National Curriculum Computing Strands

Computing

Computing is the use of digital technologies to solve problems, understand systems and create purposeful products that meet needs and provides new and better (innovation) services to others. It fosters innovation, originality and harnesses collaboration, synergy and teamwork.

3 Strands of Computing

Computer Science — Information Technology — Digital Literacy

Computer Science

The **Computer Science** Strand is about using computational thinking to solve problems and make things for a purpose.

It generally, but not always, involves writing programs. You can use computational thinking to solve many worthwhile problems by creating a sequence of instructions for the context of the problem, which are not programming instructions.

Computer Science is the study of the foundational principles and practices of computation and computational thinking, and their application in the design and development of computer systems.

Information Technology

Information Technology is the study of the foundational principles and practices of computation and computational thinking, and their application in the design and development of computer systems. The Information Technology Strand is in two parts.

a) Pupils should know how it all works; how information of all kinds becomes accessible to and manipulable by technology. The core idea is that of digitization and its consequences.

b) Pupils need to know how to use technology to work in the other two strands; they need a full range of competences.

Information technology deals with the creative and productive use and application of computer systems, especially in organisations, including considerations of e-safety, privacy, ethics, and intellectual property.

The Digital Literacy Strand

Digital Literacy is in two parts:

a) The safe and responsible use of technology.

b) Solving problems and making useful things by the use of digital tools, such as spreadsheets, video editing applications and so on.

Just as the ability to read, spell, punctuate, and perform basic arithmetic, are essential life skills, so is the ability to use a computer. Digital Literacy is the ability to use computer systems confidently and effectively.

**TAKEN FROM CAS COMPUTING IN THE NC – A GUIDE FOR PRIMARY TEACHERS CAS COMPUTING IN THE NC*

CONTENT AREAS THAT PUPILS DEVELOP KNOWLEDGE OF…		
Computer Science (CS)	Information Technology (IT)	Digital Literacy (DL)
Problem solving through programming/coding and computational thinking. Understanding how computers and systems work.	Use technology to create, organise, store, manipulate and retrieve digital content. Know which program to use for a given task.	Know how to stay safe online. Follow internet etiquette. Know how to communicate online. Understand how to search online safely.
COMPUTING SYSTEMS ALGORITHMS & **PROGRAMMING** BUILDING PROGRAMMING KNOWLEDGE (INCLUDING MISCONCEPTIONS AND THE NOTIONAL MACHINE) PROGRAMMING LANGUAGE CHOICE **DATA & INFORMATION** COMPUTATIONAL THINKING & PROBLEM SOLVING	DIGITAL ARTEFACTS COMPUTING CONTEXTS	**CREATING MEDIA** MECHANICS - *'skills and knowledge required to be an effective, safe and discerning user of a range of computer systems'.* E-SAFETY SEARCHING FOR SELECTING INFORMATION

Progression

Progression across key stages

All learning objectives have been mapped to the National Centre for Computing Education's taxonomy of ten strands, which ensure that units build on each other from one key stage to the next.

Progression across year groups

Within the Teach Computing Curriculum, every year group learns through units within the same four themes, which combine the ten strands of the NCCE taxonomy (see table below). This approach allows the use of the spiral curriculum approach to progress skills and concepts from one year group the next.

PRIMARY THEME	COMPUTING SYSTEMS AND NETWORKS	PROGRAMMING	DATA AND INFORMATION	CREATING MEDIA
Taxonomy strands	**Computer Systems** **Computer networks**	**Programming** **Algorithms** **Design and development**	**Data and information**	**Creating media** **Design and development**
	Effective use of tools			
	Impact of technology			
	Safety and security			

Knowledge Organisation

The Teach Computing Curriculum uses the National Centre for Computing Education's computing taxonomy to ensure comprehensive coverage of the subject. All learning outcomes can be described through a high-level of ten strands:

