SHOBNALL PRIMARY & NURSERY SCHOOL

APPROACH TO THE TEACHING OF COMPUTING

“Technology is best when it brings people together.” — Matt Mullenweg

November 2021

Reviewed: November 2022, October 2023, October 2024

Review:

November 2027

CONTENTS

INTRODUCTION

This document outlines the teaching, organisation and management of computing taught and learnt at Shobnall Primary & Nursery School.

The document has been drawn up as a result of staff discussion and its implementation is the responsibility of all teaching staff. The responsibility for monitoring and review rests with the computing subject leader.

The main purposes of this document are:

- To establish an entitlement for all pupils.
- To establish expectations for teachers of this subject.
- To promote continuity and coherence across the school.

VISION

"At Shobnall Primary & Nursery School, our vision is to prepare the children within our care for life in the 21st Century, which is becoming increasingly driven by technology. Our curriculum will ensure children to have the ability to connect with others safely and respectfully, understanding the need to act within the law and with moral and ethical integrity. Our curriculum will equip the children with the skills necessary to flourish in a technology-based world, including the use of algorithms, coding, programming, hardware and software."

PRINCIPLES

CODING	We believe our pupils should have competence in coding for a variety of practical and inventive purposes, including the application of ideas within other subjects.
CONNECT	We believe our children should have an understanding of the connected nature of devices and the ability to communicate ideas well by using applications and devices throughout the curriculum.
COLLECT	We aim for our pupils to have the ability to collect, organise and manipulate data effectively.

THEORY UNDERPINNING OUR PRACTICE AND PRINCIPLES

Technology is quickly becoming at the centre of everything we do and it is for this reason that we must equip all children with the necessary knowledge and skills to thrive in a world that relies on technology.

The computing curriculum gives pupils the foundational knowledge of technology, that will enable them to build upon as they move through their lives. This is supported for the Department for Education (2013) who state that;

"A high-quality computing education equips pupils to use computational thinking and creativity to understand and change the world. Computing has deep links with mathematics, science, and design and technology, and provides insights into both natural and artificial systems. The

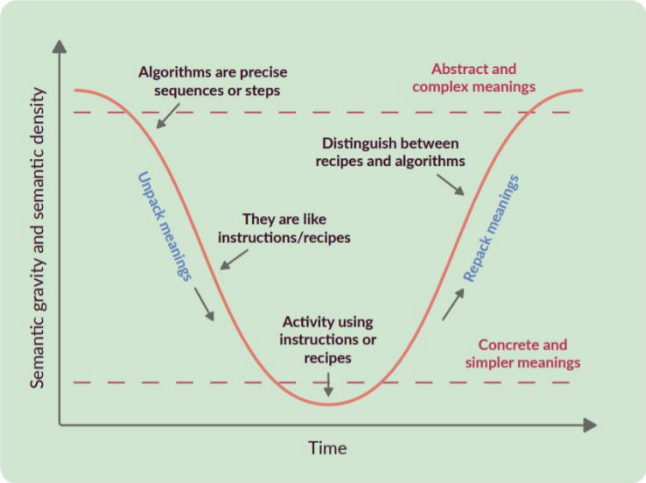
core of computing is computer science, in which pupils are taught the principles of information and computation, how digital systems work, and how to put this knowledge to use through programming. Building on this knowledge and understanding, pupils are equipped to use information technology to create programs, systems and a range of content. Computing also ensures that pupils become digitally literate – able to use, and express themselves and develop their ideas through, information and communication technology – at a level suitable for the future workplace and as active participants in a digital world."

As a school we scrutinised the best research available, and we have determined that our **definition of learning** is a **change to the long-term memory**. This means that the way we implement our curriculum maps involves repetitive teaching of the key concepts or the 'big' ideas. Each unit has built in practise, retrieval and reinforcement of the key concepts to ensure knowledge sticks in the long-term memory.

Throughout our curriculum we ensure that the **pillars of progression** are embedded throughout the curriculum. These pillars of progression being made up of **computer science, information technology and digital literacy**. These pillars of progression are recognised as areas of the curriculum, but these pillars do not sit separately from each other. Knowledge from each pillar complements the others and some subject content only exists at the interplay between these 3 pillars (2017).

