and understanding of the module content. Throughout each module, pupils continually revisit previous content and quizzing to reinforce key knowledge and vocabulary. At the end of the module, pupils take another quiz to check their



understanding and Knowledge. Baseline scores are compared with end of module results with an aim for at least 80% retention by most pupils.

Pupil Book Study

Senior leaders and subject leaders regularly undertake book studies to monitor the effectiveness of teaching and learning. This includes sessions with small groups of pupils using questioning to check and ensure information and knowledge is acquired and understood with increasing confidence. Feedback is given to teaching staff to inform future planning.

Ongoing Teacher Assessment

Teachers assess pupils throughout each session to monitor pupils and inform planning for subsequent sessions. Pupils, who are identified as needing support, will work with an adult post-teaching or during the following Science session as appropriate. Pupils working at above



expected standard will also be identified and challenged appropriately to extend their learning.

Consultations and Open Afternoon

Consultations with parents and carers take place each term and an annual written report is given in the last term of the school year. Open afternoons occur on a termly basis where parents and carers are invited into school to celebrate and enjoy children's work in books and the learning environment. Parents and carers are warmly welcomed into school and actively encouraged to contact school should the need ever arise. Teachers

also contact parents/carers to discuss the progress of a child and to celebrate achievement.