Taxonomy strand	Description
Algorithms	Being able to comprehend, design, create, and evaluate algorithms
Programming	Writing software to allow computers to solve problems
Data and Information	How data is stored, organised, and used to represent real-world artefacts and scenarios
Computer Systems	What is a computer, how do its constituent parts function together as a whole
Networks	Understand how networks can be used to retrieve and share information and come with associated risks
Creating media	Select and create a range of media including text, images, sounds and video
Design and development	The activities involved in planning, creating and evaluating computing artefacts
Effective use of tools	Use software tools to support computing work
Impact of technology	How individuals, systems, and society interact with computer systems
Safety and security	Understanding risks when using technology and how to protect individuals and systems

The taxonomy provides categories and an organised view of content to encapsulate the discipline of computing. **Whilst all strands are present at all phases, they are not always taught explicitly.* *NB The procedural and declarative knowledge are not linked to the taxonomy strands*
https://blog.teachcomputing.org/categorising-national-centre-content/

Education for a Connected World (EfaCW)

At St Mary's safeguarding our children are our main priority. We realise the need for our Computing Curriculum to equip children and young people for a digital life. We have therefore adopted Education for a Connected World – 2020 Edition EfaCW

Aims of the Framework

Education for a Connected World is a tool for anyone who works with children and young people. It enables the development of teaching and learning as well as guidance to support children and young people to live knowledgeably, responsibly and safely in a digital world. It focuses specifically on eight different aspects of online education:

1. Self-image and Identity
2. Online relationships
3. Online reputation
4. Online bullying
5. Managing online information
6. Health, wellbeing and lifestyle
7. Privacy and security
8. Copyright and ownership

The framework aims to support and broaden the provision of online safety education, so that it is empowering, builds resilience and effects positive culture change. The objectives promote the development of safe and appropriate long term behaviours, and support educators in shaping the culture within their setting and beyond.

UNIT SUMMARIES (TEACH COMPUTING)						
	Computing systems and networks	Creating media	Programming A	Data and information	Creating media	Programming B
Year 1	**Technology around us** Recognising technology in school and using it responsibly.	**Digital painting** Choosing appropriate tools in a program to create art, and making comparisons with working non-digitally	**Moving a robot** Writing short algorithms and programs for floor robots, and predicting program outcomes.	**Grouping data** Exploring object labels, then using them to sort and group objects by properties.	**Digital writing** Using a computer to create and format text, before comparing to writing non-digitally.	**Programming animations** Designing and programming the movement of a character on screen to tell stories.
Year 2	**Information technology around us** Identifying IT and how its responsible use improves our world in school and beyond.	**Digital photography** Capturing and changing digital photographs for different purposes	**Robot algorithms** Creating and debugging programs and using logical reasoning to make predictions.	**Pictograms** Collecting data in tally charts and using attributes to organise and present data on a computer.	**Digital music** Using a computer as a tool to explore rhythms and melodies, before creating a musical composition.	**Programming quizzes** Designing algorithms and programs that use events to trigger sequences of code to make an interactive quiz.
Year 3	**Connecting Computers** Identifying that digital devices have in puts, processes and outputs and how devices can be connected to make networks	**Stop-frame animation** Capturing and editing digital still images to produce a stop-frame animation that tells a story	**Sequencing sounds** Creating sequences in a blocked-based programming language to make music.	**Branching databases** Building and using branching databases to group objects using yes/no questions.	**Desktop publishing** Creating documents by modifying text, images and page layouts for a specified purpose.	**Events and actions in programs** Writing algorithms and programs that use a range of events to trigger sequences of actions.
Year 4	**The internet** Recognising the internet as a network of networks including the WWW and why we should evaluate online content.	**Audio production** Capturing and editing audio to produce a podcast, ensuring that copyright is considered.	**Repetition in shapes** Using a text-based programming language to explore count-controlled loops when drawing shapes.	**Data logging** Recognising how and why data is collected over time, before using data loggers to carry out an investigation.	**Photo editing** Manipulating digital images and reflecting on the impact of changes and whether the required purpose is fulfilled.	**Repetition in games** Using block based programming language to explore count-controlled and infinite loops when creating a game.