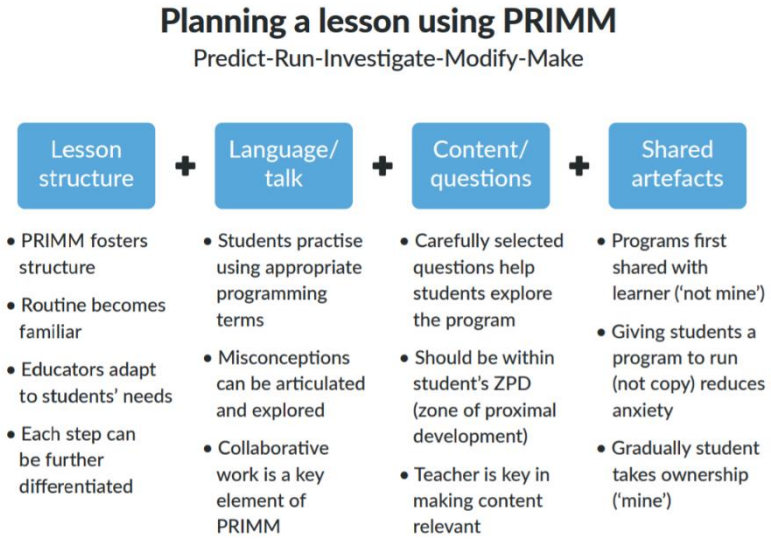
We have used the research around **cognitive load** and how children learn most effectively, to determine our approach to implementing the curriculum. Research has shown that if you teach children too many new concepts at once their short-term memory becomes overloaded and none of the knowledge will stick and move into the long term. We take an approach of **spacing** out new knowledge combined with interleaving and plenty of retrieval practise to ensure learning sticks. With **repetition, interleaving and retrieval**, research we use suggests that the more often children have to remember knowledge the more likely it just to be cemented into the long-term memory.

In addition, Malton (2013) found that within computing, and especially programming, large amounts of technological terms with precise meanings are being used. To be successful within their learning, children must not only master the use of this terminology, but also develop a firm understanding of the concept being taught. Malton (2013) has suggested that to support the teaching of computing, we must consider ensuring that the learning experiences we provide follow a semantic wave. This results in abstract concepts (with the correct terminology) being taught first, and then using simpler vocabulary to explain the meaning.



Computing Sematic Wave (National Centre for Computing Education, 2019)

In order to further reduce cognitive overload, computing lessons (specifically programming lessons) are taught using the PRIMM (Predict, Run, Investigate, Modify, Make) model (National Centre for Computing Education, 2019).



National Centre for Computing Education, 2019

Structuring our programming lessons using PRIMM ensures that lessons focus on reading code before writing code, working collaboratively, reduces cognitive load by unpacking and understanding what program code is doing and supports the children in gradually taking ownership of programs when they are ready. Hubwieser (2012) notes that it is important to consider how knowledge components or elements are sequenced when designing a curriculum and that 'knowledge determines the substantial and logical structure of the teaching process'. He acknowledges that it is not possible to teach all computing knowledge and that it is important to select the knowledge that is most important.

INTENT

Curriculum drivers shape our curriculum breadth. They are derived from an exploration of the backgrounds of our pupils, our beliefs about high-quality education and our values. They are used to ensure we give our pupils appropriate and ambitious curriculum opportunities:

- Diversity – We believe in developing pupils' understanding of British values and celebrating our unique and diverse community.
- Dreams – We promote ambition, high aspirations and foster pupils' capacity to see the possibilities within the world today.
- Decisions – We encourage our pupils to make the right choices in order to stay safe, healthy and happy.

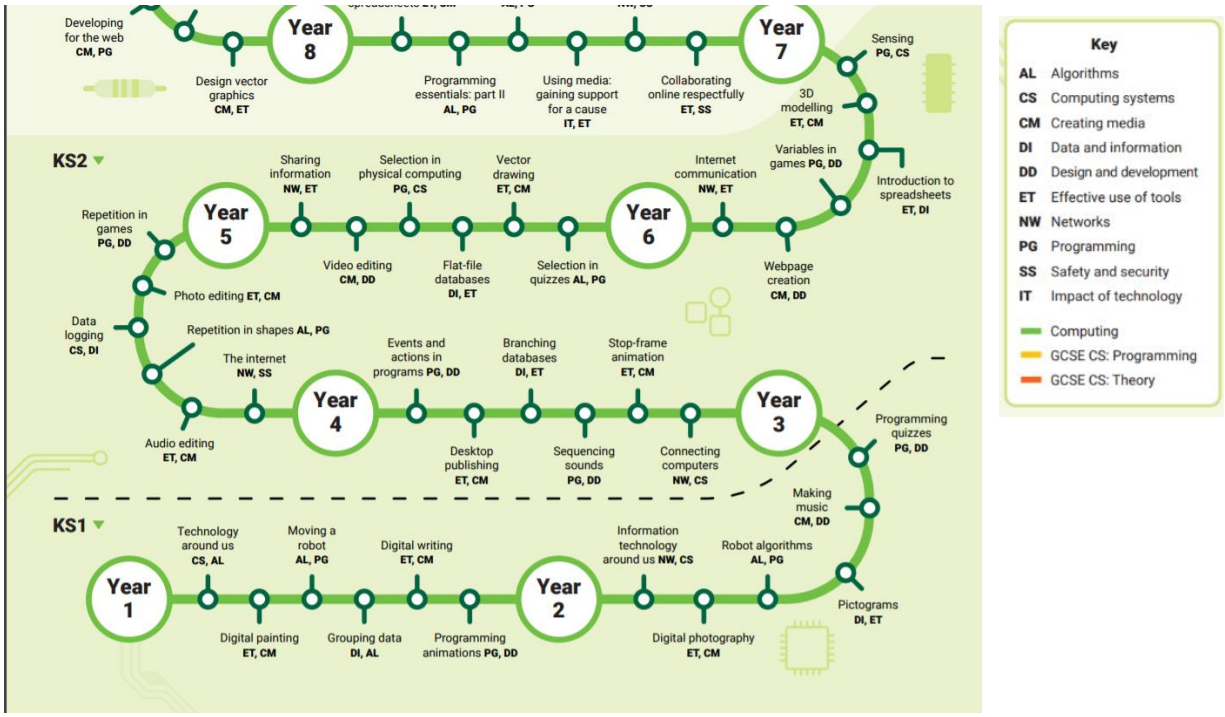
Cultural capital gives our pupils the vital background knowledge required to be informed and thoughtful members of our community who understand and believe in British values.

Curriculum breadth is shaped by our curriculum drivers, cultural capital, subject topics and our ambition for pupils to study the best of what has been thought and said by many generations of academics and scholars.

Knowledge webs help pupils to relate each topic to previously studied topics and to form strong, meaningful schema. Cognitive science tells us that working memory is limited and that cognitive load is too high if pupils are rushed through content. This limits the acquisition of long-term memory. Cognitive science also tells us that in order for pupils to become creative

thinkers, or have a greater depth of understanding, they must first master the basics, which takes time.

The Teach Computing Scheme which we follow is built around an innovative progression framework where computing content has been organised into interconnected networks called learning graphs. This supports the theory of Knowledge webs and supports the transfer of information between the short term and long-term memory. See the Teach Computing Curriculum Journey below;



IMPLEMENTATION

Our curriculum design is based on evidence from cognitive science; three main principles underpin it:

- Learning is most effective with spaced repetition.
- Interleaving helps pupils to discriminate between topics and aids long-term retention.
- Retrieval of previously learned content is frequent and regular, which increases both storage and retrieval strength.

In addition to the three principles, we also understand that learning is invisible in the short term and that sustained mastery takes time.

Our content is subject specific. We make intra-curricular links to strengthen schema. Continuous provision, in the form of daily routines, replaces the teaching of some aspects of the curriculum and, in other cases, provides retrieval practice for previously learned content.

Pupils receive 6 hours of computing lessons each half term. This can equate to an hour a week, or a week long block, depending on the structure of the individual class timetable.

Cross curricular outcomes in computing are specifically planned for, with strong links between the computing curriculum and Art, English, Music and Maths. The scheme 'Teach Computing' is used throughout the school to deliver the computing curriculum. This ensure that the

planning is informed by and aligned with the national curriculum. In addition, staff have access to the Barefoot teaching resources, however, teachers lesson design is not limited by this.