Year 5	**Systems and searching** Recognising IT systems in the world and how some can enable searching on the internet.	**Video production** Planning, capturing and editing video to produce a short film.	**Selection in physical computing** Exploring conditions and selection using a programmable microcontroller	**Flat-file databases** Using a database to order data and create charts to answer questions.	**Introduction to vector graphics** Creating images in a drawing program by using layers and groups of objects.	**Selection in quizzes** Exploring selection in programming to design and code an interactive quiz.	
Year 6	**Communication and collaboration** Exploring how data is transferred by working collaboratively online.	**Webpage creation** Designing and creating webpages, giving consideration to copyright, aesthetics and navigation.	**Variables in games** Exploring variables when designing and coding in a game.	**Introduction to spreadsheets** Answering questions by using spreadsheets to organise and calculate data.	**3D modelling** Planning, developing and evaluating 3D computer models of physical objects	**Sensing movement** Designing and coding a project that captures inputs from a physical device.	**Using the microbit for primary to secondary transfer**

National Curriculum Coverage – Years 1 and 2 (KS1)	1.1 Technology around us	1.2 Digital painting	1.3 Moving a robot	1.4 Grouping data	1.5 Digital writing	1.6 Programming animation	2.1 Information Technology around us	2.2 Digital photography	2.3 Robot algorithms	2.4 Pictograms	2.5 Digital music	2.6 Programming quizzes
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.	✓			✓	✓		✓	✓	✓	✓		

National Curriculum Coverage – Years 3 and 4 (LKS2)	3.1 Connecting Computers	3.2 Stop-frame animation	3.3 Sequencing Sounds	3.4 Branching databases	3.5 Desktop publishing	3.6 Events and actions in programs	4.1 The internet	4.2 Audio production	4.3 Repetition in shapes	4.4 Data logging	4.5 Photo editing	4.6 Repetitions in games
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.		✓		✓			✓	✓			✓	

National Curriculum Coverage – Years 5 and 6 (UKS2)	5.1 Systems and searching	5.2 Video production	5.3 Selection in physical computing	5.4 Flat-file databases	5.5 Introduction to vector graphics	5.6 Selection in quizzes	6.1 Communication and collaboration	6.2 Webpage creation	6.3 Variables in games	6.4 Introduction to spreadsheets	6.5 3D modelling	6.6 Sensing movements
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.	✓	✓						✓	✓		✓	

Declarative and procedural knowledge

Declarative knowledge, often referred to as conceptual knowledge in the literature, consists of facts, rules and principles and the relationships between them. It can be described as '**knowing that'**. In contrast, **procedural knowledge** is knowledge of methods or processes that can be performed. It can be described as '**knowing how'**. Examples of declarative and procedural knowledge across the 3 pillars can be seen in Table 1.

Table 1: Examples of declarative and procedural knowledge in computing

Form of knowledge	Computer science	Information technology	Digital literacy
Declarative	Programming syntax The purpose and function of different logic gates	Principles of effective multimedia design Spreadsheet formulae	Features of unreliable content
Procedural	Performing binary addition Implementing a repeat in a programming language	Setting up a slide master Applying conditional formatting	How to perform an advanced web search

This distinction is helpful when considering knowledge within the subject. Many aspects of computing use skills such as programming, creating digital artefacts and being able to use a search engine. It is helpful to consider these skills in terms of procedural knowledge, as they are methods and processes that can be performed. This makes identifying the knowledge required to perform these processes skilfully much easier. They are enabled by declarative knowledge such as knowledge of suitable data types and structures, knowledge of appropriate font sizes and styles and knowledge of suitable key words to use when performing searches.

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