IMPACT

Because learning is a change to long-term memory, it is impossible to see impact in the short term. We do, however, use probabilistic assessment based on deliberate practice. This means that we look at the practices taking place to determine whether they are appropriate, related to our goals and likely to produce results in the long run.

We use comparative judgement in two ways: in the tasks we set and in comparing a student's work over time.

We use lesson observations to see if the pedagogical style matches our depth expectations.

Pupils attainment and progress in computing is measured against the objectives set in the national curriculum and recorded by teachers using Classroom Monitor to inform parents and future teaching and learning activities.

EFFECTIVE TEACHING AND LEARNING IN COMPUTING

Effective teaching ensures that pupils retain knowledge they have learned in the long term. This is supported by opportunities to revisit and practise with prior knowledge. Pupils are more likely to retain knowledge when they have engaged analytically with the content they study. Teachers can support learning through clear exposition, which takes into account what pupils already know and understand. However, wider educational research offers a strong basis for a range of effective teaching approaches in computing. These are often reflected in our lessons and will include:

- **Teaching for memory** - evidence suggests that teachers can support pupils' long-term learning by drawing attention to particularly important terms and expressions, precise phenomena and broader frameworks in their teaching.
- **PRIMM** – Teaching coding using the PRIMM model ensures that children are exposed to the correct terminology, but have an understanding of it at their age-appropriate level.
- **Recall** - recalling previously taught content (retrieval practice) and revisiting content in lessons (spaced practice) have also been shown to be effective in securing pupils' knowledge over time.
- **Clear exposition that considers pupils' prior knowledge** - teachers' exposition is likely to be most effective when it is clear and carefully designed to account for pupils' existing knowledge.
- **Clear understanding of online conduct/safety** – Online safety and conduct should be at the heart of every computing lesson, ensuring that the children understand the risks and rewards of using technology.
- **Visuals** – ensuring that visual representations are used to support understanding, especially when tackling more abstract or tricky topics.
- **Real-world relevance** – all learning should be supported by a real life context and children should be able to articulate how what they have learnt in the lesson could be used outside of the learning environment.

SUPPORTING PUPILS IN COMPUTING, INCLUDING PUPILS WITH SPECIAL EDUCATIONAL NEEDS AND/OR DISABILITIES (SEND)

We recognise that in all classes children have a wide range of ability in computing, and we seek to provide suitable learning opportunities for all children by matching the challenge of the

task to the ability of the child. Berry (2018 - http://milesberry.net/2018/02/send-computing/) states the following about SEND and the computing curriculum;

"An inclusive approach to computing should ensure an appropriate balance between the foundation (computer science), application (information technology) and implication (digital literacy) elements of the curriculum. For some pupils with SEND, too great a focus on programming and other aspects of computer science at the expense of IT skills and online-safety may do little to prepare them for the practical needs of their subsequent study, employment and adult life. Particular attention should be paid to ensuring that pupils who are more vulnerable because of SEND have a secure understanding of how to keep themselves safe, and of their responsibilities, when using the internet."

All pupils are entitled to a broad computing curriculum. Any adaptations made to support pupils' learning in computing usually should not be to the overall curriculum content but rather to how the content is taught – for example, using the 'un-plugged' resources provided by Teach Computing. In the case of pupils with the most complex learning needs, there may be occasions when it is appropriate to modify the curriculum. However, this will be the exception.

Ensuring that all pupils otherwise encounter the same content is particularly important. Significantly reducing content or complexity for some pupils might in fact limit their access to content or limit their ability to learn. It is likely that pupils will benefit most from support that combines extra attention to securing the most generative knowledge, while ensuring that all pupils are able to learn about programming, digital literacy, physical computing and online safety in a rich context and through meaningful examples. This can be achieved by:

- setting tasks which are open-ended and can have a variety of responses;
- setting tasks of increasing difficulty, some children not completing all tasks;
- grouping children by ability in the room, and setting different tasks for each ability group;
- providing resources of different complexity, depending on the ability of the child;
- using teaching assistants to support children individually or in groups.

PROMOTING KEY SKILLS IN COMPUTING

Through our teaching of computing, we provide opportunities for pupils to develop the key skills of:

- **Communication***,* through reading and responding to a range of sources of information, when planning and carrying out algorithms/coding/programming, through taking part in discussions, and presenting findings in a variety of ways.
- **Co-operation**, through planning and carrying out group tasks, such as website design or data collection.
  Improving their own learning and performance*,* through reviewing their work at regular intervals, setting targets for improvement and assessing their achievement.
- **Problem-solving***,* through creating programmes, debugging, and physical computing exercises.
- **Thinking skills***,* through work on processing and evaluating information.
- **Application of number***,* through carrying out calculations from databases, using spreadsheets, data collection and writing code.
- **Digital Literacy –** through learning key computing skills such has how to create, organise, store, manipulate and retrieve data.
- **Online safety and conduct –** through explicit lessons, as well as discretely in every computing lesson.

EARLY YEARS FOUNDATION STAGE

Early years explore 'Computational Thinking' in every area of the EYFS curriculum. Computational Thinking is a set of problem solving skills that we use in everyday life and can be categorised as follows;

EYFS Computational Thinking simple definitions

EYFS Computational Thinking Skills	Simple definitions
Tinkering	Playing and exploring
Creating	Creating, checking and fixing things
Collaboration	Playing and working collaboratively
Persevering	Not giving up
Logic	Anticipating and explaining is logical reasoning
Pattern	Grouping things, comparing, spotting similarities and differences, working out rules
Abstraction	Naming and labelling, working out what is important, sticking to the main theme, ignoring what is not important, creating a summary
Algorithms and Decomposition	Responding to instructions, ordering things, sequencing things, introducing storylines, working out different ways to do things, breaking problems down into steps

Barefoot (Computational Thinking in Early Years – an overview)

They are assessed according to the Progress Models determined by the school in accordance with the Statutory Framework for the Early Years Foundation Stage.

KEY STAGE 1

Pupils should be taught to:
 understand what algorithms are; how they are implemented as programs on digital devices; and that programs execute by following precise and unambiguous instructions
 create and debug simple programs.
 use logical reasoning to predict the behaviour of simple programs.
 use technology purposefully to create, organise, store, manipulate and retrieve digital content.
 recognise common uses of information technology beyond school.
 use technology safely and respectfully, keeping personal information private; identify where to go for help and support when they have concerns about content or contact on the internet or other online technologies.

Department for Education, Computing Programme of Study (2013)

KEY STAGE 2

Pupils should be taught to:
 design, write and debug programs that accomplish specific goals, including controlling or simulating physical systems; solve problems by decomposing them into smaller parts.
 use sequence, selection, and repetition in programs; work with variables and various forms of input and output.
 use logical reasoning to explain how some simple algorithms work and to detect and correct errors in algorithms and programs.

 understand computer networks including the internet; how they can provide multiple services, such as the world wide web; and the opportunities they offer for communication and collaboration.
 use search technologies effectively, appreciate how results are selected and ranked, and be discerning in evaluating digital content.
 select, use and combine a variety of software (including internet services) on a range of digital devices to design and create a range of programs, systems and content that accomplish given goals, including collecting, analysing, evaluating and presenting data and information
 use technology safely, respectfully and responsibly; recognise acceptable/unacceptable behaviour; identify a range of ways to report concerns about content and contact.

Department for Education, Computing Programme of Study (2013)

PLANNING AND RESOURCES

We use the Teach Computing Scheme of Work which has been developed by the Department for Education and uses the National Curriculum descriptors. We ensure that there are opportunities for children of all abilities to develop their skills and knowledge in each unit, and we plan progression into the scheme of work, so that the children are increasingly challenged as they move through the school. We carry out curriculum planning in curriculum in three phases (long term, medium term and short term). The long-term plan maps the computing topics studied in each term during each key stage. We teach the knowledge, skills and understanding set out in the National Curriculum through the corresponding programme of study. The class teachers use the lesson plans and PowerPoints provided by the Teach Computing scheme for each computing lesson (short-term plans). These plans list the specific learning objectives and expected outcomes for each lesson. The class teacher keeps these individual plans, although he or she and the subject leader often discuss them on an informal basis. Plans are stored on the staff shared drive for monitoring purposes and ease of access for the teachers and computing subject leader.

There are sufficient resources for teaching all computing units in the school. They are located in the shared resource area. Additional computing resources will be loaned to the school by Teach Computing to ensure full curriculum coverage.

CROSS-CURRICULAR OPPORTUNITIES

Staff are encouraged to develop cross-curricular links with computing and other subjects to provide a relevant and meaningful curriculum for pupils.

English – Using a computer to write (Year 1 Unit 5)

PSHE / Online Safety – Technology around us (Year 1 Unit 1), Data and Information (Year 1 Unit 4), Programming (Year 1 Unit 3), IT around Us (Year 2 Unit 1), Digital Photograph (Year 2 Unit 2), Robot Algorithms (Year 2 Unit 3), Data and Information (Year 2 Unit 4), Animation (Year 3 Unit 3), Sequence in Music (Year 3 Unit 3), Audio Editing (Year 4 Unit 4), Photo Editing (Year 4 Unit 4), Sharing Information (Year 5 Unit 5), Programming A (Year 5 Unit 5),

Mathematics – Pictograms (Year 2 Unit 4), Data Logging (Year 4 Unit 4)

Music – Making Music (Year 2 Unit 5), Sequence in Music (Year 3 Unit 3), Audio Editing (Year 4 Unit 4),

Art and Design - Creating a digital painting. (Year 1, Unit 2), Photo Editing (Year 4 Unit 4)

ASSESSMENT

Assessment for learning is continuous throughout the planning, teaching and learning cycle. Key computing knowledge is taught to enable and promote the development of children's computing literacy. Assessment is supported by use of the following strategies:

- Observing children at work, individually, in pairs, in a group and in class during whole class teaching.
- Using differentiated, open-ended questions that require children to explain and unpick their understanding.
- Providing effective feedback, including interactive marking through green pen questions where appropriate, to engage children with their learning and to provide opportunities for self-assessment, consolidation, depth and target setting.
- Book moderation and monitoring of outcomes of work, to evaluate the range and balance of work and to ensure that tasks meet the needs of different learners, with the acquisition of the pre-identified key knowledge of each topic being evidenced through the outcomes.

Pupils' attainment and progress in computing is recorded by teachers using Sonar Tracking to inform parents and future teaching and learning activities.

HEALTH AND SAFETY

We enable all pupils to have access to the full range of activities involved in learning computing. Where children are to participate in activities outside the classroom, teachers should be aware of health and safety issues. Risk assessments are undertaken prior to activities, to ensure that they are safe and appropriate for all pupils. Please see the JTMAT Safeguarding and Child Protection Policy, Shobnall Primary & Nursery School Procedures for Safeguarding and Child Protection, Online Safety Procedures and Behaviour Procedures for further information regarding keeping children safe whilst using technology.

SAFEGUARDING AND CHILD PROTECTION

We seek to safeguard children and young people by:

- valuing them, listening to them and respecting them.
- adopting child protection guidelines through procedures and a code of conduct for staff and volunteers.
- recruiting staff and volunteers safely, ensuring all necessary checks are made.
- sharing information about child protection and good practice with children, parents, staff and volunteers.
- sharing information about concerns, with agencies who need to know, and involving parents and children appropriately.
- providing effective management for staff and volunteers through supervision, support and training.

See JTMAT Safeguarding and Child Protection Policy and Shobnall Primary & Nursery School Procedures for Safeguarding and Child Protection for further information.

MONITORING AND REVIEW

It is the responsibility of the computing subject leader:

- supports colleagues in their teaching, by keeping informed about current developments in computing and by providing a strategic lead and direction for this subject.
- to develop, implement and review an action plan for computing.
- to monitor computing throughout the school.
- to encourage staff to provide effective learning opportunities for all pupils.

- to develop valid activities, appropriate for children at different stages of development, which enable pupils to progress in the subject.

Monitoring of the standards of children's work and of the quality of teaching in computing is the responsibility of the computing subject leader. The work of the subject leader also involves supporting colleagues in their teaching, being informed about current developments in the subject, and providing a strategic lead and direction for the subject in the school.

This document will be reviewed at least every three years.